An Evaluation of the Impact of Physician Education on Prescribing for Hypertension in a Nursing Home

by

Jill Duncan

Submitted in partial fulfillment of the requirements
for the degree of Master of Applied Health Services Research

at

Dalhousie University
Halifax, Nova Scotia
October 2014

© Copyright by Jill Duncan, 2014

Dedication

This thesis is dedicated to my husband Colin and my children, Maxwell and Thomas.

Table of Contents

List of Tables

List of Figures

ABSTRACT

Background: Nursing home residents are a frail population with multiple co-morbidities, and at risk for polypharmacy and its associated adverse events. Nevertheless, most clinical practice guidelines (CPGs) do not consider the significance of frailty when making treatment recommendations and there is little information to guide prescribing practices for the frail elderly. To deal with this issue, new treatment recommendations for hypertension, specific to the frail elderly, have been developed by local experts in Halifax, Nova Scotia through the Dalhousie Academic Detailing Service (ADS) and PATH (Palliative and Therapeutic Harmonization) programs.

Objectives: To determine the effect of an educational intervention on appropriateness of prescribing medications for hypertension in a nursing home setting, from baseline to 7 months post-intervention, by measuring adherence to four key messages within the ADS/PATH treatment recommendations.

Methodology: Observational, before and after study in a single nursing home in Halifax, Nova Scotia. Chart Review of 138 nursing home residents from September 2012 to May 2013.

Results: 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 ($p=0.002$). At least one medication affecting blood pressure was discontinued in 25% of residents during the study period. Median monthly cost for medications affecting blood pressure was $4.18 pre-intervention and decreased to $1.05 post-intervention ($p<0.001$). Proportion of residents with at least one fall decreased from 50% in the 6 months prior to the educational intervention to 34% post-intervention ($p=0.028$). There was no change in mean blood pressure between time points (123/67 pre- vs 119/68 post-intervention).

Conclusion: Nursing home residents were generally over-treated with medications that affect blood pressure. A multi-faceted educational intervention based on treatment recommendations specific to the frail elderly can decrease the use of medications affecting blood pressure in a frail population. Decreasing the use of medications that lower blood pressure decreased the proportion of residents with a fall and lowered medication costs.

List of Abbreviations Used

ADR	Adverse Drug Reaction
ADL	Activities of Daily Living
ADS	Academic Detailing Service
AE	Adverse Event
BP	Blood Pressure
CDHA	Capital District Health Authority
CGA	Comprehensive Geriatric Assessment
CHEP	Canadian Hypertension Education Program
CIHI	Canadian Institute for Health Information
CPG	Clinical Practice Guideline
DBP	Diastolic Blood Pressure
ER	Emergency Room
HTN	Hypertension
IADL	Instrumental Activities of Daily Living
JNC	Joint National Committee
LTC	Long Term Care
PATH	Palliative and Therapeutic Harmonization
SAE	Serious Adverse Event
SBP	Systolic Blood Pressure
SDM	Substitute Decision Maker
TDF	Theoretical Domains Framework

Glossary

Clinical Frailty Scale (1)

1 = Very Fit – robust, motivated, exercises regularly for the sake of exercise, fittest for age

2 = Well – No active disease symptoms, exercise occasionally / seasonally

3 = Managing Well – No active disease symptoms, not active beyond routine walking

4 = Apparently Vulnerable – symptoms limit activities but still independent, “slowed up”

5 = Mildy Frail – needs help with some instrumental ADLs (IADLs) due to cognition or physical symptoms

6 = Moderately Frail – needs help with all IADLs +/- some ADLs

7 = Severely Frail – completely dependent in all basic ADLs, otherwise medically stable

8 = Very severely Frail – completely dependent, approaching end-of-life

9 = Terminally ill – life expectancy < 6 months, regardless of frailty category

Acknowledgements

I would like to thank the staff of St. Vincent's Nursing Home, who welcomed me into their facility, answered my questions and gave me space to work. Without them, this project would never have come to completion.

This study was supported by a grant through the Capital Health Research Fund. I would like to thank T4G for their donation of time and expertise in the creation of the widget.

I would like to acknowledge the members of my thesis committee for their expertise, time and patience: Dr. Paige Moorhouse, Dr. Laurie Mallery and Susan Bowles.

Chapter 1

INTRODUCTION

Due to medical advancements and improvements in public health, Nova Scotians are living longer. Although the total population of Nova Scotia is expected to grow by only four percent between 2000 and 2026, the subset of the population over 65 will almost double (~91%) and will represent 25% of Nova Scotia's population by 2026. (2) As of 2005, there were almost 7,000 people in 111 long-term care facilities in Nova Scotia. (3)

The prevalence of chronic disease increases with age, as does the number of medications taken to manage these conditions.(4) Residents in nursing homes are frail and commonly have multiple medical conditions, dementia, and shortened life expectancy as compared with the general population. When frail older adults take multiple medications, there is an increased risk of drug-related problems including adverse events such as falls and drug interactions. (5) Within the Canadian nursing home population, 61% of residents are prescribed 10 or more different drug classes and 27% use 15 or more drug classes. (6) Although seniors account for 15% of the Canadian population, they are estimated to account for 40% of all spending on prescribed drugs and 60% of public drug program spending. (6) In 2010, the total cost of drugs for long-term care residents in the Nova Scotia Pharmacare Program was approximately $17 million dollars. (7)

With little available evidence about the risks and benefits of medications in the frail elderly, physicians extrapolate from clinical practice guidelines (CPGs), despite the fact that these guidelines infrequently provide treatment recommendations for this population.

The Palliative and Therapeutic Harmonization (PATH) Program within Capital Health helps frail older adults and their families/substitute decision makers understand their health status, prognosis, and anticipated quality of life and guide them through the process of skills building for health care decision making. 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 Dalhousie Continuing Medical Education to develop appropriate, evidence informed practice recommendations for the treatment of hypertension and diabetes in the frail elderly.

The present study evaluated the impact of an educational initiative for physicians and non-physicians caring for residents in a nursing home in the Capital District Health Authority to relay information about the ADS/PATH hypertension treatment recommendations, with the goal of encouraging optimal care and improving appropriate prescribing in frail older adults. The study 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 Academic Detailing / PATH hypertension recommendations for the frail elderly.

Chapter 2

BACKGROUND and LITERATURE REVIEW

2.1 Frailty and Polypharmacy

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. (8) 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.(9) 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. (8,10) 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. (11)

A clinical assessment of frailty can be quantified using the 9 point ordinal Clinical Frailty Scale. (1) A frailty level is assigned based on history and physical examination and includes consideration of cognition, mobility, function, and co-morbidities. (1,8) A description of the levels of the Clinical Frailty Scale can be found in the Glossary on page viii. The Frailty Assessment for Care-planning Tool (FACT) uses scaling that is compatible with the Clinical Frailty Scale but has been developed for use as a practical and interpretable frailty screening tool for non-experts. It can be completed in a busy clinical setting and takes about 5 minutes to complete. The FACT assesses cognition, mobility, function, and the social situation, using a combination of caregiver report and objective measures. The details of this quantitative tool were first published in 2014. (12)

Polypharmacy can be defined as the use of multiple drugs or more medications than are medically necessary. (13) As the prevalence of chronic disease increases with age, so does the number of medications taken to manage these conditions.(4) Adding to this risk, chronic disease and age-related changes, such as impaired renal or liver function, can affect a person's pharmacodynamic and pharmacokinetic response to medications.

A review by Maher (2014) found that polypharmacy is common in older adults, with the highest number of drugs taken by those residing in nursing homes. (13) When frail older adults take multiple medications, there is an increased risk of drug-related problems including non-compliance and adverse events such as falls and drug interactions. (5)

In addition to health risks, the burden of taking multiple medications has been associated with greater health care costs, both directly and indirectly. Direct drug costs represent a huge sector of health spending which continues to grow. In 2013, prescription drugs accounted for an estimated 14% of total health expenditure in Canada. Although seniors account for 15% of the Canadian population, they are estimated to account for 40% of all spending on prescribed drugs and 60% of public drug program spending. (6,14,15)

The indirect costs associated with polypharmacy are also considerable. In Canada, seniors have five times the rate of hospitalizations related to adverse drug events compared to younger adults, which affect 1 in 200 seniors, compared to 1 in 1000 non-seniors. (16) A study by Wu et al. (2012) found that emergency room (ER) visits and hospital admissions due to adverse drug reactions (ADRs) among seniors in Canada cost an estimated $35.7 million annually, with more than 80% of those costs arising from hospitalization. Of the patients with an ADR-related ER visit, 60% were found to have taken 11 or more medications within the past year. Although LTC residents represented 4% of total ADR-related ER visits, they represented 8.4% of severe ADRs. ADRs were considered “severe” if the patient was admitted to hospital or died in the ER. (17)

In 2012, 66% of seniors on public drug programs in Canada were taking five or more prescription drugs, 27% were using ten or more types of prescription drugs and and 8.6% had claims for 15 or more medications. In the LTC population, drug use was higher than the overall senior population with 61% of residents using ten or more different drug classes and 27% using 15 or more drug classes. (6) In 2010, the total cost of drugs for long-term care residents in the Nova Scotia Pharmacare Program was approximately $17 million dollars. Provincial data are consistent with national data and indicate that at

any given time, 64% of Nova Scotian Pharmacare enrollees had been prescribed five or more drugs, while 13% had been prescribed ten or more.(7)

2.2 The Use of Clinical Practice Guidelines in the Treatment of Chronic Disease in Nursing Homes

Residents of nursing homes are frail and as such commonly have multiple medical conditions, dementia, and shortened life expectancy. The average length of stay in nursing homes in Nova Scotia is 2.9 years, (18), a statistic which is slightly skewed because it includes data about younger individuals residing in the nursing home, who typically have a much longer length of life. As an example, the median life expectancy of a large nursing home in the Capital District Health Authority was shorter at 18 months. (19) These characteristics need to be considered when evaluating the risks and benefits of any treatment. Although the benefit of preventive medications (such as cholesterol lowering medications) may become negligible as people near the end of life, 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. (20)

Unfortunately, there is little direct evidence to support decisions about the risks and benefits of using medications to treat chronic health conditions when significant frailty is present. (21) Currently, many treatment decisions in LTC are based on conventional practice guidelines for individual chronic diseases using evidence developed for 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.

It has been reported that 5% of clinical trials are designed specifically for elderly patients and 15% of trials exclude elderly participants without any justification. (22) Elderly patients may be excluded from trials due to comorbidities and multiple medications, which may cause unexpected variations in drug efficacy and adverse events. Investigators may view the older population as vulnerable and therefore in need of

protection from researchers, or they may recognize the difficulty in enrolling and maintaining older, frail people in clinical trials. McMurdo states that "clearly a tension exists between the validity and the generalizability of trial findings, but this practice leaves a yawning chasm between patients in the real world and patients who participate in clinical studies." (22,23)

A content analysis of Canadian CPGs found that although seven out of ten CPGs mentioned the elderly population (>65 years), only three of these discussed issues related to elderly patients with comorbidities and four considered time to benefit in terms of life expectancy.(24) Another descriptive analysis found that five of 14 guidelines provided recommendations for frail older individuals (≥ 80 years); however when the evidence to support these recommendations was reviewed, only 1.4% of the published studies reported data for those 80 years of age and older. (25)

In the absence of relevant recommendations, treatment decisions are made based on extrapolation from studies or using the clinical judgment of practitioners. Little work has been done about how to modify these recommendations for frail elderly patients with multiple co-morbidities. In this population, there is a need for a patient focus rather than a disease focus, and a need for guidance that supports when to start and stop medications that are being used to treat frail older adults with chronic disease. (26)

A model developed by Sergi et al (2011) demonstrates that as a patient nears the end of life, it becomes more important to become selective in identifying priority diseases for treatment and less important to treat these diseases aggressively. The model suggests that broad evidence based clinical practice guidelines may direct treatment early in illness, but as a patient nears death, a more tailored approach is needed. (11,27)

2.3 Assessing Appropriate Prescribing in the Elderly

The term 'inappropriate prescribing' can be defined as the use of a medication that is associated with significant risk of an adverse drug reaction when there is an equal or more effective and lower risk alternative available (including prescribing no drug). (28) A review by O'Connor et al (2007) suggested that a more holistic definition "should

encompass the assessment of older persons' prescription medications in the context of their multiple co-morbidities, complex medication regimes, functional and cognitive status, treatment goals and life expectancy." (29) Appropriate prescribing in the elderly includes avoiding inappropriate medications and also avoiding underuse of potentially important medications.

Various clinical tools have been developed to help classify appropriate versus inappropriate medications for the elderly. The Beers criteria and the STOPP criteria are explicit lists of medications or drug classes that should generally be avoided, or used with caution, in older people. Both lists are based on expert-consensus and intended to help inform clinical decision-making concerning the prescribing of medications for older adults. (30,31) The Medication Appropriateness Index is an implicit review that provides a patient-specific assessment of the appropriateness of a specific medication using ten criteria. A score is generated for each medication, which is a quantitative measure of prescribing appropriateness. (32)

All prescribing criteria have limitations and do not replace expert knowledge and clinical decision making; however they can alert practitioners to potentially inappropriate prescribing. The Beers Criteria is one of the more commonly used resources to identify inappropriate prescribing. There has been controversy about the inclusion of certain drugs listed in the Beers criteria as being *absolutely* contraindicated in older people, irrespective of diagnosis, e.g. amiodarone, oxybutynin, doxazosin and amitriptyline. Discontinuing one drug may lead to a prescription for another drug which may equally be risky or less effective, but simply "not on the list". Another important limitation is that the Beers criteria do not address the under-prescribing of clinically indicated drugs. As an example, despite their presence on the Beer's list of medications to avoid in older adults, benzodiazepines may be appropriate to prescribe for symptom control at the end of life. In addition, many of the drugs listed in the Beers Criteria are older medications that are infrequently used. (29,31,33).

The START / STOPP criteria provide explicit, evidence based rules for both potentially inappropriate prescribing (STOPP) and potential prescribing omissions (START) and therefore address the important issue of under-prescribing. The authors believe that the "STOPP and START criteria should be used in tandem on the basis that inclusion of inappropriate medicines and omission of essential medicines are closely and inextricably linked problems in geriatric pharmacotherapy." (31) There are 22 START criteria that address commonly encountered instances of potentially inappropriate under-prescribing. As an example, the START criteria recommend antihypertensive therapy where systolic blood pressure is consistently>160 mmHg. There are no specific guidelines for how to apply the START criteria in a frail population, such as in a nursing home. Criteria should be followed where no contradiction to prescription exists and *"*where life expectancy and functional status justifies the prescription." (31,34)

It should be noted again that determination of "under-prescribing" is based on guidelines (or statements, as in the START criteria) that address individual disease entities, while most geriatric patients have multiple comorbidities. Along with comorbidities, polypharmacy, ageism, lack of scientific evidence and fear of adverse events may contribute to the under-prescription of indicated drugs. (35)

2.4 Medication Withdrawal in the Elderly

There is very little published information to guide clinicians for decision making regarding when and how to stop medications in the frail elderly. The few studies that have been published on medication withdrawal in the elderly have shown that medications can be successfully withdrawn without undesirable effects. Trial design varied, and included randomized controlled trials, open-label prospective observational studies, cohort studies and chart reviews. In some cases, drug withdrawal improves cognition, decreases mortality and results in better quality of life. (36-39)

One systematic review assessed the benefits and risks of medication withdrawal in older people. (37) It specifically examined the withdrawal of antihypertensive, benzodiazepine and psychotropic agents in patient populations with a mean age of

>/=65 years. The authors assessed that due to heterogeneous study designs, the data were not suitable for a statistical meta-analysis, although study results were summarized. Withdrawal of diuretics was maintained in 51-100% of subjects and adverse effects from medication withdrawal were infrequently encountered. As an example, one study found hypokalemia was less common in the withdrawal group (0% vs 8%), ankle edema was more common (50% vs 25%) and there was no difference between groups in blood pressure at the end of the study. Other studies found no between-group differences in blood pressure, heart failure or edema. Withdrawal was unsuccessful primarily when heart failure was present. In studies withdrawing antihypertensive therapy, many subjects (20-85%) remained normotensive or did not require reinstatement of therapy, and there was no increase in mortality. (37)

There may also be benefits related to discontinuation of multiple medications in elderly patients. One study of 119 LTC residents who stopped over 300 medications in one year found that these residents had fewer deaths during the study period (21% vs 45%) and reduced referrals to acute care (12% vs 30%) compared to a control group who did not stop medications. (36) A 2010 study in 70 older patients in the community (mean age 82.8 +/- 6.9 yrs) discontinued 58% of medications with no significant adverse events or deaths attributed to discontinuation. Discontinuation was successful with 81% of medications and 88% of patients reporting global improvement in health. (39)

2.5 Development of Consensus Guidelines in Nova Scotia: Treatment of Hypertension in the Frail Elderly

2.5.1 PATH Program

The Palliative and Therapeutic Harmonization (PATH) Program has been established in the Division of Geriatric Medicine at Capital Health to help frail older adults and their families/substitute decision makers understand their health status, prognosis, and anticipated quality of life and to guide them through the process of skills building for health care decision making. It is the philosophy of this model that as frailty progresses, some treatments designed to improve one medical condition could make other

conditions worse, thereby reducing overall quality of life. As such, the PATH Program helps patients and families realistically consider the risks and benefits of potential treatments and make decisions that are in keeping with informed goals of care.(40,41)

2.5.2 Dalhousie Academic Detailing Service

The Dalhousie Academic Detailing Service is a program that strives to promote a culture of critical thinking among Nova Scotia health care professionals and to provide them with evidence-based education to improve practice. It 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. Together with the Capital Health Drug Evaluation Unit, the ADS researches and develops evidence-based educational messages about the treatment of common medical conditions. The messages are then disseminated to family physicians and other health professionals throughout Nova Scotia through one-on-one or small-group sessions.

2.5.3 Collaboration between PATH and Academic Detailing: Evidence Informed Treatment Recommendations

Implementation of the PATH model in acute and long-term care has highlighted the need for the development of clinical practice guidelines for the treatment of common chronic medical conditions in frail older adults. The PATH program has partnered with the Academic Detailing Service through Dalhousie Continuing Medical Education to develop appropriate, evidence informed practice recommendations for the treatment of hypertension and diabetes in the frail elderly.

