Evidence in Context

Issue: Fall Prevention for Seniors in Institutional Healthcare Settings
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Health research — synthesized and contextualized for use in Newfoundland & Labrador

Fall Prevention for Seniors in Institutional Healthcare Settings in Newfoundland & Labrador

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About This Report

About NLCAHR

The Newfoundland & Labrador Centre for Applied Health Research, established in 1999, contributes to the effectiveness of the health and community services system of the province and the physical, social, and psychological well-being of the population. NLCAHR accomplishes this mandate by building capacity in applied health research, supporting high quality research, and fostering more effective use of research evidence by decision makers and policy makers in the province's health system.

About the Contextualized Health Research Synthesis Program

In 2007, NLCAHR launched the Contextualized Health Research Synthesis Program (CHRSP) to provide research evidence that would help guide decision makers in the provincial health system on issues of pressing interest to Newfoundland and Labrador. Instead of conducting original research, CHRSP analyzes findings from high level research already conducted in the subject area, such as systematic reviews, meta-analyses and health technology assessments. Findings are then synthesized and subjected to a systematic process of contextualization: they are analyzed in terms of their applicability to the conditions and capacities of the unique context of Newfoundland and Labrador. Our contextual analysis includes assessing the specific forms an issue may take in this province as well as the applicability of any proposed solutions and methods to locally available resources, infrastructure, human resources, cultural conditions and financial capacities. CHRSP uses a combination of external experts and local networks to carry out and contextualize the research synthesis and to facilitate the uptake of the results by research users. CHRSP focuses on three types of projects: health services/ health policy projects, health technology assessment (HTA) projects, and projects that combine the two to examine processes for the organization or delivery of care involving a health technology.

Who Should Read This Report?

This report provides a synthesis of the relevant research-based evidence on fall prevention for older adults in institutional healthcare settings in Newfoundland and Labrador.

This report is intended to inform and assist decision makers in Newfoundland and Labrador's four Regional Health Authorities and its Department of Health and Community Services. The findings of our synthesis are based on an international search of the literature and may also be applicable to other countries, but are specifically interpreted for the context of Newfoundland and Labrador.

Decision makers from other jurisdictions, especially those with similar potential clients, geography and resources, may also find the content helpful. The report includes explanations of research terms and technical language; as such, there is no need to have a specialized medical or health background in order to understand its content.

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Fall Prevention for Seniors in Institutional Healthcare Settings in Newfoundland & Labrador

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Acronyms

AGS	American Geriatrics Society
AMSTAR	Assessment of Multiple Systematic Reviews
CHRSP	Contextualized Health Research Synthesis Program
CI	Confidence Interval
CIHI	Canadian Institute for Health Information
DHCS	Department of Health and Community Services (Government of Newfoundland and Labrador)
IU	International Units
LTC	Long Term Care
OT	Occupational Therapist
PCH	Personal Care Home
PT	Physiotherapist
RCT	Randomized Controlled Trial
RT	Recreational Therapist
RHA	Regional Health Authority

Glossary

Acute Care	Care that provides necessary treatment for a disease or severe episode of illness for a short period of time.
AMSTAR	Assessment of Multiple Systematic Reviews: an 11-item instrument used to assess the methodological rigor of systematic reviews.
Assisted-Living Facilities	Residential settings designed to provide supportive housing for individuals who are able to direct their own care but need extra help in their day-to-day lives, and do not require nursing home care. Assisted-Living Facilities offer housing, hospitality services and personal assistance services.
Confidence Interval	A measure of the reliability of an estimate which specifies a range within which the true value of the estimated parameter is expected to lie.
Intermediate Care	Care provided to individuals who do not require the degree of care which hospitals or skilled nursing facilities provide, but who, because of their physical or mental condition(s), require care and services above the level of room and board.
Long Term Care	Facilities that provide living accommodation for people who require on-site delivery of 24-hour, seven-days-a-week, supervised care, including: professional health services; personal care services; and services such as meals, laundry, and housekeeping.
Multifactorial Intervention	A package of measures that involves an initial assessment carried out by one or more health professionals and two or more categories of intervention linked to the individual's risk profile.
Nursing Home	An institution with nursing care available on-site 24 hours per day.
Primary Research	Research that involves the collection and analysis of data from actual participants, as opposed to the combination of such research (i.e., higher level studies) or secondary analyses of previously collected data.
Randomized Controlled Trial	A type of primary research in which participants are randomized with regard to treatment, with the objective of eliminating confounding factors that may exist among the participants.
Rehabilitation	A goal-oriented and often time-limited process which enables an individual with impairments and disabilities to reach his/her optimal mental, physical and/or social functional level; services include, but are not limited to: • prevention, identification and management of complications of disability; • enabling the individual to identify and adapt to altered life circumstances; and • the continuum of health promotion, prevention of disease or dysfunction, and correction or minimization of impairments and disabilities.
Residential Care	Lodges, supportive housing, and long term care homes that offer different levels of care and may be free-standing or co-located with other types of care or hospitals.
Sub-Acute Care	Medical and skilled nursing services provided to patients who are not in an acute phase of an illness but who require a level of care higher than that provided in a long term care setting.
Systematic Review	A literature review that tries to identify, select, appraise, and synthesize published and unpublished research evidence relevant to some specific research question.

The Research Question

"What interventions are most effective in preventing falls and fall-related fractures among older adults in institutional healthcare settings?"

Background

In the fall of 2012, Newfoundland and Labrador's Department of Health and Community Services (DHCS) and its four Regional Health Authorities (RHAs) formally asked the Contextualized Health Research Synthesis Program (CHRSP) to identify and evaluate the best available research-based evidence on fall prevention for older adults in institutional healthcare settings, such as hospitals and residential care facilities. Though this research topic was initially suggested by authorities at Western Health, consultations with the province's other RHAs and with the DHCS revealed that the experience of older adults in institutional settings was a high-priority issue for them as well. CHRSP personnel then assembled a project team that included officials from three of the RHAs, a faculty member from Memorial University's School of Human Kinetics and Recreation, and the Executive Director of the Seniors Resource Centre of Newfoundland and Labrador. Dr. Vicky Scott, Clinical Associate Professor in the School of Population and Public Health at the University of British Columbia and Senior Advisor on Fall and Injury Prevention for the British Columbia Injury Research and Prevention Unit and Ministry of Health, agreed to serve as Academic Team Leader for the project, and Dr. Susan Gillam, Western Health's Chief Executive Officer, agreed to serve as Health System Leader.

In their initial description of the topic, Western Health officials framed the issue as follows:

> "*According to the Canadian Institute for Health Information, falls were the cause of 57% of all injury-related hospitalizations, and more than three quarters of all in-hospital deaths in those admitted for an injury. Accreditation Canada has identified a fall prevention strategy as a Required Organizational Practice with the goal to reduce the risk of injuries resulting from falls. Western Health has committed significant resources to the continued spread of a fall prevention program to reduce the number of falls as well as the severity of injuries resulting from falls. Quality and Risk Management leadership would use the results of this research to improve patient/client outcomes and to enhance program delivery.*"

At an initial project meeting, team members confirmed that the requested synthesis should focus exclusively on fall prevention for older adults[1] in institutional – as opposed to community – settings. This was for two reasons:

- The team decided that a synthesis including articles on both institutional and community settings would be too large in scope.
- Secondly, the team leader of the project had recently completed a report on fall prevention in the community for the Public Health Agency of Canada.

Therefore, our synthesis ultimately included only reviews of studies conducted in a range of institutional healthcare settings, including long term, residential, intermediate, acute and sub-acute care facilities.[2]

Recent scholarship indicates that falls by older adults are not only the cause of a great deal of personal suffering but also constitute a significant economic burden to society. According to Heinrich et al., costs related to falls by older people ranged between 0.85% and 1.5% of total healthcare expenditures in the USA, Australia, the EU, and the U.K. (1). The same authors found that "costs of falls in the elderly in an international perspective seemed to be higher than costs for epilepsy (0.12% to 1.12%), [and] comparable to the direct treatment costs of specific mental disorders like depression, schizophrenia and dementia (1% to 2%)..." (p. 899). Given this background, the CHRSP Project Team set out to critically assess and synthesize the existing systematic review evidence on fall and fracture prevention for older people in institutional healthcare settings.

Synthesis of the Evidence

We synthesized evidence from 19 systematic literature reviews published between April 1, 2008, and April 30, 2013. A complete description of our inclusion criteria, search strategy, article selection, data extraction procedures, and critical appraisal of included articles is contained in the web-based companion document (http://www.nlcahr.mun.ca/CHRSP/). Taken together, these 19 reviews included 290 different primary studies.