Due to uncertain benefit of treating to conventional targets in the frail elderly, consensus recommendations include less stringent treatment targets, as well as stopping criteria for medications. (12)

2.6 ADS / PATH Recommendations for the Treatment of Hypertension in the Frail Elderly

The guideline committee for the development of the hypertension recommendations consisted of members of the Academic Detailing Service and PATH program and other health professionals with expertise in the area of drug treatment and/or frailty and in total included 2 family physicians, 2 internist geriatricians, and 4 pharmacists, who achieved 100% consensus to develop the guideline.

The committee found no studies that addressed the risks and benefits of treating frail older adults with hypertension, and therefore concentrated on studies that focused on hypertension treatment in older adults. Prominent guidelines were reviewed (including the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-7) (42); American College of Cardiology and American Heart Association Consensus Document on Hypertension in the Elderly (43); the 2011 Canadian Hypertension Education Program (CHEP) Recommendation Summaries (44); and a 2009 Statement from the European Society of Hypertension (45)); individual clinical trials (see complete reference list in Academic Detailing document); and Cochrane reviews (46). Importantly, the committee considered the characteristics of frailty, the dilemma of polypharmacy, and the relevance of the available scientific evidence as it relates to those who are frail.

The key messages of the ADS / PATH recommendations for the treatment of hypertension in the frail elderly are found in Appendix 3. A summary of the evidence on which the treatment recommendations are based is found in Appendix 4.

In summary, the hypertension recommendations aim to provide realistic, evidence-informed, targets for blood pressure control in the frail elderly. The recommendations advise physicians to make reasonable attempts to control hypertension, while taking heed to avoid harmful effects from treatment, including orthostasis and falls, which might be more likely or of greater consequence in certain patients, such as the frail or very elderly. A systolic blood pressure (SBP) target between 140 to 160 mmHg is

recommended, while taking care to avoid SBPs that are unnecessarily low, summarized in the publication of the guidelines as "promoting higher blood pressure targets for the frail elderly." Based on available evidence, no more than two anti-hypertensive medications at a time are recommended. (47).

2.7 Knowledge to Action: Effecting Sustained Practice Change

New knowledge must be effectively communicated, or "translated", to ensure uptake into clinical practice and create sustained practice change. After synthesizing research findings into clinical practice guidelines or treatment recommendations, the process of applying 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. (48,49)

2.7.1 Identifying Barriers and Facilitator to Knowledge Use

Various authors have published papers discussing barriers to knowledge use, and specifically in a health care setting. Legare et al. (2008) grouped barriers for change into three broad areas, including 1) knowledge (i.e. lack of familiarity), 2) attitude / motivation (i.e. lack of agreement) and 3) behavior (i.e. external patient factors). (50) Grimshaw (2012) acknowledges that there are barriers working at different levels of the healthcare system, many of which are beyond the control of an individual health care professional. Identified barriers include 1) structural barriers (*e.g.* financial disincentives), 2) organizational barriers (*e.g.* inappropriate skill mix), 3) peer group barriers (*e.g.* local standards of care not in line with desired practice), 4) professional (*e.g.* knowledge, attitudes and skills) and 5) professional-patient interaction barriers (*e.g.* communication and information processing issues). (49)

While there is no standard approach for identifying potential barriers to knowledge uptake, Grimshaw (2012) suggests that "those involved with knowledge translation activities need to use their judgement about how best to elicit barriers given their understanding of the context and potential barriers and resources available to them."

The Theoretical Domains Framework (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. (51) Once completed, this process can then be used to inform the choice of intervention components that could overcome the modifiable barriers and enhance the enablers.

The TDF was developed by consensus and is an integrative framework of theories of behaviour change. The TDF identifies the following domains for barriers/enablers: 1) knowledge, (2) skills, (3) social/professional role and identity, (4) beliefs about capabilities, (5) beliefs about consequences, (6) motivation and goals, (7) memory, attention and decision processes, (8) environmental context and resources, (9) social influences, (10) emotion regulation, (11) behavioural regulation, and (12) nature of the behaviour. (52,53) Michie (2005) describes the theoretical domains, component constructs, and eliciting questions that can be used as guides for identifying and understanding implementation problems that can be used as a basis for intervention development.

2.7.2 Selecting, Tailoring and Implementing Interventions

To implement evidence (i.e. new treatment recommendations) into practice, the choice of intervention components can be informed by TDF and other evidence about effectiveness of behaviour change techniques. Components should help to overcome the identified barriers and enhance the enablers.

In terms of knowledge translation, it is important to consider *to whom* the information is given as well as *by whom* the information is given. Information should be relevant to the practice of the target audience. The "messenger" should have credibility with the target audience and the skills and experience needed to transfer the information. The key messages should be simple, clear and concise and should be tailored to the needs of an individual audience. (54,55)

Grimshaw (2012) acknowledges that the evidence on the "likely effectiveness" of different strategies to overcome specific barriers to knowledge translation is not

complete. (49) The Canadian Agency for Drugs and Technologies in Health (CADTH) hosts and maintains *Rx for Change,* a searchable database containing current international research evidence about intervention strategies that can be used to alter behaviours of health technology prescribing, practice, and use. The methods used to populate the database parallel systematic-review methodology. *Rx for Change* is publicly accessible and contains research information relevant to healthcare professionals, consumers, policy makers, and researchers. (49,56)

Multifaceted interventions contain two or more components and can potentially target different barriers to knowledge uptake. The *Rx for Change* database summarized 134 systematic reviews that evaluated the effectiveness of multiple interventions. Results from 9 of 16 high quality reviews or key reviews, with a sufficient number of studies to draw conclusions, found that multifaceted interventions are generally effective for improving appropriate care behaviours. Potential interventions included audit and feedback, distribution of educational materials, educational meetings, educational outreach visits and reminders, among others. (56) Based on available evidence, a multi-faceted intervention would be appropriate to effectively communicate new information, such as new treatment recommendations, to physicians in an effort to change their prescribing.

2.7.3 Monitoring Knowledge Use and Evaluating Outcomes

Once the treatment recommendations and guidelines have been "transferred" or "translated" to healthcare professionals, the adoption of the recommendations into clinical practice should be monitored and outcomes evaluated. Knowledge is used conceptually, to change a practitioner's levels of knowledge, understanding and attitude, and instrumentally, to change behavior or practice; however, measuring knowledge use can be difficult and there are few well-developed approaches or instruments to evaluate the implementation or the impact of knowledge transfer. (48,57,58)

Knowledge use can be measured in terms of its impact on the patient, the care provider and the organization. The impact of adopting new treatment guidelines on patients could be measured by change in health status (morbidity or mortality) and quality of life. Administrative databases or clinical charts could be used to extract specific relevant clinical outcomes. Questionnaires could be used to assess satisfaction with care. The impact of knowledge use on physicians or other healthcare providers could assess satisfaction with practice and time taken for new practices through questionnaires and interviews. The impact on the organization (LTC facility or healthcare system) could be measured by length of stay and costs, determined by analysis of administrative databases or clinical charts. (48)

Chapter 3

RESEARCH QUESTION and OUTCOMES

The research project involved an educational intervention for physicians and non-physicians caring for residents in a nursing home in the Capital District Health Authority on new hypertension treatment recommendations that were specifically developed for the frail elderly population. The project evaluated the impact of this educational intervention on physician prescribing in a nursing home, with the goal of encouraging optimum care and improving appropriate prescribing in frail older adults.

This project provides an assessment of the real-world uptake of guideline recommendations, as well as an assessment of the effectiveness, safety and economic outcomes of the Academic Detailing / PATH hypertension guideline recommendations for the frail elderly.

3.1 Research Question

To what degree will a multi-faceted education program, provided to physicians and non-physicians (nurses and pharmacists) caring for residents in a nursing home, that promotes new treatment recommendations for the management of hypertension for the frail elderly, result in more appropriate prescribing of antihypertensive medications, as measured by the adherence to specific treatment recommendations, over a seven month period?

3.2 Primary Composite Outcome

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 (Appendix A) from baseline to seven months post-educational intervention.

The four primary outcomes are:

a) Under-treatment (i.e. reduction in the proportion of residents with SBP > 160 mmHg on zero medications affecting blood pressure)

b) Increase in proportion of residents with SBP between 140 and 160 mmHg

c) Increase in proportion of residents on ≤2 medications affecting blood pressure

d) Overtreatment (i.e. reduction in the proportion of residents with SBP <140mmHg on ≥1 medications affecting blood pressure)

3.3 Secondary Outcomes

Secondary outcomes include

a) change in physician prescribing of medications affecting blood pressure,
b) change in systolic blood pressure,
c) change in medication costs
d) incidence of resident falls and
e) incidence of cardiovascular events

Change will be calculated as the difference in mean values before and after the educational intervention.

To evaluate the impact of the provincial academic detailing service (launched about 1 year prior to the intervention) on physician prescribing, the change in appropriateness of prescribing from 1 year prior to the intervention to baseline will be measured, as a composite outcome of adherence to the 4 key messages of treatment recommendations.

A list of primary and secondary outcomes is found in Table 1.

Chapter 4

STUDY METHODOLOGY

4.1 Study Design

This was an observational, before and after study in a 149 bed nursing home in the Capital District Health Authority between September 15, 2012 and May 4, 2013. The project evaluated the impact of an educational intervention on prescribing by physicians in a nursing home with a goal of encouraging optimum care and improving appropriate prescribing in frail older adults.

Ethics approval to conduct the thesis research was received from the Capital Health Research Ethics Board June 11, 2012, with annual approval received May 30, 2013 and May 1, 2014.

4.2 Participant Groups

There were two participant groups impacted by this study: the physicians and the residents in the nursing home.

4.2.1 Physicians

Physicians providing care to residents of the nursing home were targeted for educational sessions on treatment recommendations for hypertension specific to the frail elderly. The nursing home uses a dedicated per-floor physician model of care, whereby each floor of the nursing home has an assigned physician who provides care. Within the nursing home, a total of nine physicians care for 149 patients, including six physicians assigned to a floor and three additional physicians, retained at the request of individual residents, who provide care to individual residents outside the physician per floor model. All six physicians assigned to a floor of the nursing home attended the educational presentation and of these, five signed a consent form allowing their prescribing data to be included in the study.

4.2.2 Nursing Home Residents

To measure adherence to treatment recommendations and appropriateness of prescribing, data on the residents of the nursing home, including medications and medical history, was collected in a database. There is a maximum of 149 residents in the nursing home at any time. Historical information provided by the Director of Nursing indicated approximately 50% turnover in any 12 month period.

Residents, or their substitute decision maker (SDM), were approached for consent by the Director of Nursing or another nursing home staff member. A total of 158 residents (or their SDM) provided consent for their data to be entered into the database over the study period. Of these residents, 138 had care provided by the physicians who consented to be part of the study and therefore comprised the total study population.

The pre-intervention population consisted of all residents in the nursing home that provided consent, along with physician consent, two weeks prior to the educational intervention. The post-intervention population consisted of all residents in the nursing home that provided consent, along with physician consent, seven months after the educational intervention.

4.3 Description of Intervention

The intervention was a multi-faceted educational program to disseminate recommendations for the treatment of hypertension in frail older adults. Multi-faceted interventions have been shown to be more effective than single interventions in changing prescribing behavior. (59) The goal of the proposed intervention was to encourage optimum care and improve the appropriateness of prescribing for residents in the nursing home with hypertension. It was hoped that using clear, straight-forward messages and providing tools to support those messages will effect sustained practice change in the treatment of hypertension in the nursing home.

In preparation for the educational program on the treatment recommendations, a barrier assessment was conducted by the study team using the Theoretical Domains Framework. (51,52,60) This assessment was used to identify components of an

educational program that would assist in the uptake of the recommendations. The completed Barrier Assessment can found in Table 3.

4.3.1 Content of the Educational Program

The educational intervention was based on evidence-informed practice recommendations that have been developed through Dalhousie Academic Detailing Service and the PATH program for the treatment of hypertension in the frail elderly. (47) The information and recommendations presented provide a standard of care for the treatment of hypertension in frail residents that has not previously existed. The ADS/PATH review of the evidence for the treatment recommendations, as provided in the Academic Detailing material, is found in Appendix 4.

Key Messages of the Educational Intervention (47)

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.

The Dalhousie ADS / PATH Consensus Recommendations aim to provide appropriate, evidence informed targets for blood pressure control in the frail elderly. (Appendix 3) The recommendations recognize that there is uncertain benefit in treating to conventional hypertension targets in the frail elderly and therefore include a higher systolic blood pressure treatment target than suggested in conventional guidelines as well as stopping criteria. The recommendations advise physicians to make reasonable attempts to control hypertension, while taking heed to avoid harmful effects from

treatment, including orthostasis and falls, which might be more likely or of greater consequence in certain patients, such as the severely frail or very elderly. It is recommended that a seated blood pressure (not supine) be used to make treatment decisions. (47)

4.3.2 Group Presentation

A large group presentation was carried out on October 4, 2012 by two of the physicians (PM and LM) involved in the creation of the treatment recommendations, and supported by two pharmacists (JD and SB). The message was delivered by local key opinion leaders (including geriatricians and pharmacists) to encourage uptake of the messages. The interactive presentation was 60 minutes in length and was provided to multiple stakeholders including all physicians, nurses (RNs and LPNs) and pharmacists caring for residents in the nursing home. The presentation was the educational component of a yearly event that is held for staff at the facility. The presentation was attended by six physicians, 12 registered nurses, 18 licensed practical nurses and one pharmacist, as well as administrative staff.

The power point presentation covered the recommendations for the treatment of hypertension in the frail elderly as well as information on background and context of the issues and the supporting evidence. There was significant discussion about the evidence, the difference between current hypertension guidelines and these recommendations, the treatment of chronic disease in the frail elderly and issues with stopping medication for chronic conditions.

The presentation included education on the philosophy of the PATH program, which is also the philosophy behind the treatment recommendations. It is hoped that physicians will become aware of the need to recognize the frailty status of residents and alter existing recommendations to fit the context of frailty.

Education to nurses and physicians was provided on the technique of taking blood pressure, including the importance of using seated blood pressure to make treatment

decisions. In addition, it was suggested that nurses note in the chart if blood pressure was “seated” or “lying”.

4.3.3 Written Information

The complete Academic Detailing material “Issues in Hypertension 2011” was available for all participants at the group presentation. (47)

Small laminated cards were distributed to the physicians with the treatment recommendations. (Figure 2)

4.3.4 Poster and Chart Reminders

A poster that summarized the hypertension treatment recommendations was developed. This poster was placed in a prominent location in each nursing station in the nursing home. (Figure 1)

Stickers were placed in resident charts as reminders to physicians and other health care professionals about the key messages of the treatment recommendations. (Figure 2)

A sticker with reminders about how to measure blood pressure in residents was placed in resident charts and in the binders that contained the blood pressure graphs. (Figure 3)

4.3.5 Letter to Substitute Decision Marker (SDM) re: Medication Changes.

At the nursing home, SDM permission is required to stop any medication for a resident. This was identified by the study team prior to the intervention as a barrier to making medication changes, due to the time required to contact the SDM to ensure they understood why a medication was being stopped. When medications are stopped, the SDM and family may believe that physicians are “giving up” on their family member. It was acknowledged that it was important to explain to residents and their decision makers that stopping medication with limited or no potential benefit may decrease adverse events and improve quality of life in the frail elderly. (61)

To help overcome this barrier, a letter was drafted by the study physicians (PM and LM) to assist in discussions with residents or SDMs about discontinuation of medication affecting blood pressure. This letter could be given in hard copy, or could be used to guide a discussion in person or by telephone. The letter was provided to physicians at the presentation and was available for download from the PATH website. A template of this letter is found in Figure 4.

4.3.6 Online Resource – Widget

To supplement the written material, the treatment recommendations were translated into a widget, which was an online tool that study physicians could access on their phones or computers. This widget was located on the PATH website (www.pathclinic.ca). After entering unidentified patient-specific parameters (i.e. systolic blood pressure, frailty level and number of antihypertensive medications), the widget provides a tailored treatment recommendation according to the guidelines.

The widget was created by T4G as an in-kind donation of time and expertise. (www.t4g.com) A set of logic statements was provided to T4G by the study team, along with a statement of treatment recommendation that would appear if "true". The complete set of logic statements and recommendations is found in Table 4.

4.4 Data Collection

Data was collected through chart audits performed by the principal investigator. Baseline and final data were collected for each consenting resident.

Baseline data on demographic factors, medical history, medication use (including medications affecting blood pressure), blood pressure readings and frailty level (1) was collected for all consenting residents retrospective to September 15, 2012 (two weeks prior to the educational intervention). If residents were admitted after the educational intervention, baseline data was collected retrospective to one week after admission.

Final data was collected seven months after the education was complete (retrospective to May 4, 2013), allowing time for the regular process of physician visits, patient

assessments and routine resident medication reviews (which take place every 6 months) to occur. By waiting seven months, all residents had the opportunity for at least one medication review. Data collected included changes in medications that affect blood pressure, recent blood pressure measurements, frailty level, incidence of falls and cardiovascular events. If residents died or were transferred out of the facility, final data was collected retrospective to two weeks prior to death or transfer.

The hypertension treatment recommendations for the frail elderly were included as part of the Academic Detailing program, which was launched in October 2011. The program included one-on-one discussions with family physicians and group presentations on topics in hypertension, including treatment targets for the frail elderly. It is not known if the physicians caring for residents at the nursing home participated in an Academic Detailing session on this topic. Therefore, to measure the potential impact of Dalhousie's Academic Detailing program on physician prescribing, prescribing data and resident blood pressure was also collected as of September 15, 2011, if available.

A complete list of the data collected is found in Table 2.

4.5 Data Sources and Management

All data was collected from individual resident charts at the nursing home. Data was entered into a password protected Microsoft Excel database (version 2007).

4.5.1 Medical History

Information on medical history, including current and past medical conditions, was obtained from the admission note (written by the social worker), the initial physician notes, and current and past Comprehensive Geriatric Assessments (CGAs; Appendix 5). The Clinical Frailty Scale score and diagnosis of dementia were obtained from completed CGAs.

4.5.2 Medications

Medication lists were obtained from the Medication Administration Records. Only medications taken regularly (i.e. not as needed) were recorded. Changes in

medications were obtained by reviewing physician prescriptions, physician notes and bi-annual medication reviews.

The following classes of medications were considered to affect blood pressure: diuretics, ACE inhibitors, angiotensin receptor blockers, beta-blockers, calcium channel blockers, nitroglycerin patches, oral nitrates and alpha-blockers.

4.5.3 Blood Pressure

At this facility, blood pressure measurements were generally recorded every two months and plotted on graphs maintained for each resident. On some floors, graphs for all residents were kept in common binders; on others, graphs were kept in individual resident charts.

4.5.4 Falls and Cardiovascular Events

Incidence of falls and cardiovascular events were obtained by review of multi-disciplinary team notes and physician notes. Falls were also identified by incident reports filed in the chart. History of falls or problems with balance was also obtained from the CGA.

4.5.5 Medication Costs

Medication costs were calculated from the Nova Scotia Provincial Formulary, dated February 2014 and accessed online. (62)

The Seniors' Pharmacare Program is available to all Nova Scotia seniors 65 years or older who have a valid Nova Scotia Health Card, and do not have private drug coverage. In addition, coverage is provided for long term care residents under 65 years of age who have no drug insurance through the Under 65-Long Term Care (LTC) Pharmacare Program.

4.6 Outcomes

The primary composite outcome of the study is the degree of adherence to each of the four key messages of the treatment recommendations. Specific component outcomes

are listed in Table 1. Secondary outcomes are also listed in Table 1, along with the statistical tests that were used to analyze the data.

4.7 Statistical Analyses

All analyses were performed using SPSS Statistics 20 by IBM. Analyses were performed using non-parametric tests comparing related samples. A two-sided p-value less than .05 was considered statistically significant for all tests. Specific primary and secondary outcomes are listed in Table 1 along with the statistical tests that were used to analyze the data.

4.7.1 Descriptive Analysis

Descriptive statistics (numbers and proportions for categorical variables; means, standard deviations, medians and ranges for continuous variables, as appropriate) were expressed for demographics, medical conditions, drug use of medications affecting blood pressure, history of falls, and frailty level.

4.7.2 Analysis of Differences

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, which analyzes the median of differences between related samples. Analysis was based on "related samples" because a total of 91 residents were included in both the pre- and post-intervention populations, representing 77% and 88% of the population, respectively.

Differences in proportions between time points were tested using Cochran's Q Test, which analyzes the distributions of proportions in related samples.

4.7.3 Logistic Regression

Logistic regression was used to explore patient specific factors (i.e. sex, age, frailty) associated with the incidence of falls. Univariate and multivariable analyses were performed. Predictor variables were age, sex, clinical frailty scale, 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. The "tolerance" is an indication of the percent of variance in the predictor that cannot be accounted for by the other predictors. Therefore, very small values indicate that a predictor is redundant, and values that are less than .20 may merit further investigation. A tolerance statistic less than 0.2 suggested multi-collinearity between independent variables.

Chapter 5

RESULTS

5.1 Resident Flow

A total of 138 residents were included in the study. Data was collected for 118 residents pre-intervention (September 2012) and 104 residents post-intervention (May 2013). These numbers differ due to deaths, transfers, new admissions, and consent. A total of 91 patients were included in both the pre- and post-intervention population.

In addition, data was collected for 85 residents at 1 year pre-intervention (retrospective to September 2011). All of the residents included in the 1 year pre-intervention population (September 2011) are also included in the PRE-intervention population (September 2012). Figure 5 shows details of the resident flow through the study period.

5.1.1 Medication Reviews

Formal medication reviews are completed by the health care team for each resident bi-annually (every 6 months), including the physician, registered nurse, and pharmacist.

A total of 92% of the post intervention population had a formal medication review completed during the study period. For those residents with both pre and post intervention data, 99% (n=90) had a formal medication review completed during the study period.

5.1.2 Comprehensive Geriatric Assessment

Comprehensive geriatric assessment (CGA) is a multidisciplinary process that identifies medical, social, and functional limitations of a frail older person in order to develop a coordinated plan of care. (63) Within the regional health authority, a CGA form has been developed for use in LTC, which can be found in Appendix 5. This standardized assessment documents an older patient's health status, including cognition (e.g., dementia, delirium), mood, mobility, function, medical conditions, and medications, among other information. They are required to be completed annually. It is

recommended that family physicians complete the LTC-CGA for every resident, and to keep it updated every six months and after any significant change in health status. (64)

A total of 69% of the post intervention population had a CGA completed during the study period. For those residents with both pre and post intervention data, 67% (n=61) had a CGA completed during the study period.

5.2 Demographics and Medical History

The pre-intervention and post-intervention populations did not differ in their demographic characteristics. Mean age of the residents was 86.9 +/- 9.7 years and 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 assessed at a Frailty Level of 7 (severely frail) on the Clinical Frailty Scale, with 28% assessed at a Frailty Level of 6 (moderately frail). A description of the Clinical Frailty Scale is found in the Glossary.

Demographics and medical history of the pre- and post- intervention populations are found in Table 5.

5.3 Adherence to Key Messages

Adherence to the four key messages of the recommendations for the treatment of hypertension in the frail elderly was measured at each time point. Complete details for adherence to key messages are found in Table 6.

The first key message was to consider starting treatment when the systolic blood pressure was ≥160mm Hg. 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.

The second key message was to aim for a seated SBP between 140 and 160 mm Hg. Pre-intervention, 18 residents (15.7%) were within the recommended blood pressure range. Post-intervention, 7 residents (6.7%) were within the recommended range (p=0.109).

The third key message was to use no more than 2 medications to treat hypertension. In the pre-intervention population, 86.4% of residents were on ≤ 2 medications affecting blood pressure, while in the post-intervention population, 88.5% of residents were on ≤ 2 medications (p=1.000).

The fourth key message was to consider tapering and discontinuing anti-hypertensive medication if SBP <140mm Hg. A total of 49.6% (n=57) of the pre-intervention population had a SBP of less than 140mm Hg and were treated with at least one medication affecting blood pressure. In the post-intervention population, this proportion was 47.1% (p=0.593).

There was no difference in the proportion adhering to any of the key messages between the pre- and post- intervention populations, or between pre-academic detailing (1 year pre-) and pre-intervention populations.

5.4 Medication Use

5.4.1 Regularly Scheduled Medications

Prior to the intervention, residents were prescribed a mean of 8.8 +/-3.8 regularly scheduled medications, which decreased to 8.2 +/- 3.5 medications post-intervention (p=0.066). Residents were on a minimum of 1 medication and a maximum of 19 regularly scheduled medications, with a median of 9.

A histogram of the number of regularly scheduled medications taken by residents is found in Figure 7.

5.4.2 Medications Affecting Blood Pressure

Table 7 shows the average number of medications affecting blood pressure taken by residents and the change over the study period. In those with a documented history of hypertension, use of medications affecting blood pressure decreased from 1.5 +/- 1.3 medications to 1.2 +/- 1.3 ($p<0.001$)

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 ($p=0.002$).

A total of 13.7% of residents were taking three or more medications prior to the intervention, which decreased to 11.5% after the intervention.

The proportion of residents using each individual class of medication decreased from before the intervention to after, although the difference was statistically significant only for the use of calcium channel blockers (17.8% to 12.5%; $p=0.016$)

The proportion of residents taking medications affecting blood pressure is shown in Figure 6. The use of alpha blockers and oral nitrates did not change between study time points, with a single resident using each of these classes. These classes of medication are not shown in Figure 6.

5.4.3 Prescribing Changes – Medications Affecting Blood Pressure

Data was collected on changes in prescriptions for medication affecting blood pressure that occurred at any time during the study period.

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%). Medications were discontinued in 9 residents (7.6%), dose was decreased in 4 residents (3.4%) and dose was increased or a medication was added in 3 residents (2.5%).

Following the intervention, there was a significant increase in the proportion of residents with changes made in medications affecting blood pressure ($p<0.001$). Of the post-intervention population (n=104), changes were made in antihypertensive drug therapy during the study period for 37 residents (35.6%). Medications were discontinued in 26 residents (25.0%), dose was decreased in 14 residents (13.5%) and dose was increased or a medication was added in 6 residents (5.8%).

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.

5.4.4 Change in Cost of Medications Affecting Blood Pressure

Median monthly cost for medications affecting blood pressure was $4.18 pre-intervention and decreased to $1.05 post-intervention ($p<0.001$ for the difference). The interquartile range was $0 to $13.82 pre-intervention and $0 to $10.46 post-intervention.

Daily and monthly costs per resident for medications affecting blood pressure are shown in table 11.

5.5 Resident Falls

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. ($p=0.028$ for the difference)

Complete data on falls is found in Table 9.

5.6 Blood Pressure

Blood pressure of residents did not differ between study time points. Mean systolic blood pressure was 123 +/- 16 mmHg in the pre-intervention population, with a range of 80 to 180. Mean diastolic blood pressure in this population was 67 +/- 11 mmHg, with a range of 40 to 108.

The distribution of systolic blood pressure in the pre-intervention population is shown in Figure 8. Complete data on blood pressure across study time points is found in Table 10.

A diagnosis, or note of, postural hypotension was found in the charts of 10 residents (n=138, 7.2%) Pre-intervention, seven of these residents were prescribed at least one medication affecting blood pressure. Physicians discontinued one medication affecting blood pressure in two of these patients during the study period. Three residents with postural hypotension were prescribed either three or four medications affecting blood pressure at both pre- and post-intervention.

Data was collected for a total of 138 residents, at baseline and final time points. 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”.

5.7 Safety: Death and Cardiovascular Events

Of the 118 residents included in the pre-intervention population, 24 died during the study period. An additional four residents admitted after the intervention died before the end of the observation period. None of these deaths were considered to be primarily due to cardiovascular causes. One resident had a myocardial infarction before death (last recorded BP 134/70), and one resident had a stroke prior to death (last recorded BP 140/70), although neither was deemed to be the primary cause of death. One resident had a pulmonary embolism during the study period that did not result in death.

Three residents had episodes of TIAs during the study period and four residents had episodes of angina recorded in their chart. Episodes of bradycardia, hypotension and atrial fibrillation were each recorded for two residents. Three residents had episodes of syncope. Pre-intervention blood pressures for the patients who experienced syncope were 100/66, 120/62 and 138/80, respectively.

5.8 Logistic Regression Analysis – Prediction of Resident Fall

Logistic regression analysis was used to predict the probability that a participant would have a fall during the study period. The predictor variables were age, sex, clinical frailty scale, systolic blood pressure, diagnosis of dementia, number of scheduled medications, number of medications affecting blood pressure and number of co-morbidities.

A review of multi-collinearity between independent variables was performed. Tolerance statistics were well above 0.2, indicating no significant collinearity between independent variables, therefore variance in any one independent variable cannot be accounted for by other independent variables.

Univariate analysis indicated that none of the variables were able to significantly predict a fall within the study period. Table 12 shows the odds ratios, Chi Square and p value for each of the predictors. A criterion of 0.05 was used to test statistical significance.

Variables from the univariate analysis with a p value <0.5 were included in the multivariable analysis. A test of a model using age, clinical frailty, diagnosis of dementia and systolic blood pressure was not statistically significant, Chi Square (4, N=94) = 4.692, p=0.320. The model was not statistically significant when SBP (p=0.983) was removed (Chi Square (3, N=94) = 4.691, p=0.196).

Chapter 6

DISCUSSION

6.1 Nursing Home Study Population

The care model of the nursing home in this study is representative of nursing homes across Capital Health. A total of six physicians were providing care for 149 residents using a physician per floor model. Prior to the implementation of this care model (Care by Design) in 2009, residents entering a nursing home maintained or found a family physician for their primary care. (65)

The population of nursing home residents in this study was an example of a frail population. Just prior to the intervention, median age was 89 years and residents had been in the nursing home for a median of 1.7 years. The mean age of residents during the study was 87 years, which is slightly higher than the reported mean age of nursing home residents in Nova Scotia in 2011-12, which was 85 years. (66) Residents were prescribed a median of nine regularly scheduled medications and had a median of five co-morbidities listed in their medical record. Over 60% of residents were assigned a Clinical Frailty Score of seven, indicating "severe frailty" and were completely dependent in all basic activities of daily living (ADLs). Of the pre-intervention population, 24 residents (20%) died during the seven month study period. This is slightly less that the estimated 50% turnover in any 12 month period for this facility (estimate by Director of Nursing).

The residents in this study were predominantly female (91%). It is acknowledged that because women tend to live longer than men, the ratio of women to men increases considerably with age, however this very high proportion of females is not reflective of general population of older adults in Nova Scotia. In 2005, 74% of nursing home residents in Nova Scotia were female. (3) Overall in Nova Scotia, there were 227 women per 100 men in the 85+ age group in 2007. (67)

In the study population, approximately 25% of nursing home residents had diabetes, which is reflective of the prevalence of diabetes in the elderly general population in Nova Scotia. According to a 2009 provincial report, the prevalence of diabetes in Nova Scotia is 24% for those aged 70-79 and 21% of aged 80 and over. (67) The prevalence is also similar to the results of a 2004 survey of nursing home residents in the United States, where 24.6% of residents had diabetes as a primary admission and/or current diagnosis. (68)

Interestingly, there were no residents listed as being a "smoker" in their charts, although it is not known if this is accurate. A "history of smoking" was not recorded in any patient admission note.

6.2 Treatment of Hypertension in the Nursing Home Population

A total of 64% of residents had a diagnosis of hypertension recorded in their medical history and 60% of all residents were prescribed at least one medication affecting blood pressure. These rates are similar to overall Canadian data that estimate the prevalence of hypertension in those aged 85 and older to be 74.6%, and report that 62.6% of seniors receive chronic drug treatment for hypertension. (6)

Our study showed a higher rate of diagnosed hypertension, based on physician documentation, and a higher rate of treatment for hypertension than found in a retrospective chart review of 15 Canadian nursing homes. (69) In that study, 36% of nursing home residents were diagnosed with hypertension (mean age 84 years), and 77% of this cohort (27% of total) were receiving antihypertensive medication. Overall, 467 (64%) of those residents with a diagnosis of hypertension achieved target blood pressure. As in our study, hypertension was accepted as the diagnosis if documented by a physician in the medical record. Two thirds of residents had a physician-assigned diagnosis of dementia, compared to 75% of residents in our study. Average length of stay of residents in LTC was not reported. Target blood pressures were defined according to 2001 Canadian hypertension recommendations: ≤140/90 mmHg in patients with uncomplicated hypertension and ≤130/80 in patients with diabetes or

chronic kidney disease. (70) Blood pressure was measured in a "standard fashion by trained health care personnel and at the same time of day", although details on the "standard fashion" were not provided.

In our study, residents' blood pressure measurements were generally below 140 mmHg. The mean blood pressure of the pre-intervention population was 123/67 mm Hg. A total of 20 (17%) residents had a systolic blood pressure ≥140mm Hg and 5 (4%) had SBP ≥150 mm Hg. Residents were taking a mean of 1.2 medications affecting blood pressure. When considering only residents with a documented history of hypertension (n=76), mean SBP was slightly higher at 125/68 mm Hg and residents were taking a mean of 1.5 medications affecting blood pressure.

6.2.1 Appropriateness of Treatment for Hypertension

Appropriateness of treatment was measured by adherence to the key messages of the educational intervention.

a) Overall, residents were "over-treated" with medications affecting blood pressure. Approximately 50% of residents had a SBP <140mmHg while on at least one medication affecting blood pressure.
b) Less than 20% of all residents had a SBP in the recommended range of 140 to 160 mmHg. For most residents, SBP was well below this acceptable range.
c) 13% of residents were on 3 or more medications affecting blood pressure.

6.3 Scope of Impact of the Educational Intervention

6.3.1 Use and Cost of Medications Affecting Blood Pressure

This study demonstrated that physician prescribing for hypertension in nursing home residents can be influenced by an educational intervention on recommendations specific to the treatment of the frail elderly. During the study period, physicians made a change in the prescription of at least one medication affecting blood pressure for 36% of residents, including discontinuing a medication in 70% of these changes. 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.

Although the use of medications affecting blood pressure decreased, there was no change in mean blood pressure for the population over the study period. There was a significant increase in the proportion of residents on no medication affecting blood pressure (40% to 48%, p=0.003). Likewise, the proportion of residents prescribed two or more blood pressure medications decreased from 36% to 23% over the study period.

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. It is 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 2.5mg ($0.33) is greater than the cost of amlodipine 5mg ($0.24). (62)

6.3.2 Falls

Along 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, as compared 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.(71) As an example, vasodilators have been associated with an increased risk of falling, but the association was not significant for beta-blockers and only marginally significant for diuretics. (71,72)

Although a cause and effect relationship cannot be confirmed by the observation design, it is possible that the reduction in use of medications affecting blood pressure contributed to the reduction in residents falls in our study. Review of the Hill criteria for causation show that the association meets some but not all criteria for causality. (73) For example, there was a temporal relationship seen in our study, and the association

does make epidemiologic and biologic sense. However, a dose response gradient could not be established and the association is not specific.

In Nova Scotia, it has been found that hospitalization due to a fall-related injury is most frequent in those aged 75 and over. When the 65-74 and 75+ age groups are compared, the likelihood of being hospitalized due to a fall related injury increased by two and half times for men and four times for women in the older age group. (67) Falls are especially problematic for those living in long-term care settings. Rubenstein (2006) reported that there is a mean of 1.7 (range 0.6-3.6) falls per person-year in nursing home. (74) This can be translated into a fall expected about every other day in a nursing home with 100 beds. (75)

The risk of falls has been shown to be multi-factorial. Risk factors include muscular weakness, balance and gait deficits, poor vision, delirium, cognitive and functional impairment, orthostatic hypotension, urinary urge incontinence, and nocturia. Other contributing factors include comorbidities, such as dementia and Parkinson disease, as well as side effects and interactions of drugs. (75,76)

In our study, no individual factors were found to be associated with a resident having a fall, including age, frailty level, diagnosis of dementia, or number of medications affecting blood pressure, among others. This may be due to a small sample size, and the random variability in the factors potentially associated with a fall.

6.3.3 Recording Blood Pressure Measurements in Resident Charts

Over the course of the study period, blood pressure readings in the chart did not generally include the position of the resident during the measurement. Of 276 potential readings, only 7% of readings documented the position of the resident, and only 3% were recorded as “sitting”. 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.

In future educational interventions, more emphasis should be placed on the importance of recording the position in which blood pressure is measured and using seated blood pressure to make treatment decisions.

6.4 Safety Implications

With a higher blood pressure treatment target, there is theoretically an increased risk of cardiovascular events, although this has not been demonstrated in the pertinent medical literature. In this short term, observational study, in a frail population, it is not possible to draw conclusions about the effect of the educational intervention on the rate of cardiovascular events or deaths. From review of physician notes, there was no indication that changes in blood pressure medication were a factor in any death or cardiovascular event.