Moreover, some of the reviews in our synthesis included studies conducted in the community as well as studies that were conducted in institutional healthcare settings. We included such reviews only if they analyzed the institutionally-based studies separately from the rest so that it was possible to identify a finding or findings specific to interventions delivered in those settings. For that reason, the reader may be confident that our findings accurately reflect the existing review literature on fall prevention in

[1] We defined older adults as persons ≥ 65 years old.

[2] See the Glossary for definitions of the different settings listed here.

hospitals, residential care facilities, and the like. Nevertheless, a large proportion of the 290 studies were conducted in the community. Because we did not retrieve full-text versions of the individual studies, and because there was some inconsistency in the way these studies are described in the review literature, we are unable to state with total confidence the proportion that were conducted in institutional as opposed to community settings. After careful analysis, we estimate that approximately 105 took place within institutional settings; ultimately, it is these studies that constitute the basis for our findings.

Our critical appraisal methodology for systematic reviews employed the Assessment of Multiple Systematic Reviews (AMSTAR), a validated measurement tool for evaluating the methodological quality of systematic reviews (2). AMSTAR scores range from 0 to 11. A higher AMSTAR score can be taken as an indicator that the various stages of the review (e.g., literature searching, pooling of data, critical appraisal, etc.) were conducted appropriately. A low AMSTAR score does not necessarily mean that the review should be discarded, merely that less confidence can be placed in its findings and that the review must be examined closely to identify its limitations. In Table 1 below, we provide the AMSTAR scores for the reviews included in the synthesis.

Table 1:
AMSTAR scores for systematic reviews synthesized in this report

Review (Year)(Reference)	AMSTAR Score
Avenell et al. (2009) (3) (Cochrane Review)	9/11 (82%)
Cameron et al. (2012) (4) (Cochrane Review)	9/11 (82%)
Gillespie et al. (2010) (5) (Cochrane Review)	9/11 (82%)
Murad et al. (2011) (6)	9/11 (82%)
Kalyani et al. (2010) (7)	8/11 (73%)
Sawka et al. (2010) (8)	8/11 (73%)
Cusimano et al. (2008) (9)	7/11 (64%)
DiBardino et al. (2012) (10)	6/11 (55%)
Church et al. (2011) (11)	5/11 (45%)
Tice (2011) (12)	5/11 (45%)
Bischoff-Ferrari et al. (2009a – “Fall…”) (13)	4/11 (36%)
Bischoff-Ferrari et al. (2009b – “Prevention…”) (14)	4/11 (36%)
Neyens et al. (2011) (15)	4/11 (36%)
Choi and Hector (2012) (16)	3/11 (27%)
Chung et al. (2011) (17)	3/11 (27%)
Bischoff-Ferrari et al. (2012) (18)	2/11 (18%)
Chua and Wong (2011) (19)	2/11 (18%)
Lai et al. (2010) (20)	2/11 (18%)
Stern and Jayasekara (2009) (21)	1/11 (9%)

As this table indicates, not all reviews were equal in terms of methodological quality; we took this variability into account when formulating our conclusions. We also took into account the number of

studies included in each review, as well as the rigor with which they attempted to isolate variables that have a significant measurable impact on fall outcomes. In particular, we relied quite heavily on the three Cochrane reviews that appear at the top of Table 1. As it turned out, the lower-scoring, less comprehensive reviews generally corroborated the findings of the higher-scoring reviews, but they occasionally contributed some original findings or analyses; we have noted these as well.

We are confident that our synthesis constitutes a thorough and discriminating analysis of the existing review evidence; however, it is important to note that any analysis based primarily on systematic reviews is subject to certain limitations. In the first place, a large majority of the studies included in these reviews were either randomized controlled trials (RCTs) or quasi-randomized controlled trials. Though RCTs are typically regarded as the gold standard in biomedical research, it is not always easy or even possible to evaluate complex, multivariable health services or programs using this design. In addition, RCTs may not capture clinically relevant findings that, for one reason or another, do not meet the threshold for statistical significance. We would offer the reader the following suggestions for how to interpret the systematic review evidence in this synthesis:

- if a high-quality systematic review of well-conducted RCTs demonstrates clearly that a given intervention reduces the rate of falls or fractures, then the reader can place a high level of confidence in that intervention;
- if, on the other hand, a high-quality systematic review *fails* to demonstrate clearly that a given intervention has any kind of effect – positive or negative – on the rate of falls or fractures, the reader should *not* necessarily conclude that the intervention is ineffective or harmful.

We would also note that the content of the most recently published review in our synthesis – the review by Cameron et al. – was last assessed by its authors as being up-to-date on June 30, 2012. A PubMed search for RCTs published between June 30, 2012, and April 30, 2013 failed to identify any relevant primary studies, but the reader should keep in mind that there is a great deal of new research being conducted on fall prevention for seniors, and the reviews in our synthesis do not include findings published after June 30, 2012. Readers who wish to stay current on new fall-prevention research and technological advances should consider attending events such as the National Fall Prevention conference to be held in Toronto in May, 2014. Finally, readers may also wish to become acquainted with findings and recommendations based on lower-level evidence. According to most evidence-rating systems, systematic reviews and meta-analyses of RCTs constitute the highest level of evidence, but, for the reasons just cited, there may be any number of sensible and worthwhile practices that have not been (or cannot be) evaluated using these methodologies. As a result, studies deeming these practices to be effective will be judged to be of relatively low quality by the standard assessment tools. With this in mind, we have included, at the end of our synthesis, tables that grade the strength of the evidence supporting the fall-prevention interventions that are most commonly employed (see Tables 4 and 5).

The following discussion covers the five major themes that arose in the synthesis of the evidence for fall and fracture prevention among seniors in institutional settings:

- Multifactorial fall-prevention interventions;
- Vitamin D and Calcium;
- Exercise;
- Interventions targeting medications, the physical environment, staff education, and the organization of care; and
- Hip protectors.

Multifactorial fall-prevention interventions

***Key message*:**

There is LIMITED review evidence to indicate that multifactorial fall-prevention interventions are effective in either care facilities or hospitals; however, this lack of conclusive research findings may be attributable to the complexity of these interventions and the difficulty of implementing them faithfully.

The review evidence covered by our synthesis offers limited and qualified support for multifactorial fall-prevention interventions, which involve an initial assessment carried out by one or more health professionals and two or more types of interventions linked to the individual's risk profile. The best such evidence is supplied by Cameron et al., who pooled results from studies conducted in care facilities and found that some programs targeting individual risk factors showed a possible reduction in rate and risk of falling but deemed the evidence in support of this finding as inconclusive. The same authors found clearer evidence that multifactorial programs reduced the rate of falls in hospitals, but offered no recommendations as to what specific components should be included in these programs. In general,

> "[t]he interpretation of the multifactorial interventions is complex because of the variation in components, frailty of the sample, duration and intensity of the intervention, and how the interventions were implemented" (4, p. 16).

Indeed, other review authors who evaluated multifactorial interventions also cited the complexity of these interventions and the challenges involved in implementing them as factors that may help to explain their seemingly limited impact. Neyens et al. explain that "[a]n intervention that may be effective in itself might not yield favorable effects if the intervention is not implemented according to plan, is badly complied with, and/or encounters serious obstacles in daily practice" (15, p. 417). And as DiBardino et al. point out,

> "Adoptability of a multidisciplinary intervention will clearly impact adherence and the intervention's ultimate effectiveness. Single intervention strategies… are simpler to execute and adhere to" (10, p. 501).