6.5 The Effect of the Academic Detailing Service on Study Results

The hypertension treatment recommendations for the frail elderly were included as part of the provincial Academic Detailing program on Hypertension, which began in October 2011. Family physicians across Nova Scotia received one-on-one education sessions by trained detailers. Although the treatment recommendations were only one component of the Academic Detailing material, there was some concern that the program may have already impacted physician prescribing prior to the educational intervention on October 4, 2012.

Data collected one year prior to the educational intervention (n=85) showed that prescribing for hypertension in the nursing home population did not significantly change in the year prior to the educational intervention. There was no change in the mean number of medications affecting blood pressure taken by residents in this one year period.

6.6 Change in Guideline Recommendations since 2012

In the time since the educational intervention and the original development of the ADS/PATH hypertension recommendations, there has been increasing

acknowledgement of the importance of considering age and frailty in the treatment of hypertension.

In 2014, recommendations for the treatment of hypertension were updated by both Canadian and American advisory groups. CHEP documents published in 2014 make several recommendations for the "very elderly," a group they define as over the age of 80. For the very elderly *without diabetes or target organ damage*, drug therapy should be initiated when systolic blood pressure is >160 mm Hg to reach a systolic blood pressure target <150 mmHg. If macrovascular target organ damage is present, antihypertensive therapy should be considered if systolic blood pressure readings average 140 mmHg or higher. It is recommended that caution should be exercised in elderly patients who are frail and that decisions regarding initiating and intensifying pharmacotherapy in the very elderly should be based upon an individualized risk-benefit analysis. (77)

Although recommendations are not specific to the frail elderly, the 2014 recommendations from JNC-8 increased the target systolic blood pressure (SBP) from ≤140 to ≤150 mm Hg in persons aged 60 years or older without diabetes mellitus or chronic kidney disease (CKD). In patient with CKD, and in people of any age with albuminuria (defined as greater than 30mg of albumin per gram of creatinine), target SBP is ≤140mm Hg. They also advise that antihypertensive treatment should be individualized, taking into consideration such factors as frailty, comorbidities, and albuminuria in people aged 70 years or older with reduced renal function, although no specific recommendations are made. (78)

6.7 Study Limitations / Challenges

This study was an observational before and after study in a single nursing home in Halifax, Nova Scotia. The observational study design, with data collected through chart review, can be used to generate a hypothesis, which can be tested further in a larger, controlled study.

The study was designed to provide a "snapshot" of physician prescribing before and after the educational intervention. There were 91 patients that were included in both the pre- and post-intervention populations, representing 77% and 88% of the populations respectively. 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. Analysis of the percentage of residents with a change in their medications affecting blood pressure was done on the full pre- and post-populations, as well as the 91 residents included in both populations. Results did not differ significantly.

New residents in the nursing home have the potential to benefit from the education provided on treatment recommendations for hypertension in the frail elderly. It is possible that given the potential for selection bias, and the high percentage of residents that were included in both the pre- and post-intervention populations, that the observed differences in medication use could be conservative.

The educational intervention was provided to all physicians and data was collected for all residents who provided consent. The use of a control group - such as a different nursing home with no educational intervention or a separate group of physicians not receiving the intervention - would have strengthened the study.

Chart review provides a real-world picture of the information recorded in a nursing home resident's medical record; however there are limitations to using chart review as the data source for research, which include incomplete documentation, information that is unrecorded, difficulty interpreting information found in the documents (e.g. jargon, acronyms), problematic verification of information, and variance in the quality of information recorded by different medical professionals. (79) In our study, the medical history that is recorded on admission may also give rise to an incomplete data set, as it is unlikely that the two page note recorded by the social worker and the brief admission

note in the “physician’s notes” provide a complete medical history. Nevertheless, it was assumed that all medical conditions that are relevant to a resident’s continued care are recorded and that the degree to which these reflect the actual medical issues would not change during the study period. All medications with the potential to lower blood pressure were recorded as “anti-hypertensives”. Notably, an incomplete medical record would influence any understanding of how to judge the appropriate use of antihypertensive medications, as it is known that some of these drugs are used to treat indications other than hypertension, such as heart failure. It should be noted that these same assumptions can be applied to both the before and after intervention populations, thereby minimizing attributable error.

All residents in the nursing home, regardless of assessed level of frailty, were included in the analysis of recommendations specific the “frail elderly”. Residents admitted to nursing homes in Nova Scotia, are assumed to be frail. The use of Comprehensive Geriatric Assessment, and specifically the assessment of frailty using the Clinical Frailty Scale, is based on clinical judgement of the physician. Even using the validated scale, assessment may differ between clinicians, resulting in different levels of frailty being assigned. To strengthen our study and provide consistency, a single clinician could assess frailty of the residents in the nursing home.

A barrier assessment was completed by the study team prior to the educational intervention, using the Theoretical Domains Framework to consider various behavioural change theories. Specific components were included to address potential barriers, including 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.

Interventions were of minimal cost, with support from the nursing home for the large group presentation, donation of time and expertise from T4G for development of the widget and support from Capital Health Research Fund for material costs of posters,

stickers, laminates etc. To implement a similar educational intervention more widely would need to include consideration of costs involved in individual components.

A large group session was part of the educational intervention for this study, to ensure that the same message was given to all health care professionals, including physicians and nurses. Smaller group, or individual sessions may have improved uptake by physicians by encouraging more interaction and discussion of concerns with the presenters. Although the widget was available for access on the PATH website, there was no mechanism to know how many times it was accessed by the study physicians.

The study used multi-faceted interventions to address potential barriers within the health system. All interventions happened simultaneously, and there was no control group; therefore the study was not designed to address the effectiveness of individual components of the multi-faceted intervention. A qualitative component to this study could have explored which specific tools or components of the educational intervention were useful in affecting prescribing for hypertension in the nursing home population.

The sample size for this study was the population of a single nursing home. A total of 138 residents (or their caregivers) provided consent over the study period. It is likely that this sample size, over a study period of 7 months, did not have the power to detect differences in mortality, cardiovascular events or other safety outcomes. It is likely that there was a significant random variability in the health of the residents.

6.8 Implications of Research

This research project involved education on the new hypertension treatment recommendations specific to the frail elderly for physicians and non-physicians caring for residents in a nursing home in Halifax, 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.

This research project demonstrated that the nursing home residents were over-treated with medications that affect blood pressure. Although systolic blood pressure was well under the recommended range, residents continued to be prescribed medications affecting blood pressure, putting them at risk for drug related harms, such as falls and other adverse events. Based on this observation, it seems that treatment recommendations for the frail need to focus on over-treatment, rather than under-treatment, by promoting higher blood pressure targets. This project demonstrated 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. (13) All treatment decisions in a nursing home should consider the potential increased risks and more limited benefits in a frail population.

Other treatment recommendations specific to the frail elderly have been completed by the PATH / Academic Detailing groups or the Diabetes Care Program of Nova Scotia (i.e. the use of statin lowering medications and Diabetes, respectively), and there are plans to develop recommendations for other chronic diseases. 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, it is anticipated that there may be greater interest to implement treatment recommendations for the frail elderly in nursing homes within the Capital District Health Authority and across Nova Scotia. This project may serve as a pilot project for a broader provincial educational intervention of the hypertension

recommendations and replication of the educational intervention for other recommendations under development.

Broader education on treatment recommendations specific to the frail elderly has the potential to benefit both nursing home residents and physicians. As in our study, educational interventions should provide specific recommendations, as well as background evidence, to support individualized, and potentially less aggressive, treatment of hypertension in nursing home residents. 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.

REFERENCES

(1) Rockwood K, Song X, MacKnight C, Bergman H, Hogan DB, McDowell I, et al. A global clinical measure of fitness and frailty in elderly people. CMAJ 2005 Aug 30;173(5):489-495.

(2) Nova Scotia Senior Citizens Secretariat. A Statistical Profile of Nova Scotia Seniors 2003. 2003.

(3) CBC. Canada's nursing homes: National Statistics. data published 2007; Available at: http://www.cbc.ca/news2/interactives/map-nursing-homes/. Accessed August 9, 2014.

(4) HCC. Decisions, Decisions: Family Doctors as Gatekeepers to Prescriptions Drugs and Diagnostic Imaging in Canada. 2010 September 2010.

(5) Tamura BK, Bell CL, Inaba M, Masaki KH. Outcomes of polypharmacy in nursing home residents. Clin Geriatr Med 2012 May;28(2):217-236.

(6) CIHI. Drug Use in Seniors on Public Drug Programs in Canada, 2012. 2014.

(7) Personal Communication. Michael Joyce, Director Health Economics, Nova Scotia Department of Health and Wellness. 1-30-2012. 2012.

(8) Moorhouse P, Rockwood K. Frailty and its quantitative clinical evaluation. J R Coll Physicians Edinb 2012;42(4):333-340.

(9) Theou O, Rockwood MR, Mitnitski A, Rockwood K. Disability and co-morbidity in relation to frailty: how much do they overlap? Arch Gerontol Geriatr 2012 Sep-Oct;55(2):e1-8.

(10) NPS Medicinewise News. Older, safer, wiser. 2013 September 2; Available at: http://www.nps.org.au/publications/health-professional/medicinewise-news/2013/older-wiser-safer. Accessed May, 2014.

(11) Mallery LH, Moorhouse P. Respecting frailty. J Med Ethics 2011 Feb;37(2):126-128.

(12) Mallery LH, Allen M, Fleming I, Kelly K, Bowles S, Duncan J, et al. Promoting higher blood pressure targets for frail older adults: A consensus guideline from Canada. Cleve Clin J Med 2014 Jul;81(7):427-437.

(13) Maher RL, Hanlon J, Hajjar ER. Clinical consequences of polypharmacy in elderly. Expert Opin Drug Saf 2014 Jan;13(1):57-65.

(14) Morgan SG, Smolina K, Mooney D, Raymond C, Bowen M, Gorczynski C, et al. Canadian Rx Atlas, 3rd edition. 2013.

(15) CIHI. Prescribed Drug Spending in Canada 2012 Report. 2014.

(16) CIHI. Adverse Drug Reaction–Related Hospitalizations Among Seniors, 2006 to 2011. 2013.

(17) Wu C, Bell CM, Wodchis WP. Incidence and economic burden of adverse drug reactions among elderly patients in Ontario emergency departments: a retrospective study. Drug Saf 2012 Sep 1;35(9):769-781.

(18) Nova Scotia Department of Health and Wellness. Continuing Care - Enhancing Care for the Frail Elderly - Pharmacy. 2014; Available at: http://novascotia.ca/dhw/ccs/polypharmacy.asp. Accessed July 21, 2014.

(19) Personal Communication. Medical Director of Northwood Nursing Home . 2014.

(20) Maddison AR, Fisher J, Johnston G. Preventive medication use among persons with limited life expectancy. Prog Palliat Care 2011 Jan;19(1):15-21.

(21) Parsons C, Hughes CM, Passmore AP, Lapane KL. Withholding, discontinuing and withdrawing medications in dementia patients at the end of life: a neglected problem in the disadvantaged dying? Drugs Aging 2010 Jun 1;27(6):435-449.

(22) McMurdo ME, Witham MD, Gillespie ND. Including older people in clinical research. BMJ 2005 Nov 5;331(7524):1036-1037.

(23) Van Spall HG, Toren A, Kiss A, Fowler RA. Eligibility criteria of randomized controlled trials published in high-impact general medical journals: a systematic sampling review. JAMA 2007 Mar 21;297(11):1233-1240.

(24) Mutasingwa DR, Ge H, Upshur RE. How applicable are clinical practice guidelines to elderly patients with comorbidities? Can Fam Physician 2011 Jul;57(7):e253-62.

(25) Cox L, Kloseck M, Crilly R, McWilliam C, Diachun L. Underrepresentation of individuals 80 years of age and older in chronic disease clinical practice guidelines. Can Fam Physician 2011 Jul;57(7):e263-9.

(26) Guthrie B, Payne K, Alderson P, McMurdo MET, Mercer SW. Adapting clinical guidelines to take account of multimorbidity. BMJ 2012 BMJ Publishing Group Ltd;345.

(27) Sergi G, De Rui M, Sarti S, Manzato E. Polypharmacy in the elderly: can comprehensive geriatric assessment reduce inappropriate medication use? Drugs Aging 2011 Jul 1;28(7):509-518.

(28) Gallagher P, Barry P, O'Mahony D. Inappropriate prescribing in the elderly. J Clin Pharm Ther 2007 Apr;32(2):113-121.

(29) O'Connor MN, Gallagher P, O'Mahony D. Inappropriate prescribing: criteria, detection and prevention. Drugs Aging 2012 Jun 1;29(6):437-452.

(30) American Geriatrics Society 2012 Beers Criteria Update Expert Panel. American Geriatrics Society updated Beers Criteria for potentially inappropriate medication use in older adults. J Am Geriatr Soc 2012 Apr;60(4):616-631.

(31) O'Mahony D, Gallagher P, Ryan C, Byrne S, Hamilton H, Barry P, et al. STOPP & START criteria: A new approach to detecting potentially inappropriate prescribing in old age. European Geriatric Medicine 2010 /2;1(1):45-51.

(32) Hanlon JT, Schmader KE, Samsa GP, Weinberger M, Uttech KM, Lewis IK, et al. A method for assessing drug therapy appropriateness. J Clin Epidemiol 1992 Oct;45(10):1045-1051.

(33) Dimitrow MS, Airaksinen MS, Kivela SL, Lyles A, Leikola SN. Comparison of prescribing criteria to evaluate the appropriateness of drug treatment in individuals aged 65 and older: a systematic review. J Am Geriatr Soc 2011 Aug;59(8):1521-1530.

(34) Gallagher P, Ryan C, Byrne S, Kennedy J, O'Mahony D. STOPP (Screening Tool of Older Person's Prescriptions) and START (Screening Tool to Alert doctors to Right Treatment). Consensus validation. Int J Clin Pharmacol Ther 2008 Feb;46(2):72-83.

(35) Cherubini A, Corsonello A, Lattanzio F. Underprescription of beneficial medicines in older people: causes, consequences and prevention. Drugs Aging 2012 Jun 1;29(6):463-475.

(36) Garfinkel D, Zur-Gil S, Ben-Israel J. The war against polypharmacy: a new cost-effective geriatric-palliative approach for improving drug therapy in disabled elderly people. Isr Med Assoc J 2007 Jun;9(6):430-434.

(37) Iyer S, Naganathan V, McLachlan AJ, Le Couteur DG. Medication withdrawal trials in people aged 65 years and older: a systematic review. Drugs Aging 2008;25(12):1021-1031.

(38) Alexander GC, Sayla MA, Holmes HM, Sachs GA. Prioritizing and stopping prescription medicines. CMAJ 2006 Apr 11;174(8):1083-1084.

(39) Garfinkel D, Mangin D. Feasibility study of a systematic approach for discontinuation of multiple medications in older adults: addressing polypharmacy. Arch Intern Med 2010 Oct 11;170(18):1648-1654.

(40) PATH. Palliative & Therapeutic Harmonization Clinic. 2014; Available at: http://www.pathclinic.ca. Accessed March 22, 2014.

(41) Moorhouse P, Mallery LH. Palliative and therapeutic harmonization: a model for appropriate decision-making in frail older adults. J Am Geriatr Soc 2012 Dec;60(12):2326-2332.

(42) Lenfant C, Chobanian AV, Jones DW, Roccella EJ, Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Seventh report of the Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7): resetting the hypertension sails. Hypertension 2003 Jun;41(6):1178-1179.

(43) Aronow WS, Fleg JL, Pepine CJ, Artinian NT, Bakris G, Brown AS, et al. ACCF/AHA 2011 expert consensus document on hypertension in the elderly: a report of the American College of Cardiology Foundation Task Force on Clinical Expert Consensus Documents. Circulation 2011 May 31;123(21):2434-2506.

(44) Campbell NR, Kaczorowski J, Lewanczuk RZ, Feldman R, Poirier L, Kwong MM, et al. 2010 Canadian Hypertension Education Program (CHEP) recommendations: the scientific summary - an update of the 2010 theme and the science behind new CHEP recommendations. Can J Cardiol 2010 May;26(5):236-240.

(45) Mancia G, Laurent S, Agabiti-Rosei E, Ambrosioni E, Burnier M, Caulfield MJ, et al. Reappraisal of European guidelines on hypertension management: a European Society of Hypertension Task Force document. J Hypertens 2009 Nov;27(11):2121-2158.

(46) Musini VM, Tejani AM, Bassett K, Wright JM. Pharmacotherapy for hypertension in the elderly. Cochrane Database Syst Rev 2009 Oct 7;(4):CD000028. doi(4):CD000028.

(47) Dalhousie Academic Detailing. Issues in Hypertension 2011 . 2011 April 28, 2011(November/28).

(48) KT Clearinghouse. The Knowledge to Action Cycle. 2013; Available at: http://ktclearinghouse.ca/knowledgebase/knowledgetoaction. Accessed April 26, 2014.

(49) Grimshaw JM, Eccles MP, Lavis JN, Hill SJ, Squires JE. Knowledge translation of research findings. Implement Sci 2012 May 31;7:50-5908-7-50.

(50) Legare F, Ratte S, Gravel K, Graham ID. Barriers and facilitators to implementing shared decision-making in clinical practice: update of a systematic review of health professionals' perceptions. Patient Educ Couns 2008 Dec;73(3):526-535.

(51) French SD, Green SE, O'Connor DA, McKenzie JE, Francis JJ, Michie S, et al. Developing theory-informed behaviour change interventions to implement evidence into practice: a systematic approach using the Theoretical Domains Framework. Implement Sci 2012 Apr 24;7:38-5908-7-38.

(52) Michie S, Johnston M, Abraham C, Lawton R, Parker D, Walker A, et al. Making psychological theory useful for implementing evidence based practice: a consensus approach. Qual Saf Health Care 2005 Feb;14(1):26-33.

(53) Cane J, O'Connor D, Michie S. Validation of the theoretical domains framework for use in behaviour change and implementation research. Implement Sci 2012 Apr 24;7:37-5908-7-37.

(54) Canadian Health Services Research Foundation. A Communications Primer. 1998.

(55) Graham ID, Logan J, Harrison MB, Straus SE, Tetroe J, Caswell W, et al. Lost in knowledge translation: time for a map? J Contin Educ Health Prof 2006 Winter;26(1):13-24.