The clear implication here is that health authorities that wish to implement a multifactorial fall-prevention model would need to tailor interventions to specific care settings and populations, and ensure the availability of the infrastructure and resources – human and material – required for faithful implementation. In-house cost analysis is particularly critical since, from an organizational standpoint, administrators must be confident that an intervention is not only effective but that it is also *cost*-effective. For these reasons, we will not be presenting evidence here on 'one-size-fits-all' multifactorial models of fall prevention – there is simply no guarantee that these models can be imported successfully into particular practice settings. Rather, the evidence clearly suggests that decision makers would be well-advised to develop their own models, taking careful note of available resources and the assessed needs of their client populations. And though this report cannot recommend a specific composite *model* for fall-prevention initiatives, decision makers can use this report as a guide to the existing high-level evidence on the clinical effectiveness of potential program *components*. To give some sense of the full number of program components there are to choose from, Table 2 lists the eight systematic reviews in our synthesis that evaluated multifactorial interventions along with the various individual program components included in each intervention package.[3]

Table 2:
Components of Multifactorial Fall Prevention Interventions

Review	Components of Multifactorial Fall Prevention Interventions
Cameron, 2012	Individual assessment followed by one or more of: environmental modifications/assistive technologies, medication reviews, exercise, staff training and patient education, management of urinary incontinence, podiatry referral (in care facilities), and opthalmology referral (in hospitals).
Choi, 2012	Some combination of the following: comprehensive medical exam, occupational therapy assessment, activities of daily living, home environmental and behavioral assessment, cognition assessment, gait stability, medication review, staff training, and education for residents.
Church, 2011	Individual assessment and one or more of: education and training, exercise programs, safe footwear and clothing recommendations, home hazards assessment and modification, vision or medication adjustments, and recommendations for behavioural change or home-based physical therapy.
Cusimano, 2008	Individual assessment followed by one or more of: exercise, medication, environmental/assistive technologies, staff training and patient education.
DiBardino, 2012	Some combination of the following: mobility assessment/assistance/aids, medication modification, education on risk factors, fall-risk sign/warning in patient charts, bedside interventions (i.e., bed alarms, bedrail adjustments, changes in bed position and location), toileting schedule, exercise, hip protectors, environmental modifications.

[3] Readers may also wish to consult other resources that have translated the available evidence into practical guidelines: the Canadian Fall Prevention Curriculum (CFPC), an evaluated education program for health care professionals (www.canadianfallprevention.ca); the new *Getting Started Kit* by Safer Health Care Now (www.saferhealthcarenow.ca); and Lead Author Vicky Scott's 2012 book *Fall Prevention Programming: Designing, Implementing and Evaluating Fall Prevention Programs for Older Adults* (29).

Neyens, 2011	Individual assessment followed by one or more of: exercise, safety recommendations, Vitamin D supplementation, incontinence care, hip protectors, staff and patient education, medication reviews, environmental checks.
Stern, 2009	Individual fall-risk assessment followed by one or more of: education of patients and staff, medication review, modification of environment, exercise and alarms, risk-alert card, an information brochure, an exercise program, an education program and utilisation of hip protectors.
Sawka, 2010	Individual risk assessment with feedback and advice to physicians, followed by one or more of: staff and resident education, balance and resistance training, hip protectors, environmental modification, drug modification, select specialist referral, and hip protectors.

Unfortunately, there was little consensus in the review literature as to which components should be considered essential in any multifactorial fall-prevention model. As mentioned earlier, the highest-quality review in our synthesis on multifactorial interventions was the one by Cameron et al., who declined to reach any conclusions about specific intervention components. Nonetheless, a full reading of the entire body of review literature suggests some promising directions. For instance, one component common to all the multifactorial fall-prevention interventions evaluated in these reviews was assessment of individual patient risk factors. While it is beyond the scope of this synthesis to draw conclusions about which methods of risk assessment produce the most accurate information, the reader should be aware that there is systematic review evidence to support the validity and reliability of a number of specific risk-assessment tools for falling[4] (22). However, there is no one tool that has been validated across different healthcare settings or across different subgroups of populations within the same setting. Therefore, when selecting an assessment tool for clinical use, healthcare administrators should choose one designed specifically for the context in which the tool is to be applied. Beyond that, it will suffice here to note that systematic identification of those at significant risk of falling and careful assessment of their individual risk factors should serve as the basis of any fall-prevention effort.

Moving beyond assessment, Cusimano et al. reviewed a subset of the studies included in the review by Cameron et al. and found that multifactorial programs significantly reduced the number of recurrent fallers in residential care settings and shared some common general intervention strategies. These included environment modification, resident and staff education, and "specific strategies tailored to the needs of individual residents, such as medication reviews and the provision of hip protectors for recurrent fallers" (9, p. 121). We examine the review evidence on these and other strategies below; however, it is important to remember that failure to identify evidence of a given strategy's effectiveness does not necessarily indicate that the strategy is ineffective. For instance, it may be that the effectiveness of individual model components – such as education – is diminished or obscured when these individual components are implemented and evaluated in isolation from other model components.

[4] Examples of validated risk-assessment tools and associated instructions for use may be found in the resources mentioned on p13 – the CFPC (www.canadianfallprevention.ca), the *Getting Started Kit* (www.saferhealthcarenow.ca), and *Fall Prevention Programming* (29).

Vitamin D and Calcium

Key Message:

There is STRONG review evidence that daily combined doses of at least 700-800 IUs of vitamin D and at least 600 mg of calcium are safe and effective in reducing fractures in frail elderly living in care facilities.

The bulk of the higher-and moderate-quality evidence in our synthesis indicates that daily vitamin D in combination with calcium is an effective way to reduce the risk of fractures among elderly residents of care facilities. More specifically:

- point estimates of the reduction in incidence of hip fractures ranged from 25% (according to Avenell et al., 2009) (3) to 26% (according Tice, 2011) (12), and
- point estimates of the reduction in incidence of total (vertebral and non-vertebral) fractures ranged from 26% (as in Tice, 2011) (12) to 29% (as in Chung et al., 2011) (17).[5]

In the pooled studies that support this finding, the minimum daily dose of vitamin D was 800 international units (IUs) and the minimum daily dose of calcium was 600 milligrams (mg), though according to the highest quality review on vitamin D's effectiveness in our synthesis, "there is evidence supporting the hypothesis… that vitamin D in doses of 700-800 IU daily, with co-administration of 1000 mg calcium, is effective in reducing the rate of hip fractures in frail older people in institutional care" (3, p. 10). Moreover, these authors found that "the risk of harmful effects from vitamin D and calcium is small, [though] some people, particularly with kidney stones, kidney disease, or high blood calcium should seek medical advice before taking these supplements" (p. 2). On the other hand, there was little evidence in our synthesis to indicate that vitamin D by itself – i.e., without co-administration of calcium – can be effective in reducing fracture risk. Although some lower-quality evidence suggests that it can be effective (14,18), the bulk of the higher-quality evidence suggests that vitamin D supplementation is rendered less effective or ineffective unless supplemental calcium is administered along with it.

There is some suggestion from this literature that combined vitamin D and calcium may actually be more effective in institutionalized elderly persons than in community-dwelling elderly persons, though a number of reviews did not discern a significant difference between these two populations. The potentially greater effectiveness of vitamin D and calcium for seniors living in institutional settings is

[5] It should be noted that in each case there is a range of values – called a confidence interval (CI) – within which the true value of the estimated reduction in incidence of fracture is expected to lie. So, while the point estimate given by Avenell et al. for the reduction in incidence of hip fracture is 25%, they also note that 95 times out of 100 this number will actually fall anywhere between 8% and 38% (Tice puts these numbers at 3% and 44%). Likewise, Tice estimates that 95 times out of 100 the reduction in *total* fracture incidence will fall anywhere between 12% and 38%, whereas Chung et al. report a CI of 11% to 43%.

consistent with "the accumulation of evidence, from clinical biochemistry and epidemiology, that many frail institutionalized older people are vitamin D deficient, particularly in the winter months, when the incidence of hip fracture is highest" (3, p. 10).

The evidence to support the effectiveness of vitamin D in reducing the incidence of *falls* (as opposed to fractures) in institutional settings is somewhat less certain. The best evidence in our synthesis on this issue is supplied by Murad et al., who found that vitamin D use was associated with a statistically significant reduction in the risk of falls, one that appeared to be more pronounced among seniors who were deficient in vitamin D. These authors also noted a greater reduction in the risk of falls when calcium was co-administered along with vitamin D. However, they discerned a significant effect in pooled data only from community-dwelling seniors, not from institutionalized seniors (6).

Most of the evidence for vitamin D's effectiveness in fall and fracture risk reduction was obtained from nursing and residential care facilities. Because of a lack of systematic review evidence, we were unable to draw conclusions about vitamin D's effectiveness in preventing falls and fractures among hospitalized seniors.

Exercise

Key message:

There is FAIR review evidence that particular forms of balance training are effective in reducing falls among residential care populations.