(56) CADTH Canadian Agency for Drugs and Technologies in Health. Rx for Change database. 2014; Available at: http://www.cadth.ca/en/resources/rx-for-change. Accessed April 28, 2014.

(57) Alberta Mental Health Research Partnership. Knowledge Translation: A synopsis of the literature 2008. 2009.

(58) Van Eerd D, Cole D, Keown K, Irvin E, Kramer D, Gibson J, et al. Report on knowledge transfer and exchange practices: A systematic review of the quality and types of instruments used to assess KTE implementation and impact. 2011.

(59) O'Brien MA, Rogers S, Jamtvedt G, Oxman AD, Odgaard-Jensen J, Kristoffersen DT, et al. Educational outreach visits: effects on professional practice and health care outcomes. Cochrane Database Syst Rev 2007 Oct 17;(4)(4):CD000409.

(60) Francis JJ, O'Connor D, Curran J. Theories of behaviour change synthesised into a set of theoretical groupings: introducing a thematic series on the theoretical domains framework. Implement Sci 2012 Apr 24;7:35.

(61) Garfinkel D, Mangin D. Feasibility study of a systematic approach for discontinuation of multiple medications in older adults: addressing polypharmacy. Arch Intern Med 2010 Oct 11;170(18):1648-1654.

(62) Nova Scotia Department of Health. Nova Scotia Formulary - February 2014. 2014; Available at: http://novascotia.ca/dhw/pharmacare/documents/formulary.pdf. Accessed March 1, 2014.

(63) Ellis G, Whitehead MA, O'Neill D, Langhorne P, Robinson D. Comprehensive geriatric assessment for older adults admitted to hospital. Cochrane Database Syst Rev 2011 Jul 6;(7):CD006211. doi(7):CD006211.

(64) Marshall EG, Boudreau MA, Jensen JL, Edgecombe N, Clarke B, Burge F, et al. A new long-term care facilities model in nova scotia, Canada: protocol for a mixed methods study of care by design. JMIR Res Protoc 2013 Nov 29;2(2):e56.

(65) CDHA. Care by Design. 2014; Available at: http://www.cdha.nshealth.ca/care-by-design. Accessed May 26, 2014.

(66) CIHI. When a Nursing Home is home: How do Canadian Nursing Homes Measure Up on Quality. 2013.

(67) Nova Scotia Department of Seniors. Seniors Statistical Profile 2009. 2009 September 2009.

(68) Resnick HE, Heineman J, Stone R, Shorr RI. Diabetes in U.S. nursing homes, 2004. Diabetes Care 2008 Feb;31(2):287-288.

(69) Tsuyuki RT, McLean DL, McAlister FA. Management of hypertension in elderly long-term care residents. Can J Cardiol 2008 Dec;24(12):912-914.

(70) McAlister FA, Zarnke KB, Campbell NR, Feldman RD, Levine M, Mahon J, et al. The 2001 Canadian recommendations for the management of hypertension: Part two--Therapy. Can J Cardiol 2002 Jun;18(6):625-641.

(71) Woolcott JC, Richardson KJ, Wiens MO, Patel B, Marin J, Khan KM, et al. Meta-analysis of the impact of 9 medication classes on falls in elderly persons. Arch Intern Med 2009 Nov 23;169(21):1952-1960.

(72) Myers AH, Baker SP, Van Natta ML, Abbey H, Robinson EG. Risk factors associated with falls and injuries among elderly institutionalized persons. Am J Epidemiol 1991 Jun 1;133(11):1179-1190.

(73) Bradford-Hill A. The environment and disease: Assocation or causation? Proc R Soc Med 1965;58:295.

(74) Rubenstein LZ. Falls in older people: epidemiology, risk factors and strategies for prevention. Age Ageing 2006 Sep;35 Suppl 2:ii37-ii41.

(75) Becker C, Rapp K. Fall prevention in nursing homes. Clin Geriatr Med 2010 Nov;26(4):693-704.

(76) Rojas-Fernandez CH, Seymour N, Brown SG. Helping pharmacists to reduce fall risk in long-term care: A clinical tool to facilitate the medication review process. Can Pharm J (Ott) 2014 May;147(3):171-178.

(77) Hypertension Canada. Canadian Hypertension Education Program (CHEP) 2014 recommendations. 2014; Available at: http://www.hypertension.ca/images/CHEP_2014/2014_CompleteCHEPRecommendations_EN_HCP1009.pdf. Accessed May 22, 2014.

(78) James PA, Oparil S, Carter BL, Cushman WC, Dennison-Himmelfarb C, Handler J, et al. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). JAMA 2014 Feb 5;311(5):507-520.

(79) Gearing RE, Mian IA, Barber J, Ickowicz A. A methodology for conducting retrospective chart review research in child and adolescent psychiatry. J Can Acad Child Adolesc Psychiatry 2006 Aug;15(3):126-134.

Appendix 1 - Tables

Table 1: Primary and Secondary Outcomes Measured

Type of Outcome		**Specific Outcome**	**Statistical test**
Primary Composite Outcome *change = before/after educational intervention*	Increase in appropriateness of prescribing: Adherence to 4 key messages of treatment recommendations	Reduction in undertreatment (i.e. in the proportion of residents with SBP > 160 mmHg on zero medications affecting blood pressure)	Cochran's Q
		Increase in proportion of residents with SBP between 140 and 160 mmHg	Cochran's Q
		Increase in proportion of residents on ≤2 medications affecting blood pressure	Cochran's Q
		Reduction in overtreatment (i.e. the proportion of residents with SBP <140mmHg on ≥1 medications affecting blood pressure)	Cochran's Q
Secondary Outcome *change = before/after educational intervention*	Physician prescribing	Change in mean number of antihypertensive drugs prescribed for each resident.	Wilcoxon Signed Rank Test
		Proportion of patients taking individual medications, classes of medications or combinations of medications	Descriptive statistics (numbers and proportions for categorical variables)
	Patient outcome	Change in mean systolic blood pressure.	Wilcoxon Signed Rank Test
		Proportion of residents with a fall in the previous 6 months	Cochran's Q
		Association of resident fall with independent variable including age, frailty, diagnosis of dementia, SBP	Logistic regression
	Economic	Mean change in medication costs for each resident	Wilcoxon Signed Rank Test
Secondary Outcome *change = before/after Academic Detailing*	Change in appropriateness of prescribing: Adherence to 4 key messages of treatment recommendations	Reduction in undertreatment (i.e. in the proportion of residents with SBP > 160 mmHg on zero medications affecting blood pressure)	Cochran's Q
		Increase in proportion of residents with SBP between 140 and 160 mmHg	Cochran's Q
		Increase in proportion of residents on ≤2 medications affecting blood pressure	Cochran's Q
		Reduction in overtreatment (i.e. the proportion of residents with SBP <140mmHg on ≥1 medications affecting blood pressure)	Cochran's Q
	Physician prescribing	Change in mean number of antihypertensive drugs prescribed for each resident.	Wilcoxon Signed Rank Test

Appendix 1 - Tables

Table 2: Data Collected From Resident Charts.

General data description	**Specific data**	1 YR PRE intervention (Sept 2011; if applicable)	BASELINE (Sept 2012, or on admission)	FINAL (May 2013, or on discharge or death)
Demographics	Unique identifier	X	X	X
	Date of birth		X	
	Date of entry into the LTC facility	X	X	
	Date of death (if applicable)			X
	Date of transfer out (if applicable)			X
	Usual Physician		X	
Medical History	Major medical conditions		X	
	History of cardiovascular disease and cardiovascular risk factors (hypertension, diabetes, hyperlipidemia, smoking)		X	
	Diagnosis of dementia and MMSE score / date of MMSE		X	X
	Number of falls (within previous 6 months)		X	X
Physician Prescribing	All medications known to affect blood pressure (generic name, dose, frequency) taken on data collection date	X	X	X
	All medications taken regularly (i.e. not as needed) on data collection date		X	X
Resident Review Processes	Date of all medication reviews and comprehensive geriatric assessments (within 6 months of pre and between pre and post data collection dates)	X	X	X
	Result of medications review or CGA: was a change made in anti-hypertensive agents?	X	X	X
Patient Outcomes	Systolic and diastolic blood pressure most recently taken before data collection date. If known, indicate if standing, lying, sitting. Measurement and date taken.	X	X	X
	Clinical Frailty Scale(1), as indicated on comprehensive geriatric assessment	X	X	X
	Major cardiovascular events since collection of pre-education data (myocardial infarction, stroke, death)			X
	Cause of death, if applicable.			X

Table 3: Barrier Assessment using the Theoretical Domains Framework (52)

Domain	Constructs	Questions to consider about potential barriers	Potential Barriers in our clinical situation	Elements to include in the presentation / tools we could provide
(1) Knowledge	Knowledge Knowledge about condition / scientific evidence Procedural knowledge	• Are they aware of the guideline? • What do they think the guideline says? • What do they think the evidence is? • Do they know they should be doing it? • Do they understand why they should be using the guideline?	• Lack of knowledge about treating hypertension in the frail elderly (when to start, what target to use, when to stop) • Lack of knowledge about the evidence, and lack of evidence, behind treatment recommendations • Not sure how to use frailty in treatment decisions • Not sure what frailty is or how to measure it • Do they understand the problem of polypharmacy?	• Present the recommendations • Present the evidence behind the recommendation – including the uncertainty, what is known and what is not known about treating HTN in the frail elderly • Present data demonstrating why polypharmacy is a problem (convince them that decreasing the # meds is a positive thing) • Review frailty, provide means of accessing the descriptors of the clinical frailty scale after we've finished the teaching session
(2) Skills	Skills Competence / ability / skill assessment Interpersonal skill Coping strategies	• Is it more work to apply these guidelines than previous standard of care? • Do they know HOW to apply the guidelines	• Lack of awareness about how to incorporate frailty into treatment decisions • Lack of knowledge of how to measure BP correctly • Can I trust the BP measurement I see?	• Simple steps to follow for med review • How to measure BP correctly (use sitting BP to make treatment decisions) • Include cases in presentation to illustrate • How to check for orthostasis • Chart reminders on measuring BP

Domain	Constructs	Questions to consider about potential barriers	Potential Barriers in our clinical situation	Elements to include in the presentation / tools we could provide
(3) Social / Professional role and identity	Identity Professional identity / boundaries / role Group / social identity Social / group norms Alienation / organisational commitment	• Purpose of the guidelines? • Credibility of the source? • Do they think the guidelines should determine their behaviour? • Is following the guidelines in conflict with professional standards? (moral / ethical issues)	• Will they consider the "consensus" credible? • Are they afraid that stopping medication may do harm? • fear of inconsistency of key messages with medical training • Do they agree with the guideline? And the evidence (or lack of evidence) behind the recommendation? • Fear of not following current accepted guidelines. • Fear of liability? • Role of physician as healer: reluctance to follow a guideline that suggests less intervention	• Discussion during presentation – what are physicians worried about if they stop a medication? • Include a case example • Confront this topic directly. • Include information in presentation about where the recommendations came from / process used / content experts (give professional credibility)
(4) Beliefs about capabilities (self-efficacy)	Self-efficacy Control – of behaviour and material and social environment Perceived competence Self-confidence / professional confidence Empowerment Self esteem Optimism / pessimism	• How difficult (or easy) is it to do? (internal / external constraints) • What problems have they encountered? • What would help them? • How confident are they that they can do it? • How capable are they of maintaining it? • How well equipped / comfortable do they feel to do it?	• Med review process is already established (enabler) • No time to notify the family of medication changes • No established process for notifying family of med changes • Question: do they need to notify family of med changes? • Do they trust the BPs recorded in the chart?	• Communication with families: Provide a letter that could be used to notify family of potential changes to medications and reasons why that could be used to guide a telephone conversation or given as a hard copy.

Domain	Constructs	Questions to consider about potential barriers	Potential Barriers in our clinical situation	Elements to include in the presentation / tools we could provide
(5) Belief about consequences (anticipated outcomes / attitude)	Outcome expectancies Anticipated regret Attitudes Reinforcement / consequences Incentives / rewards Beliefs Unrealistic optimism	• What do they think will happen if they follow the guideline? (patient, colleague, positive, negative, short and long term consequences) • Costs of following the guideline vs costs of consequences? • What happens if they don't follow it? • Do benefits outweigh the costs? • How will they feel if they do / don't do it? • Does the evidence suggest that it is a good thing?	• fear of the individual clinical situation - potential for CV outcomes • Thinking that implementing the guidelines will not change patient care: "who will notice either way?" • Fear of confrontation from family members: "How do I explain my actions?"	• Related to social / professional • Important to communicate change in medication and reasons why (letter or phone call)
(6) Motivation and Goals (intention)	Intention (stability and certainty) Goals (autonomous, controlled) Goal target / priority Intrinsic motivation Commitment	• How much do they want it? • How much do they feel they need to do it? • Are there other things they want to do / achieve that might interfere? • Does the guideline conflict with others? • Are there incentives?	• Conflict with CHEP guidelines? • Where does this guideline stand in terms of importance compared with other guidelines they have to use daily? • Are they worried the guideline will change soon, so no point in implementing it now?	Present data to show that CHEP guidelines do not apply to frail elderly

Domain	Constructs	Questions to consider about potential barriers	Potential Barriers in our clinical situation	Elements to include in the presentation / tools we could provide
(7) Memory, attention and decision processes	Memory Attention Attention control Decision making	• Is this something they usually do? • Will they think to do it? • Will they remember to do it? • Might they decide not to do it? (competing tasks, time constraints)	• Will they think to use the guidelines? Need something to keep guidelines in forefront of decision making at med review (widget may help)	• Poster for resident chart • Poster for nursing station • Other reminder tools? • Widget • Discuss process of BP measurement (who, when, how)
(8) Environmental context and resources (environmental constraints)	Resources / material resources (availability and management) Environmental stressors Person / environment interaction Knowledge of task environment	• To what extent do physical or resource factors facilitate or hinder using the guideline recommendations? • Are they necessary resources available? • How could standards for BP measurement help?	• lack of time to follow up appropriately and alert families	• Tools to help with notifying families (letter) • Knowledge that reduced # meds may lead to more time for nurses. • Discussion concerns during presentation / discussion: confront this directly.
(9) Social influences	Social support Leadership / team working Organisational climate Social pressure Power / hierarchy Champions Social comparisons (several more)	• To what extent do social influences facilitate or hinder the use of the guidelines? (peers, managers, patients, relatives) • Will they observe others using the guideline?	• Organisational support at project nursing home is very good (enabler) • Fear of family's reaction to discontinuing medication	• Can one nurse take the lead to ensure BPs are measured regularly and recorded properly – indicating "sitting"?

Domain	Constructs	Questions to consider about potential barriers	Potential Barriers in our clinical situation	Elements to include in the presentation / tools we could provide
(10) Emotion	Affect Stress Anticipated regret Fear Burn-out Cognitive overload / tiredness Threat Positive / negative affect	• Does following the guideline evoke an emotional response? • To what extent do emotional factor facilitate or hinder? • How does emotion affect it?	• Fear of adverse event in a resident? (CV outcome)	
(11) Behavioural regulation	Goal setting Implementation intention Action planning Self-monitoring Generating alternatives Barriers / facilitators	• What preparatory steps are needed to do it? • Are there procedures or ways of working that encourage it		

Domain	Constructs	Questions to consider about potential barriers	Potential Barriers in our clinical situation	Elements to include in the presentation / tools we could provide
(12) Nature of the behaviours	Routine / automatic / habit Breaking habit Direct experience / past behaviour Representation of tasks Stages of change model	• What is the proposed behaviour? • Who needs to do what differently? When, where, how, how often and with whom? • What do they currently do? • Is this a new behaviour or an existing behaviour that needs to become a habit? • Can the context be used to prompt the new behaviour (layouts, reminders, equipment) • How long are changes going to take? • Are there systems for maintaining long-term change		

Appendix 1 - Tables

Table 4: Creation of the Widget: Logic Statement and Tailored Patient-Specific Recommendations

Parameters		**Tailored Treatment Recommendation**
1	If #AHT = 0 and SBP<140 and CFL <7	Blood pressure is below recommended targets. Continue to monitor blood pressure.
2	If #AHT = 0 and SBP<160 and CFL = 7, 8 or 9	
3	If SBP is between 140 and 160 and CFL <7 and orthostasis = NO	Blood pressure falls within recommended target. No change recommended.
4	If SBP is between 160 and 190 and CFL = 7, 8 or 9 and orthostasis = NO	
5	If SBP is between 140 and 160 and CFL <7 and #AHT >0 and orthostasis = YES	Resident is experiencing orthostasis. Although blood pressure is within accepted targets, consider discontinuing one antihypertensive. ALERT: Before discontinuation, consider if the medications are indicated for rate control for atrial fibrillation or symptomatic control of heart failure.
6	If SBP is between 160 and 190 and CFL = 7, 8 or 9 and #AHT >0 and orthostasis = YES	
7	If SBP is between 140 and 160 and CFL <7 and #AHT =0 and orthostasis = YES	Resident is experiencing orthostasis. Blood pressure is within accepted targets. Continue to monitor blood pressure.
8	If SBP is between 160 and 190 and CFL = 7, 8 or 9 and #AHT =0 and orthostasis = YES	
9	If #AHT >2	NOTE: In general, no more than 2 antihypertensives are recommended in the frail elderly.
10	If SBP <135 and #AHT >0 and CFL <7 and orthostasis = NO	Blood pressure falls below recommended target. Consider stopping at least one antihypertensive. ALERT: Before discontinuation, consider if the medications are indicated for rate control for atrial fibrillation or symptomatic control of heart failure.
11	If SBP <155 and #AHT >0 and CFL = 7, 8 or 9 and orthostasis = NO	
12	If SBP <135 and #AHT >0 and CFL <7 and orthostasis = YES	Resident is experiencing some orthostasis and blood pressure falls below recommended target. Consider stopping at least one antihypertensive. ALERT: Before discontinuation, consider if the medications are indicated for rate control for atrial fibrillation or symptomatic control of heart failure.
13	If SBP <155 and #AHT >0 and CFL = 7, 8 or 9 and orthostasis = YES	
14	If SBP is between 135 and 139 and #AHT >0 and CFL <7 and orthostasis = NO	Resident is close to an appropriate target blood pressure. Consider discontinuing one antihypertensive and monitoring blood pressure. ALERT: Before discontinuation, consider if the medications are indicated for rate control for atrial fibrillation or symptomatic control of heart failure.
15	If SBP is between 155 and 159 and #AHT >0 and CFL = 7, 8 or 9 and orthostasis = NO	
16	If SBP is between 135 and 139 and #AHT >0 and CFL <7 and orthostasis = YES	Resident is close to an appropriate target blood pressure, however they are experiencing some orthostasis. Consider discontinuing one antihypertensive and monitoring blood pressure.