The best evidence in our synthesis on the effectiveness of exercise in preventing falls is supplied by Cameron et al., who found that balance training using specialized mechanical apparatus was the only exercise modality that was associated with a statistically significant reduction in fall rate.[6] Cameron et al. reviewed research on two particular types of balance training: supervised perturbed gait exercise on a treadmill and balance training using computerized visual feedback, both of which were evaluated in intermediate care settings with residents not experiencing acute illness, dementia, or other cognitive impairments. The former involves the use of a specialized treadmill that continuously and randomly generates unexpected perturbation while walking, whereas the latter employs a computerized force platform and a screen for providing visual feedback (23,24). Both are individualized forms of exercise that target gait, balance, and coordination. Beyond these two specific and highly technical exercise interventions, Cameron et al. found "no evidence overall that exercise reduces falls in care facilities" (4, p. 18). In contrast to trials involving community-dwelling older people, the evidence in our synthesis does not support the effectiveness of other popular forms of exercise – such as Tai Chi – in preventing

[6] We do not state the numerical effect size observed by Cameron et al. here because the CI around the point estimate was quite large, spanning over 60 percentage points.

falls among seniors in institutional settings. As stated previously, however, this does not necessarily mean that these exercises are *ineffective* in preventing falls; rather, it means that little support for them can be found in the literature reviewed for this synthesis. Furthermore, though the particular kinds of balance training evaluated in the review by Cameron et al. relied on specialized and costly mechanical apparatus, the effectiveness of these interventions suggests that other forms of balance training using more readily available technologies might also have a significant preventive effect. It may be worth noting that a systematic review by Silva et al. published after our searches were conducted found that combinations of balance and resistance training exercises performed several times a week for at least one to three months were found to have a significant preventive effect on falls in long term care (LTC) facilities (25).

Key message:

There is FAIR review evidence that providing additional physiotherapy – i.e., more than seven sessions per week – in hospital rehabilitation wards may reduce risk of falling.

Pooled data from the review by Cameron et al. also showed a significant reduction in the risk of falling among older inpatients in sub-acute hospital wards who were offered additional physiotherapy.[7] This finding appears to have been particularly influenced by one trial in which the members of the intervention group received ten sessions per week during their hospital stay, while the comparison group received three sessions per week (26). Participants in this trial were in relatively good health in that they were not experiencing severe cardiac, lung, or kidney issues, did not have arthritis, and had achieved a passing score of cognitive ability according to the Abbreviated Mental Health Test. Physiotherapy in this study consisted of stretches, lower limb exercise, and balance and gait activities.

Interventions targeting medications, the physical environment, staff education, and the organization of care

Key message:

There is LIMITED review evidence to support the use of medication review, environmental modification, staff education, or reorganization of care as stand-alone measures for preventing falls and fractures, but these interventions may be effective when offered in conjunction with other components of a multifactorial fall-prevention program.

[7] Once again, the CI around the point estimate was quite large – spanning over 75 percentage points – and so we do not state the numerical effect size observed by Cameron et al.

The best evidence in our synthesis on medication review is supplied, again, by Cameron et al., who found that results relating to pharmacist-led medication reviews in care facilities were inconsistent (26). The review identified five studies that investigated the effect of medication reviews, and only one of them reported a significant reduction in either the rate or the risk of falling. Only four of these studies were amenable to meta-analysis but pooled results from this subset showed no evidence of effectiveness. As well, these authors found no evidence to indicate that staff education, changes to the organization of care, and/or environmental adaptations, such as low beds or wireless position-monitoring devices, have any effect on the rate or risk of falls in either hospitals or care facilities (though they do note that carpet flooring in a hospital rehabilitation ward appeared to significantly increase falls compared with vinyl flooring).

However, another high-quality review by Sawka et al. found that *fractures* were reduced in one of three studies of multimodal interventions in nursing homes, and the authors noted that "some important differences between the multimodal intervention offered by Jensen et al., in which hip fractures were reduced, compared to intervention[s]… in which hip fractures were not reduced included… ongoing support for fall prevention [as opposed to a one-off educational session], supply and repair of mobility aids, and medication adjustments" (8, p. 9). Furthermore, Sawka et al. also found that *falls* were reduced in two of these three studies and noted that one of the main differences between the lone ineffective intervention and the two successful ones was the inclusion of environmental hazard checks. The intervention in the Jensen study mentioned above – which observed a reduction in both fractures *and* falls – went beyond simply noting environmental hazards and involved actively modifying the physical environment by improving lighting, rearranging furniture, providing new beds with new mattresses, installing grip bars, and removing loose carpets (27). Considered together, the evidence reviewed by Sawka et al. and Cameron et al. suggests that interventions like medication review, environmental modification, and staff education become maximally effective only as part of a multi-component fall-prevention model.

Hip Protectors

Key message:

The review evidence demonstrating hip protectors' effectiveness in reducing the risk of fracture in residential or nursing care populations is UNCERTAIN, in large part because study participants' acceptance of, and adherence to, this measure has been consistently low.

The highest quality evidence in our synthesis on the effectiveness of hip protectors is provided by Gillespie et al., who found that the reduction in the risk of hip fractures associated with hip protectors barely met the threshold for statistical significance (5). Furthermore, when these researchers excluded from the analysis those studies found to be at high risk of bias, the statistical significance of this effect disappeared altogether. They acknowledge this to be a "counter-intuitive" finding (p. 11) given that the bulk of the evidence up to 2001 appeared to indicate that hip protectors significantly reduced the

incidence of hip fracture. Gillespie et al. cite a couple of factors to explain the lingering uncertainty surrounding the effectiveness of hip protectors, and the discrepancy between the earlier evidence and their own findings. In the first place they point out that study participants' acceptance of and adherence to these devices has been "consistently poor", despite primary researchers' efforts to improve compliance: "clearly, if protectors are not worn they cannot be effective" (p. 11). Secondly, they suggest that aspects of the design, conduct, analysis, and reporting of the early RCTs in particular may have introduced bias. To this we would add that until very recently there were no established guidelines for assessing the biomechanical and clinical effectiveness of different varieties of hip protectors (28), and this gap further brings into question the reliability of earlier studies. Finally, the reader should be aware that manufacturers are continually making improvements to hip protector designs in order to address effectiveness and acceptance. As such, there appears to be a clear need for additional studies using more recent hip protector models that have undergone biomechanical testing.

Summary of Review Evidence

The systematic review evidence included in this synthesis presents a pair of somewhat paradoxical findings:

- On the one hand, evidence to support the effectiveness of multifactorial fall-prevention programs in institutional health settings suggests possible benefits, though the evidence is ultimately inconclusive.
- On the other hand, there appear to be only a small number of individual interventions that are unquestionably effective when used by themselves, and a larger range of interventions that may become maximally effective only when delivered in combination with others.

In the next section, we work through these findings and examine their implications for healthcare in Newfoundland and Labrador.

Key Messages from the Evidence Synthesis

1. There is **LIMITED** review evidence to indicate that multifactorial fall-prevention interventions are effective in either care facilities or hospitals; however, this lack of conclusive research findings may be attributable to the complexity of these interventions and the difficulty of implementing them faithfully.

2. There is **STRONG** review evidence that daily combined doses of at least 700-800 IUs of vitamin D and at least 600 mg of calcium are safe and effective in reducing fractures in frail elderly living in care facilities.

3. There is **FAIR** review evidence that particular forms of balance training are effective in reducing falls among residential care populations.

4. There is **FAIR** review evidence that providing additional physiotherapy – i.e., more than seven sessions per week – in hospital rehabilitation wards may reduce risk of falling.

5. There is as yet **LIMITED** review evidence to support the use of medication review, environmental modification, staff education, or reorganization of care as stand-alone measures for preventing falls and fractures, but these interventions may be effective when offered in conjunction with other components of a multifactorial fall-prevention program.

6. The review evidence demonstrating hip protectors' effectiveness in reducing the risk of hip fracture in residential or nursing care populations is **UNCERTAIN**, in large part because study participants' acceptance of, and adherence to, this measure has been consistently low.

Recommendations Based on Lower-Level Evidence

Systematic reviews or meta-analyses typically reflect the findings of randomized controlled trials; as such, they seldom reflect findings from lower-level evidence. As noted previously, there may be sensible and worthwhile fall-prevention interventions whose effectiveness has been studied by other methods but has not been demonstrated in systematic reviews or meta-analyses. This may, for example, be attributable to the fact that certain interventions cannot readily be tested using RCT methodology or may have been evaluated by only a single RCT. In order to provide a more comprehensive understanding of the state of the evidence on fall prevention in institutional settings, we have partially reproduced a series of tables from Lead Author, Vicky Scott's 2012 book *Fall Prevention Programming: Designing, Implementing and Evaluating Fall Prevention Programs for Older Adults* (29). Table 4 and Table 5 below provide a list of some of the most commonly-employed fall prevention interventions in residential and acute-care settings, with letter grades denoting the strength of the recommendation supporting each intervention. As Table 3 indicates, the assessment of the strength of the recommendation is based partly on levels of scholarly evidence and partly on the findings of an expert review panel that balanced evidence with knowledge of clinical relevance. The tables in *Fall Prevention Programming* were originally adapted from the National Institute for Clinical Excellence's clinical practice guidelines for the prevention of falls in older people.

Table 3:
Levels of Evidence and Strength of Recommendations

Levels of Evidence
Level I: Evidence from systematic reviews and meta-analysis of randomized controlled trials
Level II: Evidence from at least one properly designed randomized controlled trial
Level III: Evidence from comparative studies, correlation studies and case-control studies
Level IV: Evidence from case studies or expert committee reports or opinions
Strength of Recommendations
A: Directly based on Class I evidence
B: Directly based on Class II evidence or extrapolated recommendations from Class I evidence
C: Directly based on Class III evidence or extrapolated recommendations from Class I or II evidence
D: Directly based on Class IV evidence or extrapolated recommendations from Class I, II, or III evidence

Table 4:
Fall-Prevention Interventions in Residential-Care Settings

Multifactorial Interventions for Preventing Falls in Residential Settings	Strength of the Recommendation
Environmental modification	B
Assessment of appropriate use of assistive equipment	B
Review and modification of medications, particularly psychotropics	B
Safer transferring techniques and ambulation	B
Creation of a multidisciplinary team	B
Completion of a general medical assessment	B
Creation of an individual fall prevention plan	B
Including a comprehensive program of interventions	B
Staff commitment to fall prevention	B
Single Factor Interventions for Preventing Falls in Residential Settings	**Strength of the Recommendation**
Review and modification of medications (particularly psychotropics)	B
Use of fall diaries kept by nursing staff to record information about the falls, circumstances around falls, and prevention information for potential future falls	B
Structured multidisciplinary assessment in the immediate post-fall period (e.g., 7 days)	B
Increased supervision of frailest residents	B
Exercise programs	B
Volunteer companions for those at highest fall risk	C
Wearing shoes at all times	C

Table 5:
Fall-Prevention Interventions in Acute-Care Settings

Interventions for Preventing Falls in Acute-Care Settings	Strength of the Recommendation
Interventions targeting multiple risk factors coupled with supervised exercise (for long-stay patients)	A
Patient education	B
Vitamin D and calcium	B
Alternatives to restraints, including volunteer companions, physical activity, safe transfers, and hazard-free environments	B
Review and modification of medications	C
Delirium-avoidance programs	C
Selection of sub-floor materials and coverings	C
Use of chair alarms	D

The Newfoundland and Labrador Context

Throughout the course of this project, we have tried to identify contextual factors unique to Newfoundland and Labrador that may influence the relevance and applicability of the research-based evidence. This section of the report addresses those contextual factors, and is based on an analysis of relevant administrative data and consultations with key informants.

Contextualization Approach

The consultations that informed our contextual analysis comprised a full team meeting, attended by all but two members of the project team (team members are listed on page 5); a series of follow-up interviews with the various RHA representatives on the project team, conducted by Robert Kean and Stephanie O'Brien; and one supplementary interview with a local expert on vitamin D research who was not on the project team, also conducted by Robert Kean and Stephanie O'Brien. In assembling the team, we deliberately sought out persons with extensive professional experience in this subject area as well as practical knowledge of the province's healthcare system. Some team members also had a background in scholarly research, but this section of the report is based primarily on team members' practical experience as clinicians, administrators, and/or decision makers.

In some cases, our interview subjects offered suggestions as to how health system planners should make use of the findings generated in the synthesis. We have reported the most relevant of their suggestions in the following sections.

Client Base

Population aging is occurring all across Canada, but it is especially pronounced in Newfoundland and Labrador. In 2009, the proportion of persons aged 65 years and over in this province was close to the Canadian average – 14.8% compared to 13.9% in Canada as a whole. At that time, there were four other provinces with a higher proportion of older adults. However, according to all projected scenarios, Newfoundland and Labrador will have the highest proportion of older adults in Canada by the year 2036 – between 30.6% and 32.1% (30). This projected demographic trend has serious implications for the province's health system, since population aging has been identified as one of the principal drivers of recent growth in public-sector health spending. The Canadian Institute for Health Information (CIHI) estimates that, from 1998 to 2008, population aging accounted for 10.8% of total public-sector spending growth in Canada as a whole and well over 20% of spending growth in Newfoundland and Labrador[8] – more than in any other province (31). In general, older adults consume proportionally more healthcare

[8]According to CIHI, aging has been a more important healthcare cost driver in provinces that have not experienced any significant in-migration of working-age individuals, and Newfoundland and Labrador experienced net interprovincial *out*migration every year between 1998 and 2008 (30). However, it should be noted that in 2008-09 net interprovincial migration in this province actually became positive for the first time in 24 years, and is expected to remain so for the foreseeable future.

dollars than other age groups, and, as their share of the population grows, we can expect demand for health services to grow along with it.

CIHI further notes that the biggest consumers of healthcare dollars are the relatively small number of people who have multiple chronic illnesses, which tend to require intensive medical attention with age (31). Many such persons ultimately require placement in long term care (LTC) facilities. Over the past few decades, LTC facilities in this country have witnessed a rise in the proportion of residents who require a higher level of care; according to CIHI, 25% of LTC residents in Canada received level III[9] or higher care in 1998, but by 2008 the percentage of residents requiring this level of care had risen to 33%, in part because of the increasing incidence of dementia and related conditions among older adults (31). Our interviewees confirmed that the residents of this province's LTC homes generally require a higher level of care than would have been the case twenty or even ten years ago – in at least one region the number of residents requiring level III care or higher is in excess of 90%. Furthermore, the kinds of chronic illnesses and conditions that are now common among the LTC resident population typically give rise to symptoms that are known risk factors for falls, including impaired cognition, wandering behaviors, delirium, incontinence/urgency, and impairments in balance, gait, and muscle strength (29). Not surprisingly, fall incidence in LTC settings is estimated to be approximately three times higher than among older persons in the community (4). The incidence of falls in acute-care settings is similarly high (29).

Economic Factors

According to the 2013 estimates tabled by the Government of Newfoundland and Labrador, the $2,319,097,000 spent on health in 2012-13 was the largest single expenditure in that year's provincial budget, comprising well over a third of all the money the government spent (32). The situation is much the same across the country as a whole. Even when inflation and population growth are accounted for, recent public-sector health spending in Canada has outstripped the growth in the economy and in government revenues by a considerable margin (31). In Newfoundland and Labrador, as in other provinces, the health system is steadily consuming an increasing share of public revenues, leading to concerns that health spending is 'crowding out' other important public-sector investments in areas such as education and infrastructure. Senior health decision makers – as well as the public – are increasingly keen to find ways of checking the growth of public-sector health spending by using existing resources more efficiently and more productively. When the most recent provincial budget was handed down in Spring 2013, the province's health minister alluded to the growing share of the budget allocated to healthcare and emphasized the need to "ensure the investments [in healthcare] are sustainable investments" (33). Clearly, the government has only finite resources with which to improve targeted health outcomes, and any new initiatives will need to be crafted with an eye to cost-effectiveness and fiscal restraint. This is as true for fall prevention as it is for myriad other health objectives set out by the healthcare system.

[9] Level three (III) care is "that required by a person who is chronically ill and/or has a functional disability (physical or mental)" and who "therefore requires a range of therapeutic services, medical management and skilled nursing care plus provision for psychosocial needs" for months or years (41).

Effective fall prevention in institutional care settings could potentially generate significant saving for the province. CIHI's Patient Cost Estimator, an application available on the Institute's website, gives an estimate of how great these savings might be. According to the Patient Cost Estimator, the average estimated hospital inpatient costs associated with fixation/repair of hip/femur fractures among adults aged 60-79 years in Newfoundland and Labrador in 2010-11 totaled $13,334 per patient, and the average estimated cost of trauma-induced hip replacement was $15,437 per patient. For the 80+ year age group, these numbers rise to $15,733 and $17,414, respectively. Data from CIHI's National Trauma Registry further reveal that in NL in 2011-12 there were eleven in-hospital hip fractures among persons ≥ 65 years of age and a further 107 that occurred in residential institutions.[10] A rough calculation[11] suggests that a single year of these incidents may have cost the provincial treasury approximately $1.8 million in hospital inpatient expenses. Given that the increasingly intensive utilization of acute-care and LTC beds is another key driver of growth in public-sector healthcare spending cited by CIHI, it is clear that any measures that improve health outcomes among the older adults who use these services would ultimately translate into spending reductions.