Appendix 1 - Tables

Parameters		Tailored Treatment Recommendation
17	If SBP is between 155 and 159 and #AHT >0 and CFL = 7, 8 or 9 and orthostasis = YES	ALERT: Before discontinuation, consider if the medications are indicated for rate control for atrial fibrillation or symptomatic control of heart failure.
18	If SBP >160 and CFL <7 and orthostasis = NO	Blood pressure is above the recommended target. Consider adding one antihypertensive. Monitor for orthostasis.
19	If SBP >190 and CFL = 7, 8 or 9 and orthostasis = NO	
20	If SBP >160 and CFL <7 and orthostasis = YES	Resident is experiencing some orthostasis. Although blood pressure is above the recommended target, consider monitoring blood pressure.
21	If SBP >190 and CFL = 7, 8 or 9 and orthostasis = YES	

Appendix 1 - Tables

Table 5: Demographics of PRE- and POST- Intervention groups

Characteristic	PRE-Intervention (Sept 2012) N=118 +/- SD or %	POST-Intervention (May 2013) N=104 +/- SD or %
Age (yr)		
Mean	86.9 +/- 9.7	86.8 +/- 9.7
Range	48.1 to 105.4	48.7 to 104.1
Median	88.6	88.2
Interquartile	82.3 to 93.2	82.3 to 93.1
Sex		
Female	107 (90.7%)	94 (90.4%)
Male	11 (9.3%)	10 (9.6%)
Length of Stay (years)		
Mean	2.6 +/- 2.5	3.0 +/- 2.6
Range	0 to 13.5	0.1 to 14.1
Median	1.7	2.0
Interquartile	0.8 to 4.1	1.0 to 4.6
Clinical Frailty Level	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
Range	0 to 12	2 to 12
Median	5	5
Interquartile range	4 to 8	4 to 8
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%)
NIDDM – not treated with insulin	24 (20.3%)	21 (20.2%)
History of Hypercholesterolemia	27 (22.9%)	28 (26.9%)

Appendix 1 - Tables

Table 6: Adherence to Key Messages of Hypertension Treatment Recommendations

Key Message		1 year PRE intervention N=85	PRE-intervention N=118	POST-intervention N=104
Key Message #1 In the frail elderly, consider starting treatment when SBP is ≥160	Residents with data on SBP	83 (97.6%)	115 (97.5%)	104 (100%)
	# residents with SBP>160	2	2	1
	# residents with SBP>160 who are not prescribed antihypertensive (UNDER-TREATED)	1	1	0
	Proportion UNDER-TREATED	1.2% 1/83	0.9% 1/115	0% 0/104
Key Message #2 Aim for a sitting SBP of 140 to 160mg Hg.	Residents with data on SBP	83 (97.6%)	115 (97.5%)	104 (100%)
	Number of residents with SBP between 140-160	14	18	7
	Proportion within target	16.9%	15.7%	6.7%
	Statistical difference in proportions? (Cochran's Q test)	No difference P=0.827		n/a
		n/a	No difference P=0.109	
Key Message #3 In general, use no more than 2 medications to treat hypertension.	Proportion on ≤2 medications affecting blood pressure	89.4% (76/85)	86.4% (102/118)	88.5% (92/104)
	Statistical difference in proportions? (Cochran's Q test)	No difference P=0.564		n/a
		n/a	No difference P=1.000	
Key Message #4 Anti-hypertensives can be tapered and discontinued if sitting SBP is less than 140 mmHg	Proportion of residents who are OVERTREATED (SBP<140mmHg, on ≥1 antihypertensive)	50.6% 42/83	49.6% 57/115	47.1% 49/104
	Data not available	No SBP n=2	No SBP n=3	n/a
	Statistical difference in proportions? (Cochran's Q test)	No difference P=0.593		n/a
		n/a	No difference P=0.593	

Appendix 1 - Tables

Table 7: Medication Use PRE- and POST- Intervention

	PRE-Intervention (Sept 2012) N=118 +/-SD	POST-Intervention (May 2013) N=104 +/- SD
Number of Medications Taken Regularly		
Mean	8.8 +/-3.8	8.2 +/- 3.5
Range	1 to 19	1 to 18
Median	9	8
Interquartile Range	6 to 11	6 to 10
Number of Medications Affecting Blood Pressure	N=118	N=104
Mean	1.2 +/- 1.2	0.9 +/- 1.1
Median	1.0	1.0
0	47 (39.8%)	50 (48.1%)
≥1	71 (60.2%)	54 (51.9%)
Number of Medications Affecting Blood Pressure (those taking >= 1 HTN medication)	N=71	N=54
Mean	2.0 +/-1.0	1.8 +/- 1.0
Median	2	1
1	28 (39.4%)	30 (55.6%)
2	27 (38.0%)	12 (22.2%)
3	8 (11.3%)	7 (13.0%)
4	7 (9.9%)	5 (9.3%)
5	1 (1.4%)	0
Hypertension Medications	N=118	N=104
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%)
Hypertension Medications (those taking >= 1 HTN medication)	N=71	N=54
Diuretics	38 (53.5%)	28 (51.9%)
ACE inhibitors	18 (25.4%)	10 (18.5%)
ARBs	10 (14.1%)	7 (13.0%)
Beta Blockers	37 (52.1%)	27 (50.0%)
Calcium Channel Blocker	21 (29.6%)	13 (24.1%)
Alpha Blockers	1 (1.4%	1 (1.9%)
NitroPatch	12 (16.9%)	7 (13.0%)
Oral Nitrates	1 (1.4%)	1 (1.9%)

Appendix 1 - Tables

Table 8: Medications Affecting Blood Pressure: Change During Study Period.

Variable		1 year PRE intervention (Sept 2011)	PRE-Intervention (Sept 2012) +/-SD	POST-Intervention (May 2013) +/- SD
ALL RESIDENTS		N=85	N=118	N=104
Number of medications affecting blood pressure	Mean Median Range Interquartile Range	1.1 +/-1.1 1 0 to 4 0 to 2	1.2 +/- 1.2 1 0 to 5 0 to 2	0.9 +/- 1.1 1 0 to 4 0 to 1
		Significant Difference P=0.02 Wilcoxon Signed Rank Test		
		n/a	Significant Difference P=0.000 Wilcoxon Signed Rank Test	
Number of scheduled meds	Mean Range Median Interquartile Range	Data not collected	8.8 +/-3.8 1 to 19 9 6 to 11	8.2 +/- 3.5 1 to 18 8 6 to 10
		n/a	No difference P=0.066 Wilcoxon Signed Rank Test	
RESIDENTS WITH A DOCUMENTED DIAGNOSIS OF HYPERTENSION		N=54	N=76	N=68
Number of medications affecting blood pressure	Mean Median Range Interquartile Range	1.4 +/- 1.1 1 0 to 4 0.75 to 2	1.5 +/- 1.3 1 0 to 5 0 to 2	1.2 +/- 1.3 1 0 to 4 0 to 2
		No Difference P=0.059 Wilcoxon Signed Rank Test		n/a
		n/a	Significant Difference P=0.000 Wilcoxon Signed Rank Test	

Appendix 1 - Tables

Table 9: Resident Falls – Change During Study Period

	1 Year PRE-Intervention (Sept 2011) N=85	PRE-Intervention (Sept 2012) N=118 +/-SD	POST-Intervention (May 2013) N=104 +/- SD
Proportion of residents with a fall in the last 6 months	43.5% (37 residents)	50.0% (59 residents)	33.7% (35 residents)
	No difference P=0.144 Cochran's Q		n/a
		Significant difference P=0.028 (Cochran's Q)	
Mean number of falls per resident (All residents)	0.8 +/- 1.3	0.9 +/- 1.2	0.7 +/- 1.4
	No difference P=0.127 Wilcoxon Signed Rank		n/a
	n/a	No difference P=0.292 Wilcoxon Signed Rank	
Mean number of falls in those residents with ≥1 fall	1.8 +/- 1.5	1.8 +/- 1.1	2.1 +/- 1.7

Table 10: Blood Pressure – Change During Study Period

	1 year PRE intervention (Sept 2011) N=85	PRE-Intervention (Sept 2012) N=118 +/-SD	POST-Intervention (May 2013) N=104 +/- SD
Systolic Blood Pressure	*Missing data for n=2*	*Missing data for n=3*	
Mean	125 +/- 16	123 +/- 16	119 +/- 15
Range	80 to 180	88 to 170	90 to 172
Median	124	122	118
Interquartile range	118 to 137	112 to 132	110 to 128
	No difference P=0.082 Wilcoxon Signed Rank Test		
		No difference P=0.201 Wilcoxon Signed Rank Test	
Diastolic Blood Pressure	*Missing data for n=2*	*Missing data for n=3*	
Mean	69 +/-10	67 +/- 11	68 +/- 9
Range	45 to 100	40 to 108	50 to 98
Median	70	64	68
Interquartile range	62 to 76	60 to 71	60 to 72
	Significant Difference P=0.001 Wilcoxon Signed Rank Test		
		No difference P=0.079 Wilcoxon Signed Rank Test	

Appendix 1 - Tables

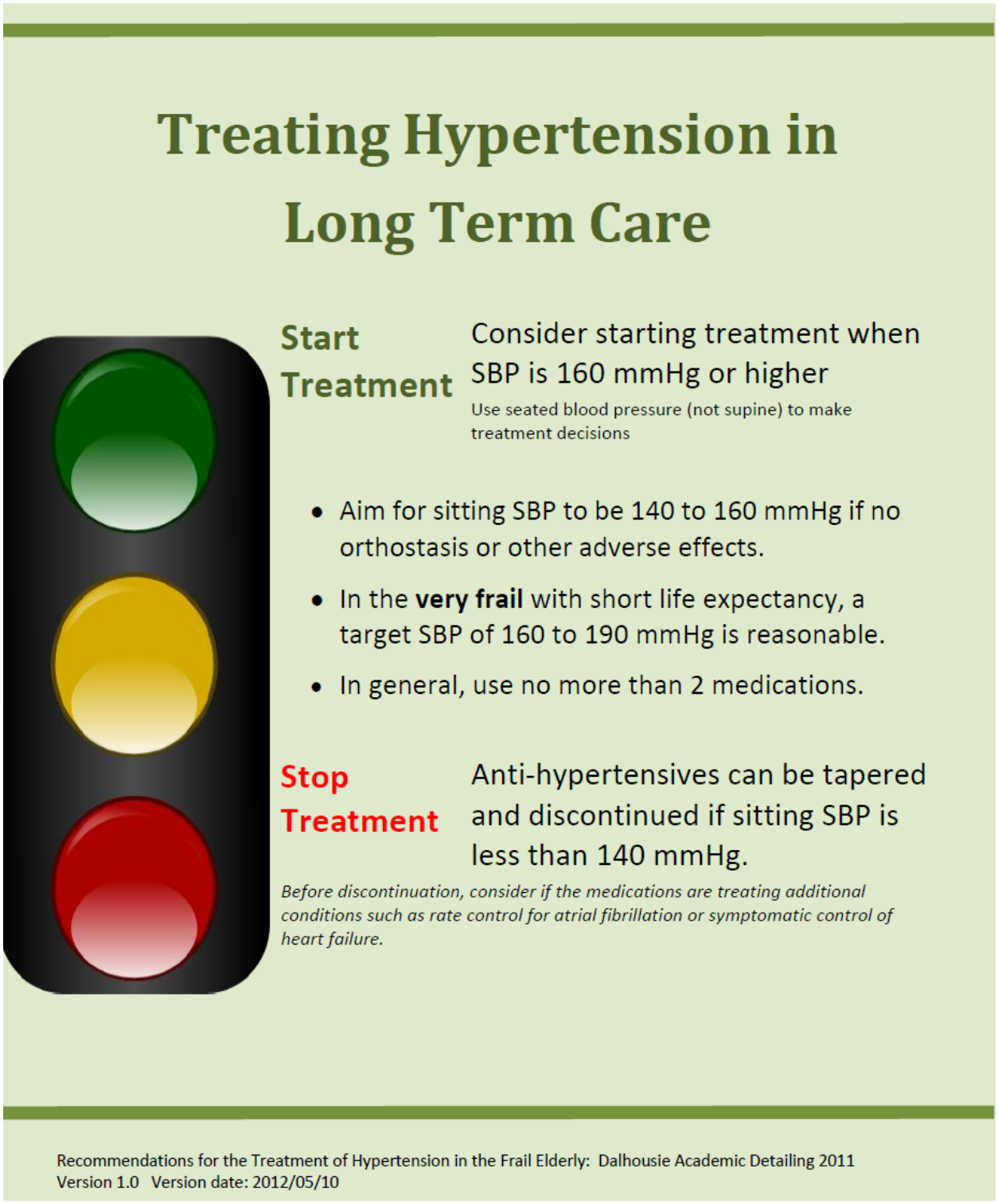
Table 11: Costs of Medications Affecting Blood Pressure – Change Over Study Period

		PRE-Intervention (Sept 2012) N=118 +/-SD	POST-Intervention (May 2013) N=104 +/- SD
Daily cost per resident for of medications that affect blood pressure	Mean Range Median Interquartile range	$0.33 +/- 0.45 0 to $2.05 $0.14 0 to $0.46	$0.25 +/- 0.39 0 to $1.60 $0.04 0 to $0.35
		Significant difference P<0.001 Wilcoxon Signed Rank	
Monthly cost per resident for of medications that affect blood pressure	Mean Range Median Interquartile range	$9.86 +/- 13.46 0 to $61.48 $4.18 0 to $13.82	$7.55 +/- 11.78 0 to $48.00 $1.05 0 to $10.46
		Significant difference P<0.001 Wilcoxon Signed Rank	

Table 12: Logistic Regression – Prediction of Resident Fall by Univariate Analysis

Predictor of Fall (Univariate)	Odds Ratio (95% Confidence Interval)	Chi Square	P value
Sex (categorical 0,1)	0.738 (0.194 to 2.808)	0.195	0.656
Age	0.985 (0.945 to 1.026)	0.512	0.474
Frailty Level	0.648 (0.337 to 1.244)	1.723	0.189
Systolic BP	1.009 (0.982 to 1.037)	0.456	0.499
Diagnosis of Dementia	0.658 (0.246 to 1.757)	0.722	0.403
Number of Scheduled Medications	0.989 (0.881 to 1.111)	0.033	0.857
Number of Medications Affecting Blood Pressure	1.035 (0.725 to 1.476)	0.035	0.851
Number of Co-morbidities	1.045 (0.884 to 1.236)	0.270	0.603

Figure 1: Poster Used in Nursing Stations



Appendix 2 - Figures

Figure 2: Laminated Card and Chart Sticker Used as Part of the Educational Program

Figure 3 : Chart Sticker for Reminder about Blood Pressure Assessment

REMEMBER

- Always use the **sitting** blood pressure to make treatment decisions.
- To measure orthostasis, record the BP lying and within one minute after standing
- In the chart, record how BP was taken. i.e. "**sitting**"

Appendix 2 - Figures

Figure 4: Letter to SDM about Changes in Medication

Resident: _____

Dear Family Member,

This letter introduces a new initiative to provide optimal treatment for high blood pressure at Saint Vincent's Nursing Home.

High blood pressure is a common problem in adults and can be associated with other health conditions such as heart problems or stroke. As people age, they often accumulate long term health problems, which together, are known as "frailty". Frailty plays an important role in everyday quality of life and function. Frailty makes people more vulnerable to side effects from medications, and also means they may not benefit from treatment in the same way that people who are not frail do. You can find more information about frailty at www.pathclinic.ca. Traditional guidelines help doctors treat blood pressure, but do not take frailty into account.

Recently, the Dalhousie Academic Detailing Service reviewed all the medical literature concerning blood pressure and frailty to come up with guidelines to help doctors treat blood pressure in frail older adults. In general the guidelines recommend a less aggressive approach to treating blood pressure, because the benefits of treatment take many years, but the side effects are always present.

The guidelines and the complete evidence review can be accessed at http://cme.medicine.dal.ca/ad_resources.htm#Hyper (Issues in Hypertension 2011).