Existing Infrastructure

Residential-care services in Newfoundland and Labrador are provided in two types of facilities: Personal Care Homes (PCHs) and LTC facilities. Admission to either of these facilities is dependent upon the level of care and services required by the individual. PCHs cater to individuals who require Level I and Level II care, i.e., individuals who require assistance with daily living and occasionally the services of a visiting professional but who do not need on-site health or nursing services (34). Conversely, LTC homes provide care and accommodations to residents who require Level III care or higher (35), with the exception of the Protective Community Residences in Corner Brook, which provide enhanced assisted living to individuals with mild to moderate dementia.

PCHs and LTC homes differ not only in the services they provide but also in how they are operated and funded. Personal Care Homes are privately owned and operated but are licensed and monitored by their respective RHAs to ensure they are complying with the *Health and Community Services Act*, the *Personal Care Home Regulations*, and any other relevant policies and standards (34). LTC homes are accredited public facilities that are funded by the DHCS and run by their respective RHAs (35). It is important to note that, although they are monitored on a regular basis, PCHs are subject to a different set of requirements than those that apply to LTC homes, where the care needs of the resident population are much higher. As such, the brunt of fall-prevention programming in this province's residential care sector is directed at LTC sites. Table 6 below provides a listing of all 40 sites in the province with LTC beds as of August 2013.

[10] One of our project team members pointed out that these kinds of incidents are often under-reported, so the actual number of hip fractures may be higher.

[11] This calculation involved averaging the four different cost estimates and multiplying by the total number of hip fractures suffered by older persons in NL's hospitals and LTC facilities in 2011-12.

We were told that most of the existing LTC facilities in the province were originally built for resident populations requiring Level I and Level II care. As previously discussed, these populations are now served primarily by privately-owned PCHs, whereas LTC homes increasingly cater to residents who are chronically ill, disabled, or who otherwise require a range of intensive therapeutic services for months or years. These facilities have been challenged by the necessity of serving a high-need population they were never designed to accommodate. For instance, as the percentage of LTC residents requiring higher levels of care has increased, so too has the need for specialized equipment to meet their needs. Unfortunately, there has not been an accompanying increase in available storage space; as a result, many facilities now have a great deal of environmental clutter that tends to increase residents' risk of falling. In the most recent provincial budget, the government announced investments totalling $72.7 million in ongoing LTC infrastructure projects taking place in Happy Valley-Goose Bay, Corner Brook, Bonavista, Clarenville, Carbonear, and St. John's (36). When developing new facilities, planners would, it is hoped, take careful note of problems generated by the design and organizational layout of existing facilities so as to prevent these same problems from re-occurring in newly-built facilities.

The shortage of space in LTC homes coupled with the need to rein in public health spending likely also means that balance training using specialized mechanical apparatus, such as gait-disturbing treadmills and computerized force platforms, will be impracticable in most, if not all, of the province's LTC facilities. However, as noted earlier, it is at least conceivable that there may be, now or in the future, other effective forms of balance training that can be delivered using smaller, less costly equipment. Therefore the province may wish to stay abreast of the research in this area in the event that new and more affordable modes of balance training emerge and prove effective.

Table 6: Facilities and Long Term Care Beds in Newfoundland and Labrador

FACILITY NAME	NO. OF LONG-TERM CARE BEDS
Eastern Regional Health Authority	
1. Waterford Hospital	50
2. Caribou Memorial Veteran's Pavilion	(Veterans Affairs Canada) 56
3. Dr. Walter Templeman Health Centre (Bell Island)	15
4. US Memorial Health Centre (St. Lawrence)	40
5. Placentia Health Centre/Lions Manor	75
6. Bonavista Peninsula Health Centre	12
7. The Salvation Army Glenbrook Lodge (St. John's)*	104
8. St. Patrick's Mercy Home (St. John's)*	210
9. Saint Luke's Home (St. John's)*	117
10. The Agnes Pratt Home (St. John's)*	134
11. Masonic Park Nursing (St. John's)*	40
12. The Hoyles-Escasoni Complex (St. John's)*	375
13. Chancellor Park (St. John's)*	70
14. Harbour Lodge Nursing Home (Carbonear)*	83
15. Interfaith Citizens Home (Carbonear)*	53
16. Pentecostal Seniors Citizens Home (Clarke's Beach)*	69
17. Golden Heights Manor (Bonavista)*	70
18. Blue Crest Nursing Home (Grand Bank)*	61
19. Dr. Albert O'Mahoney Memorial Manor (Clarenville)*	44

Eastern Health Total:	**1,678**
Central Regional Health Authority†	
20. A.M. Guy Memorial Health Centre (Buchans)	18
21. Brookfield Bonnews Health Care Centre	45
22. Fogo Island Health Centre	9
23. Notre Dame Bay Memorial Health Centre (Twillingate)	32
24. Connaigre Peninsula Health Centre (Harbour Breton)	12
25. Baie Verte Peninsula Health Centre	18
26. Green Bay Health Centre/Valley Vista Senior Citizens Home (Springdale)	77
27. Dr. Hugh Twomey Health Centre (Botwood)	79
28. Lakeside Homes (Gander)*	102
29. Carmelite House (Grand Falls-Windsor)*	64
30. North Haven Manor (Lewisporte)* (includes 12 Protective Community Residences)	63
Central Health Total:	**519**
Western Regional Health Authority	
31. Dr. Charles L. LeGrow Health Centre (Port aux Basques)	30
32. Calder Health Centre (Burgeo)	18
33. Bonne Bay Health Centre (Norris Point)	14
34. Rufus Guinchard Health Centre (Port Saunders)	22
35. Corner Brook Long Term Care Home*	236
36. Protective Community Residences (Corner Brook)*^	40
37. Bay St. George Long Term Care Centre (Stephenville Crossing)*	114
Western Health Total:	**474**
Labrador-Grenfell Regional Health Authority	
38. Captain William Jackman Memorial Hospital (Labrador City)	6
39. Labrador South Health Centre (Forteau)	14
40. New Long Term Care Home (Happy Valley-Goose Bay)*	50
41. John M. Gray Health Centre (St. Anthony)*	47
Labrador-Grenfell Health Total:	**117**
NEWFOUNDLAND AND LABRADOR total:	**2,788**

*designated as a long-term care home

† number of long term care beds in Central Health includes respite and palliative care beds

^ these residences provide enhanced assisted living to individuals with mild to moderate dementia

Acute care services in Newfoundland and Labrador are provided in 28 facilities spread across the province's four regional health authorities (RHAs). Table 7 lists these facilities and the number of acute care beds in each. NLCAHR's 2012 report, *Age-Friendly Acute Care in Newfoundland and Labrador* (http://www.nlcahr.mun.ca/CHRSP/AFAC.php) contains detailed information about acute care services for seniors in this province.

Table 7: Facilities and Acute Care Beds in Newfoundland and Labrador

FACILITY NAME	NO. OF ACUTE CARE BEDS*
Eastern Regional Health Authority	
1. General Hospital, Health Sciences Centre (St. John's)**	354
2. St. Clare's Mercy Hospital (St. John's)**	207
3. Waterford Hospital (St. John's)**	84
4. Carbonear General Hospital**	72
5. Dr. G.B. Cross Memorial Hospital (Clarenville)**	41
6. Burin Peninsula Health Care Centre (Burin)**	41
7. Dr. Leonard A. Miller Centre – Acute Rehabilitation**	72
8. Dr. Walter Templeman Health Centre (Bell Island)	3
9. Placentia Health Centre/Lions Manor	10
10. Bonavista Peninsula Health Centre	10
Eastern Health Total:	**894**
Central Regional Health Authority	
11. James Paton Memorial Health Centre (Gander)**	85
12. Central Newfoundland Regional Health Centre (Grand Falls-Windsor)**	114
13. A.M. Guy Memorial Health Centre (Buchans)	3
14. Brookfield Bonnews Health Care Centre	12
15. Fogo Island Health Centre	4
16. Notre Dame Bay Memorial Health Centre (Twillingate)	16
17. Connaigre Peninsula Health Centre (Harbour Breton)	6
18. Baie Verte Peninsula Health Centre	6
19. Green Bay Health Centre (Springdale)	8
Central Health Total:	**254**
Western Regional Health Authority	
20. Western Memorial Regional Hospital (Corner Brook)**	199
21. Sir Thomas Roddick Hospital (Stephenville)**	44
22. Dr. Charles L. LeGrow Health Centre (Port aux Basques)	14
23. Calder Health Centre (Burgeo)	3
24. Bonne Bay Health Centre (Norris Point)	8
25. Rufus Guinchard Health Centre (Port Saunders)	7
Western Health Total:	**275**
Labrador-Grenfell Regional Health Authority	
26. Labrador Health Centre (Happy Valley-Goose Bay)**	25
27. Captain William Jackman Memorial Hospital (Labrador City)**	14
28. The Charles S. Curtis Memorial Hospital (St. Anthony)**	54
Labrador-Grenfell Health Total:	**93**
NEWFOUNDLAND AND LABRADOR Total:	**1,516**

Statistics as of August, 2013

* acute care beds listed exclude the Janeway Children's Health and Rehabilitation Centre
** designated as an acute care hospital

Human Resources

Multiple interviewees noted that the work of allied health professionals such as occupational therapists (OTs), physiotherapists (PTs) and pharmacists is crucial to maintaining the health and safety of older

adult clients. The charts below provide CIHI data on the numbers of PTs, OTs, and pharmacists working in each of the province's regions. It should be noted here that these data do not distinguish between full-time employees and part-time, temporary, or casual employees. Furthermore, CIHI data differ from provincial and territorial data as a result of CIHI's collection, processing, and reporting methodologies.

Table 8:
Physiotherapists by Primary Place of Employment by Health Region, Newfoundland and Labrador, 2011 [12]

Place of Employment	Eastern	Central	Western	Labrador-Grenfell	Unknown/ Postal Code not found	Total
Hospital	85	1*	15	*	0/0	**120**
Community	*	*	0	*	0/0	**1***
Professional practice	64	*	11	*	7/0	**88**
Other	0	0	0	0	0/0	**0**
Unknown	*	0	0	0	0/0	****
Total	**159**	**17**	**26**	**11**	**7**	**220**

Table 9:
Occupational Therapists by Primary Place of Employment by Health Region, Newfoundland and Labrador, 2011

Place of Employment	Eastern	Central	Western	Labrador-Grenfell	Unknown/ Postal Code not found	Total
Hospital	66	12	1*	*	4/1	**99**
Community	23	*	*	0	0/0	**30**
Professional practice	24	0	*	*	0/0	**27**
Other	13	*	*	0	0/0	**17**
Unknown	0	0	0	0	0/0	**0**
Total	**126**	**15**	**21**	**6**	**4/1**	**173**

[12] **Source for Tables 8 and 9**: Physiotherapist Database & Occupational Therapist Database, CIHI.
Notes: '*' means that the value of that digit has been suppressed in accordance with CIHI's privacy policy; this value is from 0-9.
"Community" includes residential care facilities, assisted-living residences, community health centres, visiting agencies/businesses, and schools or school boards.
"Professional practice" includes group and solo practices/clinics.
"Other" includes post-secondary educational institutions, government, industry, manufacturing and commercial, and other employer types not otherwise specified.

Table 10:
Pharmacists by Primary Place of Employment by Health Region, Newfoundland and Labrador, 2011[13]

Place of Employment	Eastern	Central	Western	Labrador-Grenfell	Unknown/ Postal Code not found	Total
Hospital and Other Healthcare Facilities	75	1*	1*	6	1/0	**112**
Community Pharmacy	316	79	74	22	2/1	**494**
Health-related industry/ Manufacturing/Commercial	*	*	0	0	0/0	**
Other	3*	0	*	0	1/0	**4***
Unknown	0	0	0	0	0/0	**0**
Total	**432**	**94**	**91**	**28**	**4/1**	**650**

One of the most persistent general themes that emerged from our consultations with project team members was the limited availability of allied health resources – particularly PTs – and the impact this has on the ability of RHAs to deliver fully effective fall-prevention programming. To be sure, not all of our interviewees expressed the same degree of concern about this issue, and some were confident that – in certain specific areas of care, at least – there were enough such resources in their region to do the job. Indeed, the tables above demonstrate that the numbers of each type of worker vary considerably from region to region. Nonetheless, multiple interviewees felt that augmented allied health resources would enhance their ability to implement a number of fall-prevention interventions, including exercise, medication reviews, and environmental hazard checks.

For example, the amount of exercise that LTC residents get depends heavily on the number and availability of PTs, physiotherapy support workers, and recreational therapists. Multiple interviewees noted that there is a definite shortage of these workers in many LTC facilities, and this makes it difficult to help residents maintain physical function. According to a 2009 Needs Assessment released by Eastern Health,

> "There are physiotherapists and occupational therapists covering most LTC facilities in the province; however, the ratios are about 1 therapist per 300 residents. In rural areas,

[13] **Source for Table 10**: Pharmacist Database, CIHI.
Notes: The '†' sign means that the value has been suppressed in accordance with CIHI's privacy policy; this value is from 0-9.
"Hospital & and other health cares" also includes rehabilitation facilities, mental health facilities, and residential care facilities.
"Health-related industry" includes health-related industries whose focus of activity is not the direct delivery of health care services but rather health-related products, services, and/or sales.
"Other" includes group professional practices/clinics, community health centres, post-secondary educational institutions, and government and para-governmental organizations, and other places of employment not specified.

> hospital-based therapists can be responsible for up to 11 LTC and Personal Care Homes (PCH). They may be able to visit once every 6-8 weeks. Therapists and families recognize there is only time to assess residents and solve immediate problems. Active rehabilitation is sparse and provided mainly by rehabilitation support workers, where available. Therapists and families indicate that residents do not receive enough exercise, opportunities for leisure and recreation, or encouragement to be independent in self-care" (37, p. 68).

This lack of available allied health resources means residents often face long wait times for an initial assessment on admission to LTC, especially if they are admitted from the community or another LTC facility (rather than from an acute- care ward). In general, what one interviewee called "proactive" or preventative assessments and interventions are much less frequent for the general LTC population than they are for residents coming from acute care. Since physiotherapy assessments are required as the basis of individually-tailored exercise programs for residents, a delay in the assessment process means a delay in initiating a personalized exercise routine which, in turn, may lead to faster declines in functional status and mobility. Furthermore, our interviewees all agreed that implementation of the kinds of mechanized balance training described earlier would definitely require additional physiotherapists.

The situation in hospital settings is somewhat more complex. There was general agreement that patients in dedicated rehabilitation units/facilities and patients who are receiving treatment for an acute illness receive sufficient physiotherapy to minimize their risk of falling, though in some hospitals an influx of patients requiring, for example, critical care or ventilation can seriously tax the available physiotherapy resources. In situations like these, the PT may simply not have time for patients with less urgent needs. All of our interviewees agreed, moreover, that patients who remained in acute-care units after the acute phase of their treatment is complete typically do not receive adequate physiotherapy and, as a result, are at elevated risk of falling. In addition, medically discharged patients who are awaiting LTC placement generally fall very low on the PT priority list because of workload demands, and are therefore at an elevated risk of falling.[14]

However, exercise is not the only component of fall prevention that is affected by the availability of adequate allied health resources. OTs, for example, oversee hip protector fitting and provide the equipment that residents may need to ambulate independently. Likewise, the relatively small number of staff pharmacists employed in LTC facilities across the province – and particularly in the more rural areas – compromises their ability to conduct timely medication reviews for residents. To be effective, medication reviews must occur on a regular basis and/or promptly after a resident has experienced an

[14] One team member suggested adding kinesiologists to healthcare teams. According to this individual, kinesiologists could provide hands-on exercise training to patients and residents under the direction of a PT. While an increase in PT resources would still be required in order to conduct initial assessments and to design individualized exercise programs, having kinesiologists available would free up the PTs' time to see more patients and residents who are at high risk of falling, and who may otherwise have to wait long periods of time before being assessed.

adverse health event. Partly because of the high staff turnover rates that are particularly common in smaller, more rural sites, staff pharmacy positions are sometimes vacant for prolonged periods of time, and this can cause delays in the review process. Some interviewees also noted that medication reviews would be more effective if (a) multidisciplinary team rounds were established practice in all parts of the province, and (b) pharmacists had a strong presence within them.