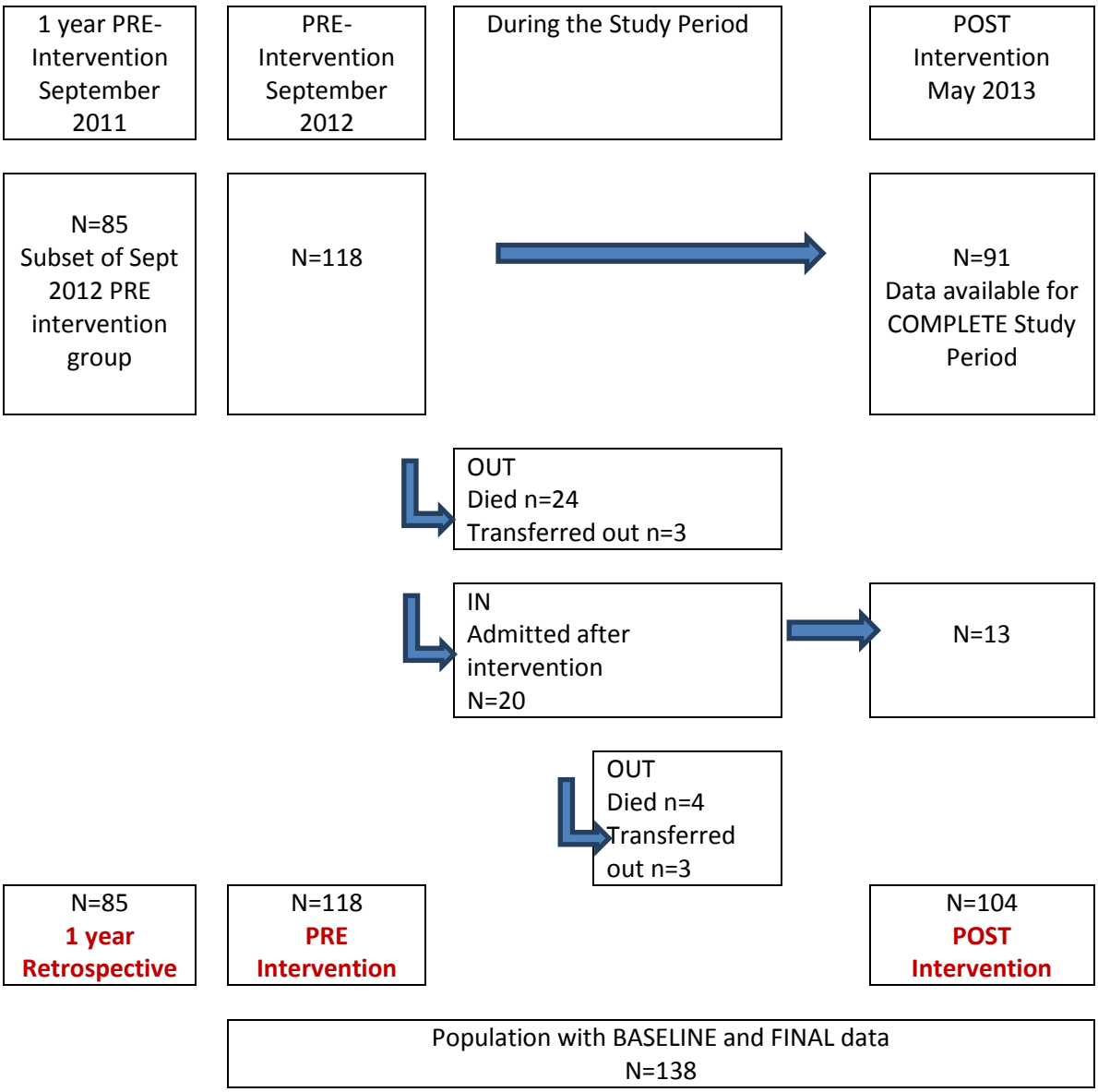
Based on these guidelines:

- ☐ The resident's blood pressure is at the appropriate level and no medication changes are needed
- ☐ The resident's blood pressure is too low, and we have reduced or discontinued those blood pressure medications that are no longer necessary. We will continue to monitor the resident's blood pressure to see if any medication changes are necessary in the future.
- ☐ The resident is showing signs of side effects from blood pressure medications, which can increase the risk of falls. We have therefore reduced or discontinued blood pressure medications that are no longer necessary. We will continue to monitor the resident's blood pressure to see if any medication changes are necessary in the future.
- ☐ The resident's blood pressure is too high, even considering frailty, and therefore a new medication has been started.

Please contact the nursing station with any questions or concerns that you may have.

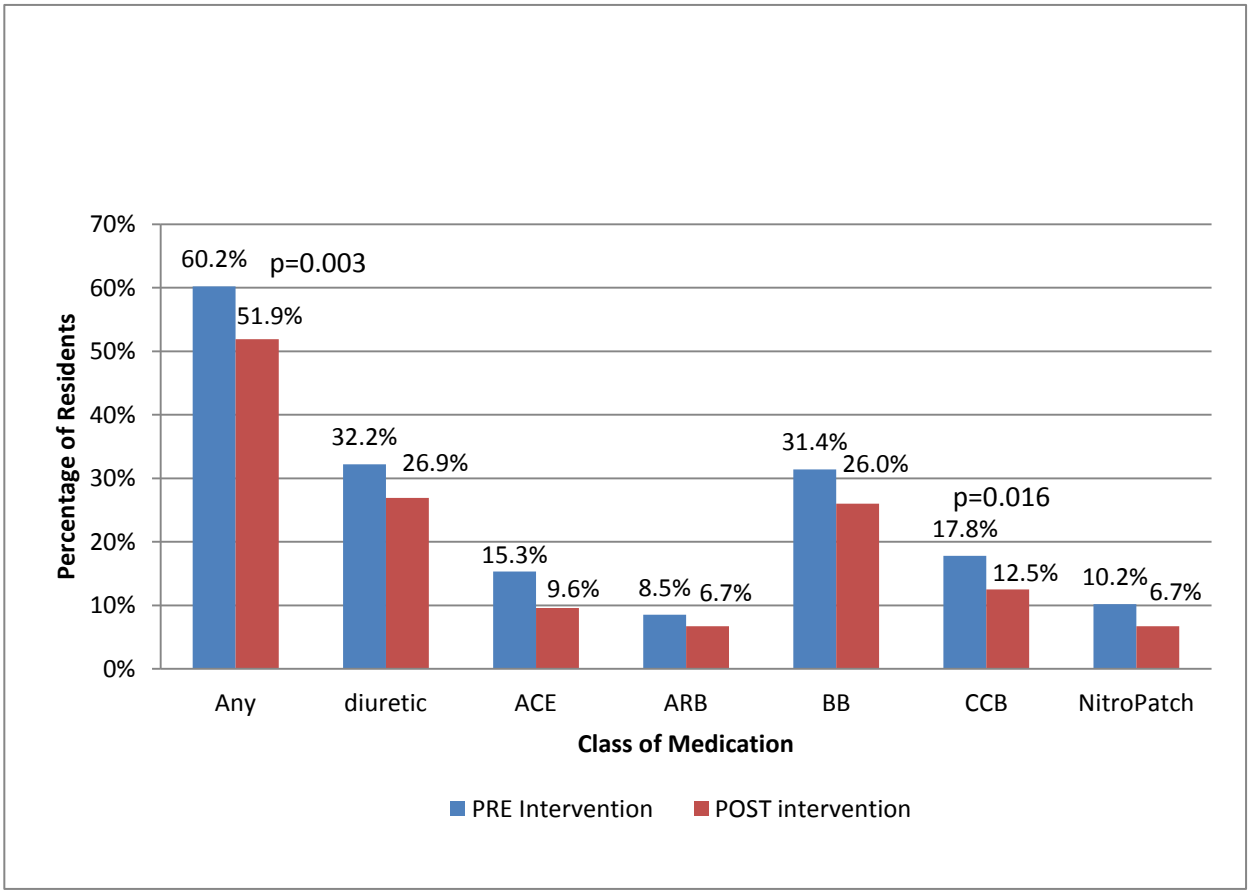
Appendix 2 - Figures

Figure 5: Resident Flow During Study Period



Appendix 2 - Figures

Figure 6: Use of Medications Affecting Blood Pressure: PRE- and POST- Intervention



Appendix 2 - Figures

Figure 7: Number of Scheduled Medications Taken by Residents PRE-Intervention (n=118)

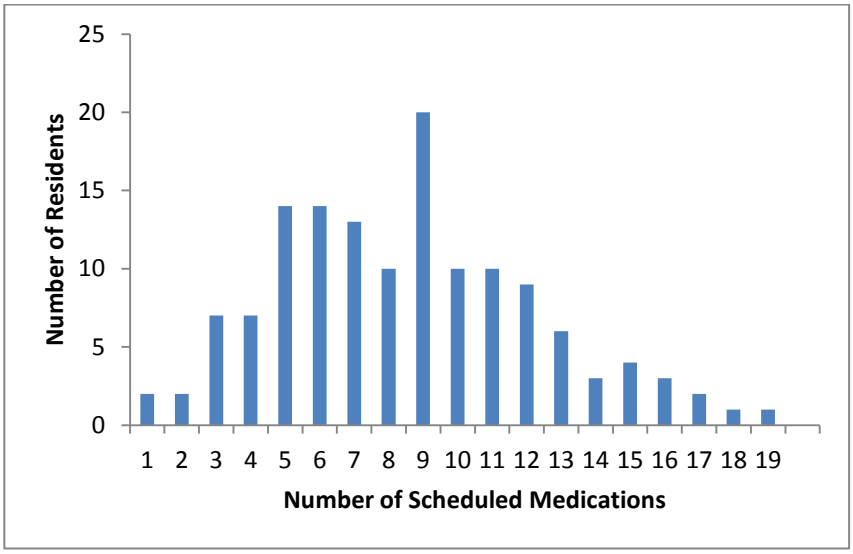
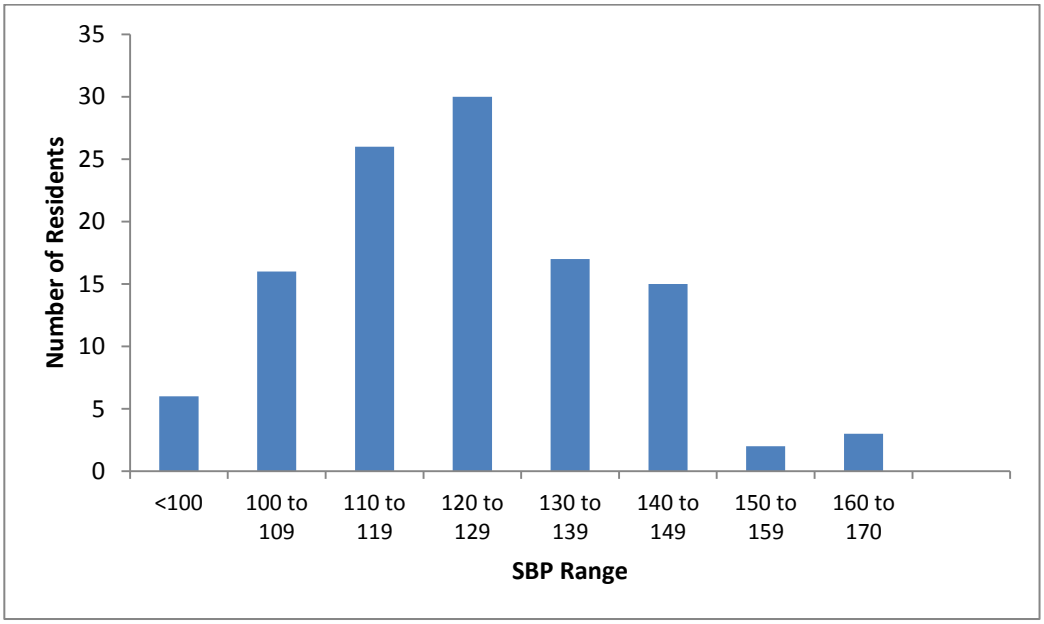


Figure 8: Range of Systolic Blood Pressure in PRE-Intervention Population (n=115)



Appendix 3: Hypertension Treatment Recommendations for the Frail Elderly – Key Messages

Dalhousie Academic Detailing 2011: Hypertension

Local Expert Consensus on Treatment of Hypertension in the Frail Elderly

Considerations before treating:

- Carefully review the risks and potential, but unproven, benefits.
- Do not make treatment decisions based only on supine measurements.

Measuring blood pressure

- When measuring BP, take readings when sitting.
- To evaluate orthostasis, measure BP lying, then immediately on standing and after 2 minutes. Ask the patient if they feel lightheaded or dizzy when standing.

Starting treatment:

- Consider starting treatment when SBP is **≥160** mmHg.
- Target SBP to **140 to 160** mmHg while sitting as long as
    - There is no orthostatic drop to <140 mmHg using the technique described above.
    - There are no adverse effects from treatment that affect quality of life.
- In the very frail with short life expectancy, a target SBP of 160 to 190 mmHg may be reasonable.
- The blood pressure target does not need to change when there is a history of diabetes.
- In general, use no more than 2 medications.

Stopping treatment:

- If sitting SBP is <140 mmHg, medications can be tapered and discontinued.
- However, before discontinuation, consider if the medications are treating additional conditions such as rate control for atrial fibrillation or symptomatic control of heart failure.

Appendix 4: Background Evidence for Recommendations: Treatment of Hypertension in the Frail Elderly

BACKGROUND EVIDENCE FOR GUIDELINES:

Treatment of Hypertension in the Frail Elderly

Reference: Dalhousie Continuing Medical Education Academic Detailing: Issues in Hypertension 2011 http://cme.medicine.dal.ca/ad_resources.htm#Hyper

- Several studies have addressed the treatment of hypertension in the elderly. Definitions of elderly vary
  - A Cochrane review defines "elderly" as ≥ 60 years old and "very elderly" as ≥ 80 years old.[6]
  - The ACCF/AHA consensus document defines elderly as ≥ 65 years old but also differentiates patients ≥ 80 years old in some discussion points.[9]
- A 2010 Cochrane review looked at the efficacy of anti-hypertensive therapy in the elderly with mild to moderate hypertension for the outcomes of
  - All-cause mortality
  - Cardiovascular morbidity and mortality
  - Withdrawals for adverse events.
  - The review included 15 studies and 24,000 subjects.
    - For the **elderly** (≥ 60 years) data came from 13 studies with 23,000 subjects.
    - For the **very elderly** (≥ 80 years) data came from 8 studies with 6500 subjects.
    - Inclusion criteria: SBP ≥140 and/or DBP ≥90
    - Mean age was 74 years. 60% of subjects were female.
    - Four studies were ≤ 2 years long, the rest were 3 to 6 years long.
    - Mean duration in elderly was 4.5 years.
    - Mean duration in very elderly was 2.2 years.
    - Mean BP at entry in most studies was 182/95.
    - No studies included in the review compared outcomes at two different target BP levels. Instead, subjects were assigned to take either active medication or placebo and the resulting BPs were recorded.
    - Patients were treated with commonly used antihypertensive medications.
      - In over 70% of the trials a thiazide diuretic was the first line drug used in the treatment group.
  - Results are in Table 1.
    - In the **elderly** there was benefit in all outcomes including total mortality.
    - In the **very elderly** there was a significant reduction in cardiovascular and cerebrovascular events when fatal and non-fatal events were combined.

    - However, all-cause mortality was not significantly different when analyzed alone.
- **Author conclusions**
    - Treating healthy persons (60 years or older) with moderate to severe systolic and/or diastolic hypertension reduces all-cause mortality and cardiovascular morbidity and mortality.
    - The decrease in all-cause mortality was limited to persons 60 to 80 years old.

Table 1 Results of antihypertensive therapy in subjects ≥60 years old and ≥80 years old[6]

Outcome	Event Rate		ARR (ARI)	RRR (RRI)	NNT for ~4.5 yrs	
	Placebo	Drug			NNT	95% CIs
Elderly (≥60 yrs)						
Total mortality	15%	14%	1.1%[a]	10%	91	53 to 333
Cardiovascular mortality and morbidity	21%	14%	4.3%[a]	18%	23	16 to 42
Cerebrovascular mortality and morbidity	7.1%	4.2%	1.9%[a]	44%	53	42 to 77
Coronary heart disease mortality and morbidity	4.8%	3.7%	0.9%	21%	111	67 to 250
Very elderly (≥80 yrs)					**NNT for ~2.2 yrs**	
Total mortality	16%	19%	(2%)[a,b]	(20%)[b]	NS	
Cardiovascular mortality and morbidity	14%	10%	2.8%[a]	25%	36	23 to 71
Cerebrovascular mortality and morbidity	7.9%	4.6%	1.8%[a]	44%	56	36 to 125
Coronary heart disease mortality and morbidity	3.5%	3.4%	0.3%[a]	14%	NS	

ARR, absolute risk reduction; ARI, absolute risk increase; RRR, relative risk reduction; RRI, relative risk increase; NNT, number needed to treat; CI, confidence interval; NS, not statistically significant.

a Results calculated by Dalhousie Academic Detailing Service from data provided in publication using meta-analysis program called Comprehensive Meta-analysis. ARR values are calculated by doing meta-analysis of ARRs from all studies and not from subtracting event rates in drug group from placebo group. NNTs are calculated from ARRs in table.

b Event rate in drug group is higher than in placebo group so values are absolute and relative risk **increase**

- Total mortality means deaths from all causes.
- Cardiovascular morbidity and mortality includes coronary heart disease plus cerebrovascular morbidity and mortality plus aneurysms, congestive heart failure, and transient ischemic attacks.
- Cerebrovascular morbidity and mortality includes fatal and nonfatal strokes.
- Coronary heart disease morbidity and mortality includes fatal and non-fatal myocardial infarctions and sudden or rapid cardiac death.

- The Cochrane review indicates that antihypertensive therapy confers **benefit** in the elderly and the very elderly.
  - What is uncertain is the optimal level of blood pressure that should be maintained, which leads to two questions

    Question A. When should pharmacotherapy be started?

    Question B. What should the blood pressure treatment target be?

Question A: At what SBP should pharmacotherapy be started in people >65 years old?

- A reappraisal of the European guidelines on hypertension management published in 2009 by the European Society of Hypertension[3,18] provides a summary of the major hypertension RCTs involving the elderly published to date.
  - In the studies cited, patients were included only if they had a **SBP ≥160** mmHg and all studies except 1 showed benefit in clinical outcomes.
  - Thus evidence supports initiating therapy in patients >65 years old with SBP **≥ 160** mmHg.[3]
    - CHEP makes this recommendation for all ages (**Grade A** Table 3).
      - This applies whether or not target organ damage is present.
- The CHEP guideline recommends strong consideration be given to starting therapy in the general population if SBP is **140-159** mmHg.
  - This recommendation applies **only** in the **presence** of macrovascular target organ damage.
    - This is a **Grade C** recommendation.
- CHEP states to consider therapy in all patients meeting the above indications **regardless of age.**
  - This is a **Grade B** recommendation.
- The authors of the European guideline reappraisal state
  - "Current guidelines recommendations on BP values at which to initiate drug treatment in the elderly [SBP 140 to 159] are not based on results from trials, but derived from other findings
    - and perhaps encouraged by the large benefits of antihypertensive therapy in all available trials in the elderly, admittedly at **higher** initial blood pressures."

Academic Detailing Comment

- Evidence supports initiating pharmacotherapy at a SBP ≥160 mmHg.
- The Grade C level of the CHEP recommendation for the general population indicates the uncertainty about starting antihypertensive therapy at SBP levels of

140 to 159 mmHg and as highlighted by the European reappraisal document, this recommendation has not been studied in RCTs of the elderly.

- It is important to note that the CHEP consideration to start therapy at SBP levels of 140 to 159 mmHg applies only in the presence of target organ damage.

Expert opinion

- Most of our content experts recognize the limitations of the evidence but this does not override their opinion about starting therapy in patients with target organ damage at SBP ≥ 140 mmHg.
- Focus on the patient and the overall risks/benefits of treatment rather than on a specific numerical value.

Question B: What should the SBP treatment target be in people >65 years old?

- The CHEP recommendations indicate a SBP treatment target of <140 mmHg regardless of age (**Grade C**).
- The ACCF/AHA consensus document states that in the elderly the generally recommended BP goal of <140/90 is based on **expert opinion** rather than on data from RCTs.[9]
- Table 2 summarizes the studies cited in the 2009 reappraisal document by the European Society of Hypertension (see page 79).[3]
  - The achieved SBP levels are reported for the more active (drug) or less active (control) treatment groups for each of the trials.
  - With the exception of **JATOS**, these studies did not randomize patients to different BP targets. Instead patients were randomized to less active or more active blood pressure therapy to evaluate specific drug regimens.
  - Again, with the exception of **JATOS**, none of the studies achieved a SBP less than 140 mmHg, the currently recommended target. However, they **all** showed some benefit. JATOS, described on the next page, did not show difference in any outcomes.

Table 2 Achieved SBP in studies of the elderly cited in 2009 reappraisal of European guidelines[3]

Study	N subjects	Duration Years	Achieved SBP			Benefit
			Control	Active	Difference	
EW	840	4.6	172	150	22	Yes
CW	884	4.4	180	162	18	Yes
SHEP	4736	4.5	170	143	27	Yes
STOP	1627	2.1	186	167	19	Yes
MRC-E	4396	5.8	165	156	9	Yes
S Eur	4695	2.0	161	151	10	Yes
S-Ch	2394	3.0	160	151	9	Yes
SCOPE	4937	3.7	148	145	3	Partial[a]
HYVET	3845	2.1	159	144	15	Yes
JATOS	4418	2.0	146	**136**	10	**No**

a Significant benefits of more active treatment were limited to some secondary endpoints

- **JATOS** studied 4400 Japanese people 65 to 85 years old; duration 2 years.[19]
  - Subjects were randomized to SBP targets of <140 mmHg vs 140 to 160 mmHg.
    - 56% of patients were on antihypertensive therapy at study entry.
    - The main initial or add-on therapy was a calcium channel blocker, efonidipine but other common antihypertensives were also used.
    - Approximately 7% of patients had pre-existing cardiovascular disease.
  - Baseline BP levels were 172/89.
  - Achieved BP levels were 136/75 vs 146/78.
  - There was **no difference** between target groups in any outcome including
    - The primary composite outcome of stroke, cardiac and vascular disease, and renal failure (4.3% vs 4.3%) (Table 3).
    - Withdrawal from adverse events (1.6% vs 1.6%).
  - 80% of subjects in both groups achieved their target SBP with 1 or 2 medications.

Table 3 Results of JATOS[19]

Efficacy outcomes	SBP target		ARR	RRR	NNT for 2.0 yrs	
	140-160	≤ 140			NNT	95% CI
Primary outcome: stroke, cardiac and vascular disease, renal failure **(morbidity)**	3.9%	3.9%	0%	0%	NS	
Primary outcome: stroke, cardiac and vascular disease, renal failure **(mortality)**	0.36%	0.41%	0.05%	0%	NS	

ARR, absolute risk reduction; RRR, relative risk reduction; NNT, number needed to treat; NS, not statistically significant.

- In 2009 after completion of the European Society of Hypertension reappraisal document, the **Cardio-sis**[20] trial was published.
  - Cardio-sis, if available, might have been included inTable 2 since 67% of the population consisted of patients ≥ 63 years old and 33% were >70.
  - Like JATOS, Cardio-sis also tested different SBP targets in patients with hypertension.
  - Cardio-sis studied 1,111 Italian people ≥ 55 years old without diabetes; duration 2 years.
  - Subjects were randomized to SBP targets of <130 mmHg vs <140 mmHg.
  - 100% of patients were already on antihypertensive therapy for at least 12 weeks at study entry.
  - Approximately 23% of patients had pre-existing cardiovascular disease.
  - Baseline BP levels were 163/90.
  - Achieved BP levels were 132/77 vs 136/79.
  - There was a **significant difference** in the primary outcome of the rate of electrocardiographic left ventricular hypertrophy between the tight and usual control groups at study endpoint (17% vs 11.4%).
    - While this primary endpoint is a surrogate outcome reported to be a strong predictor of cardiovascular outcomes, the clinical significance of the result is uncertain and according to the authors should be viewed as hypothesis-generating.
    - There was also benefit in the secondary composite outcome consisting of 13 individual outcomes.
      - Only 2 individual outcomes of the composite were positive – new onset of atrial fibrillation and coronary revascularization.
      - This secondary outcome was **not pre-specified** in the trial registry.

- The above 2 trials address SBP targets with JATOS addressing targets exclusively in the elderly (65 to 85 years old).
- HYVET, a recent trial involving the **very** elderly (≥ 80 years old) was **not** designed to evaluate different blood pressure targets.[21]
  - It was designed to evaluate the benefit of treatment with indapamide with or without perindopril vs placebo.
  - HYVET enrolled the **very** elderly (all ≥ 80 years old) N=3845; duration 2.1 years.
    - Patients with SBP ≥ 160 (and standing SBP ≥ 140) were randomized to receive either
      - placebo or indapamide 1.5 mg +/- perindopril 2 or 4 mg

        to get to a BP of <150/<80.
    - Patients were taken off previous meds if they were on any.
    - Patients were community-living and generally healthy.
      - Approximately 12% had macrovascular target organ damage.
    - In the two groups BP went from 173/91 to
      - 144/78 vs 159/84
    - There was **no** statistically significant **benefit** in the **primary** outcome of fatal and non-fatal **stroke**.
    - However the study was stopped early at a mean of 2.1 years because of benefit in death from any cause.
      - Had the trial continued longer the benefit in stroke reduction may have become statistically significant.
      - In addition, HYVET was included in the Cochrane meta-analysis[6] which showed overall statistically significant **benefit** in reduction of fatal and non-fatal stroke with antihypertensive therapy in those ≥ 80 years old.

Table 4 Results of HYVET[21]

Outcome	Events per 1000 pt-yr		RRR	P-value
Fatal or non-fatal stroke[a,b]	17.7	12.4	30%	0.06
Fatal or non-fatal heart failure[a]	14.8	5.3	64%	<.001[c]
Fatal or non-fatal cardiovascular event[a]	51	34	34%	<.001[c]

	Event Rate		ARR	RRR	NNT for 2.1 yrs	
	Placebo	Drug			NNT	95% CI
Death from any cause	12.3%	10.1%	2.2%	18%	46	24 to 637
Death from stroke	2.2%	1.4%	0.8%	36%	125	-2500 to 61[d]

a Results reported as hazards and hazard ratios of numbers of events rather than number of patients having an event so it is not possible to calculate ARR and NNT.

b Fatal or non-fatal stroke was the **primary** outcome. Result was **not** statistically significant: hazard ratio 0.70 (95% CI: 0.49 to 1.01) p = 0.06.

c These composite secondary outcomes were **not** pre-specified in the clinical trial registry.

d Results were calculated by Dalhousie Academic Detailing Service from data provided in publication. Negative confidence interval indicates non-significant result. However, published result was **statistically significant**.

ARR, absolute risk reduction; RRR, relative risk reduction; NNT, number needed to treat; pt-yr, patient year.

Academic Detailing Comments on HYVET

- HYVET supports that there is benefit from treating hypertension in the very elderly with indapamide and perindopril but does not provide evidence to support treating to a specific target.
  - The ACCF/AHA Consensus Document states that HYVET did not address the optimal BP goal for reducing CV events and mortality.[9]
- The benefit of the achieved blood pressure (144/78) in the very elderly is uncertain because it is difficult to separate the effects of lowering blood pressure from the effects of the medication given to the active treatment group.
  - Angiotensin converting enzyme inhibitors (ACEI) may have beneficial effects beyond reducing blood pressure and since this was a placebo-controlled trial, may have contributed to the benefit found in the active group.
- It is noteworthy that the benefits occurred despite over half (52%) of subjects not achieving the specified BP of <150/<80.[21]

Appendix 4: Background Evidence for Recommendations: Treatment of Hypertension in the Frail Elderly

Various Interpretations and Recommendations For the Elderly

- The CHEP recommendations for starting therapy and for targets are the same regardless of age while exercising caution in the frail elderly.[1]
- The **2011 ACCF/AHA Consensus Document**[9] states
  - Studies have shown clinical benefits with achieved SBP values averaging in the 140s, 150s, and 160s.
  - The target of <140/90 in uncomplicated elderly patients is based on **expert opinion**.
  - There is **limited evidence** to
    - Support a value of 140 mmHg as a diagnostic and therapeutic threshold.
    - Determine if patients with initial SBP between 150 and 159 would benefit from treatment.
- Nevertheless the Consensus Document considers
  - For those ≤79 years old achieved SBP values <140 mmHg are appropriate.
  - For those ≥80 years old achieved SBP levels of 140 to 145 mmHg if tolerated can be acceptable with the following **exceptions**
    - If patient has achieved SBP<150 mmHg on 1 or 2 meds with no problems, try for <140 mmHg even though there is no firm evidence to support this target.
    - If SBP is ≥150 mmHg under following 3 circumstances
      1. Taking 4 drugs
      2. Having unacceptable adverse effects, especially postural hypotension
      3. DBP is being reduced to <65 mmHg
         - For the above 3 circumstances the lowest safely achieved SBP ≥150 mmHg is acceptable.
- The Consensus Document also states there is **no data** to support lower BP targets in patients at high risk because of conditions such as diabetes, CKD, or CAD.[9]
- The Consensus Document did not report results of JATOS but communication with the authors indicates they would not change recommendations based on it.

- **Opinions of local experts are in the following comments.**
  - Most elderly should achieve a SBP of <160 mmHg.
    - Below 160 mmHg, initiation of treatment and setting BP target levels should consider the patient's overall risk assessment and not simply a numerical value.

        - In patients with SBP 140 to 159 mmHg without target organ damage or risk factors, encourage lifestyle change for at least 6 months but strongly consider drug therapy if inadequate response.
        - In general, aim for <140/<90 in every patient if tolerated even in the healthy elderly while monitoring potassium, creatinine, orthostasis, and side effects.
    - In the **frail** elderly
        - If treatment is initiated, a reasonable target is SBP 140 to 160 mmHg while sitting as long as there is no orthostatic drop to <140 mmHg while standing.
        - With **short** life expectancy, a SBP range of 160 to 190 mmHg may be reasonable.
        - In general use no more than 2 medications.
    - Make reasonable attempts to control hypertension, while taking heed to avoid harmful effects from treatment, which might be more likely or of greater consequence in certain patients, such as the frail or very elderly.
- **Academic Detailing Comments**
    - A Cochrane review indicates that antihypertensive therapy confers benefit in the elderly and the very elderly.
    - Evidence supports a SBP target of <160 mmHg in the elderly.
    - The optimal target **below 160** is **uncertain**.
    - Evidence addressing a SBP target of <140 mmHg is limited.
        - JATOS, the only trial that randomized exclusively elderly patients to different SBP targets (<140 mmHg vs 140 to 160 mmHg) showed **no difference** in any outcome between the two targets.
            - Only 7% of patients in this study had pre-existing cardiovascular disease.

The frail elderly

- Frailty is defined as the accumulation of multiple chronic illnesses and associated vulnerability. (See Appendix 2.)
    - The frail elderly commonly have dementia, functional decline, and geriatric syndromes, such as falls and impaired mobility.
    - They are at higher risk for adverse outcomes such as hospitalization delirium; adverse drug reactions which frequently present atypically;[22] and death, compared with those who are not frail.[23]
    - Older adults living in long-term care facilities tend to be very frail or very severely frail with limited life expectancy.
    - As life-expectancy is shorter in frail individuals, time required to achieve benefit should be considered in therapeutic decisions.

Appendix 4: Background Evidence for Recommendations: Treatment of Hypertension in the Frail Elderly

- The defining characteristics of frailty require a unique approach.
- Most trials enroll subjects who are at most, mildly frail and do not address hypertensive treatment in those who are severely frail or very severely frail.

Appendix 4: Background Evidence for Recommendations: Treatment of Hypertension in the Frail Elderly

- As the main concern in frailty is to decrease disability, it is important to focus on the possibility of **stroke** prevention.
  - In studies of the **non-frail** elderly, antihypertensive therapy required 1 to 2 years[24-26] or longer[27, 28] to show benefit in fatal and non-fatal stroke.
  - In contrast, HYVET did not show statistically significant reduction in fatal and non-fatal stroke after 2 years.[21]
- Advanced age and frailty may result in a greater risk of events such as stroke. Therefore the benefits of therapy **may** appear earlier than in the non-frail. However, no studies have been done to explore this.
- The potential for **adverse effects** from therapies also requires consideration.
  - The frail elderly, especially those with dementia, may not be able to communicate symptoms of drug-related adverse effects.
  - Polypharmacy is common and with each additional medication, there is an increased risk of medication-related adverse effects.[29, 30]
  - Age-related physiologic changes may alter the disposition and pharmacologic actions of drugs (e.g., onset, duration and magnitude of effect) and can result in considerable interindividual variation in response.[31]
  - **Orthostatic hypotension** is a particular concern and may lead to falls.
    - In long-term care facilities, blood pressure is frequently measured in the supine position, which may over-estimate the sitting or standing blood pressure.
- In most RCTs that included the elderly, beneficial effects were achieved with **1 or 2** anti-hypertensive medications.
  - No trial was designed to look at the benefit or risks of using 3 or more therapies. Thus, there is no definitive evidence that using more than 2 drugs to control hypertension in frail older adults is beneficial.
- RCTs exclude the very frail or very severely frail elderly and thus, recommendations for BP treatment are based on **local expert consensus**.
- When managing the frail elderly, it is worth considering the following questions:[32]
  - Is the person's life expectancy long enough to achieve benefit?
  - Are there clinically significant drug-drug interactions?
  - Are there clinically significant adverse effects?
  - Does the medication match the patient's goals of care?
  - Is this drug the least expensive alternative compared with others of equal usefulness?

Appendix 5: Comprehensive Geriatric Assessment – Long Term Care (CGA-LTC)

Long-Term Care
Clinical Geriatric Assessment (CGA)

PATIENT ID

WNL: Within Normal Limits ASST: Assisted
IND: Independent DEP: Dependent

Chief lifelong occupation: _____ Education: (yrs) _____

Cr Cl/eGFR: _____

Infection Control
MRSA _____ Pos _____ Neg
VRE _____ Pos _____ Neg
Flu shot given (d/m/y) _____
Pneumococcal vaccine given (d/m/y) _____
TB test done (d/m/y) _____
Tetanus (d/m/y) _____

Cognitive Status*
☐ WNL
☐ Dementia
☐ Delirium
MMSE _____

Emotional*
☐ WNL
☐ Depression
☐ Other
☐ Hallucinations/Delusions
☐ ⇩Mood
☐ Anxiety
Date (d/m/y): _____

Behaviours*
☐ Verbal Non-aggressive
☐ Verbal Aggressive
☐ Physical Non-aggressive
☐ Physical Aggressive

Communication:

Speech	Hearing	Vision
☐ WNL	☐ WNL	☐ WNL
☐ Impaired	☐ Impaired	☐ Impaired

Foot-care needed ☐ Yes ☐ No
Dental care needed ☐ Yes ☐ No
Skin Integrity Issues ☐ Yes ☐ No

Strength
☐ WNL ☐ Weak
Upper: Proximal Distal R L
Lower: Proximal Distal R L

Personal Directives ☐ Yes ☐ No
Substitute Decision Maker: _____
Tel #: _____

Mobility	Transfers	☐ IND ☐ ASST ☐ DEP
	Walking	☐ IND Slow ☐ ASST ☐ DEP
	Aid	_____
Balance	Balance	☐ WNL ☐ Impaired
	Falls	☐ No ☐ Yes Frequency
Elimination	Bowel	☐ Constip ☐ Cont ☐ Incont
	Bladder	☐ Catheter ☐ Cont ☐ Incont
Nutrition	Weight	☐ STABLE ☐ LOSS ☐ GAIN
	Appetite	☐ WNL ☐ FAIR ☐ POOR
ADLs	Feeding	☐ IND ☐ ASST ☐ DEP
	Bathing	☐ IND ☐ ASST ☐ DEP
	Dressing	☐ IND ☐ ASST ☐ DEP
	Toileting	☐ IND ☐ ASST ☐ DEP

Code Status:
☐ Do Not Attempt to Resuscitate
☐ Do Not Hospitalize
☐ Hospitalize
☐ Attempt to Resuscitate

Marital Status
☐ Married
☐ Divorced
☐ Widowed
☐ Single

Family Stress
☐ None
☐ Low
☐ Moderate
☐ High

Problems/Past History/Diagnosis*	Medication Adjustment Required*	Associated Medication*
1.	☐	
2.	☐	
3.	☐	
4.	☐	
5.	☐	
6.	☐	
7.	☐	
8.	☐	
9.	☐	
10.	☐	
11.	☐	
.	☐	

Current Frailty Score* (Scale description on next page)

*** NOTE: The physician must complete all items marked with an asterisk (*) and meet all Master Agreement Long-Term Clinical Geriatric Assessment (CGA) program criteria in order to claim the CGA fee.**

Scale ☐ 5. Mildly Frail ☐ 6. Moderately Frail ☐ 7. Severely Frail ☐ 8. Very Severely Ill ☐ 9. Terminally Ill

Clinical Frailty Scale**

5. Mildly Frail – These people often have **more evident slowing**, and need help in **high order IADLs** (finances, transportation, heavy housework, medications). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation and housework.

6. Moderately Frail – People need help with **all outside activities** and with **keeping house**. Inside, they often have problems with stairs and **need help with bathing** and might need minimal assistance (cuing, standby) with dressing.

7. Severely Frail – Completely dependent for personal care, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within ~ 6 months).

8. Very Severely Frail – Completely dependent, approaching the end of life. Typically, they could not recover from even a minor illness.

9. Terminally Ill – Approaching the end of life. This category applies to people with **a life expectancy <6 months**, who are **not otherwise evidently frail.**

Scoring frailty in people with dementia

The degree of frailty corresponds to the degree of dementia. Common **symptoms in mild dementia** include forgetting the details of a recent event, though still remembering the event itself, repeating the same question/story and social withdrawal.

In **moderate dementia,** recent memory is very impaired, even though they seemingly can remember their past life events well. They can do personal care with prompting.

In **severe dementia,** they cannot do personal care without help.

**1. Canadian Study on Health & Aging, Revised 2008
2. K. Rockwood et al. A global clinical measure of fitness and frailty in elderly people. CMAJ 2005; 173; 489-495

Adapted from Clinical Frailty Scale ©2007 – 2009. Version 1.2 All rights reserved. Geriatric Medicine Research, Dalhousie University, Halifax, Canada

CGA Associated Visits

Date	Comments

Physician Name (please print): _____ Physician Signature: _____

Signed on (d/m/y): _____ (Visit required on this date)