Care Processes

As our synthesis of the high-level evidence on this topic indicates, only a very small number of stand-alone interventions appear to be unquestionably effective in preventing falls or fall-related injury in LTC homes and hospitals. In the absence of a 'magic bullet,' the success of any fall-prevention programming will depend largely on the way institutional care processes are organized and combined to create a safer experience for patients and residents. Happily, establishing fall and fracture prevention has been a major organizational priority in the province's four RHAs for some time now. All four RHAs either have implemented, or are in the process of implementing, fall prevention programming throughout their respective regions. The purpose of this section of our report is not to provide a blueprint for how this work should be done – for, as we have noted, each health authority must tailor its programs to its own unique requirements and capabilities – but rather to highlight those dimensions of care processes that will mediate the success of fall-prevention initiatives. In general, the process of successful implementation of fall prevention initiatives likely requires front-line, organizational and system changes (38). Depending on the complexity of the intervention being implemented, skill and competency development of front-line staff may be required to put evidence-based recommendations into daily practice.[15] This would certainly require organizational support, ideally coming from a specified team of implementation specialists, as well as public health system support in the form of legislation, policies and procedures (38).

As mentioned in the section on multifactorial fall-prevention interventions, the first steps in preventing falls and fractures are systematic identification of those at significant risk of falling and careful assessment of their individual risk factors. We do not make recommendations here about particular assessment tools, but we do note that the 2010 Clinical Practice Guideline of the American Geriatrics Society (AGS) – considered by many to be the gold standard for clinical fall prevention guidelines – recommends multifactorial fall risk assessment for the following categories of older persons:

- those who present for medical attention because of a fall, report recurrent falls in the past year, or report difficulties in walking or balance (with or without activity curtailment);
- those who cannot perform or perform poorly on a standardized gait and balance test; and
- those who have difficulty or demonstrate unsteadiness during the evaluation of gait and balance.

[15] Again, both the aforementioned CFPC and *Getting Started Kit* by Safer Health Care Now have many practice tips for LTC settings.

Moreover, the AGS guideline recommends that the assessment should be performed by a clinician or clinicians with the appropriate skills and training and should include a focused patient history, a thorough physical examination, and a functional assessment (39). At present, fall-risk assessment for adults admitted to hospital or long term care is a standard operating practice in three of the four RHAs, and the fourth plans to implement standardized assessments as part of a regional fall-prevention strategy it will roll out later in 2013. The Morse Fall Scale (40) is the most frequently used instrument throughout the province, and those RHAs that administer assessments on a routine basis require that the nurses who conduct them have received specialized training. One of our interviewees commented that it has taken some time to entrench assessment and documentation of fall risk as a routine care process within her organization, but that there has been real improvement in this area over the past few years. The other RHAs that have adopted this practice have witnessed similar improvement, and so risk assessment should be regarded as an organizational strength that decision makers can build upon as they broaden their fall-prevention efforts. Likewise, all four RHAs have, with the support of the DHCS, implemented the *Clinical Safety Reporting System*. This system enables the RHAs to collect and report fall incidence data from institutional settings, including personal care homes, and to set baseline measures to evaluate the impact of new prevention strategies.

Another factor that may mediate the success of fall-prevention measures is their compatibility with existing protocols and regulations. This is a particularly salient issue in settings where administrators are implementing novel fall-prevention initiatives. For example, the project team representative from the RHA that is currently formalizing a regional fall-prevention strategy expressed some concern that new requirements for reporting falls may ultimately compel staff to record much of the same data already being captured by the *Clinical Safety Reporting System,* causing duplication of effort. The person worried that this might annoy staff and reduce buy-in to the new strategy. This same interviewee speculated that there might be a tension in acute-care settings between existing safe patient-handling protocols and the desire to reduce long-term fall risk by encouraging patient ambulation. Conversely, there may be a tension in some settings between least-restraint policies and the desire to prevent falls by ensuring that clients in wheelchairs – and especially those with cognitive limitations – are securely fastened to those devices so as to prevent them from falling. A final example concerns psychoactive medications. Use of these medications is one of the risk factors for falling in residential and acute care settings (29) and yet they are used in clinical settings throughout the province to manage aggression in LTC patients with dementia. The overall implication is that administrators should carefully examine established care processes to ascertain their impact on risk of client falls, and take steps to harmonize new fall-prevention initiatives with existing protocols and regulations.

For those RHAs not already doing so, incorporating regular collection and analysis of client feedback into care processes could also help to ensure the success of fall-prevention measures. This is especially true with respect to interventions that require a high degree of acceptance and adherence on the part of residents, such as hip protectors. Acceptance of, and adherence to, the wearing of hip protectors seems to vary widely across regions and care settings, and does not appear to be strongly associated with particular client-population characteristics. Nevertheless, our interviewees described many of the same acceptance and adherence issues noted in the research literature. Patients/residents with cognitive

limitations sometimes attempt to remove these devices because they do not understand why they are wearing them in the first place, whereas the cognitively healthy sometimes find the devices bulky, uncomfortable, and/or unsightly. Some have complained that their gait is altered when they wear hip protectors and that toileting is more difficult. We cannot recommend a particular brand or supplier of hip protectors,[16] but, given the importance of acceptance and adherence to their effectiveness, we do suggest that care providers make a habit of gathering feedback from clients to determine which brands they are most comfortable with.[17] We note that collection of feedback might also help administrators to identify ways of enhancing uptake of other kinds of fall-prevention initiatives; for example, one of our respondents noted that residents of the LTC homes in her setting tend to dislike the puddings in which their calcium supplements are provided. In general, administrators would be well-advised to solicit feedback on any interventions that require a high degree of acceptance and adherence on the part of patients and residents in order to be effective.

The success of fall-prevention programming will also require RHAs to build consensus among clinicians – and particularly physicians – around desired changes to customary practice. The clearest illustration of this is the way vitamin D is – or is not – administered in the province's LTC homes. At present, only one of the four RHAs has resolved to prescribe daily combined vitamin D and calcium supplements to all LTC residents throughout its region, though another intends to update its standing orders soon so that seniors in its LTC facilities will be prescribed vitamin D (but not calcium). Four sites in a third region have voluntarily implemented its RHA's draft policy of providing 1000 IU vitamin D and 1000 mg calcium daily via standing physician's orders, but the remaining sites in that region have not yet chosen to do the same. In the fourth RHA, there are no set policies or standards regarding supplementation: some facilities administer vitamin D and some do not. In all cases, physician agreement has been deemed one of the key variables that determines whether patients receive vitamin D and, in particular, calcium. At present, there are some mixed messages in the media concerning the effectiveness of vitamin D and calcium and, in particular, about the safety of calcium supplementation. It seems that a number of the province's physicians have been influenced by media-fuelled concerns about potential adverse side-effects of calcium; this has engendered considerable uncertainty about the appropriate calcium dosage or whether it should be administered at all. There is also the very legitimate concern about the effects of calcium supplementation on individuals who already receive adequate dietary calcium intake or who have high blood calcium. Nevertheless, if administrators are satisfied that daily combined dosage of vitamin D and calcium is safe and effective – and our synthesis indicates that it would be for many of the

[16] Readers interested in delving further into the differences between various types of hip protectors may wish to refer to the 2011 article by Laing et al. entitled "The effects of pad geometry and material properties on the biomechanical effectiveness of 26 commercially available hip protectors" (28).

[17] The following short video, developed by the Fraser Health Authority in British Columbia and produced in part by the lead author of this report, addresses some other strategies for increasing acceptance of hip protectors in long-term care settings: http://agingisacontactsport.com/.

province's LTC residents[18] – they may wish to consider educating physicians and building consensus on the health effects of these supplements.[19]

One final aspect of care processes that will likely have an impact on the success of fall-prevention programming is organizational culture. The four RHAs have already made significant strides in this area, largely as a result of visible buy-in at the senior executive level. The ongoing challenge for the RHAs seems to lie in ensuring that policies are carried out consistently across their regions. One of our interviewees suggested that falls in her region are sometimes accepted as inevitable. She spoke of a need to increase awareness of the impact of falls and the difference healthcare providers can make. Another interviewee suggested that informal leadership culture within individual sites is crucial in this respect, since site leaders tend to have the most influence on how – and whether – policy is translated into practice. Multiple interviewees indicated that there is a need for clear definition of roles and responsibilities in all sites with respect to practices like medication review and hazard checks. This in turn requires that tasks related to fall prevention are formally included within the job descriptions of the designated staff persons and sufficient work time is allocated to get them done. As stated, the healthcare system in this province has done (and is presently doing) a great deal of work to prevent unnecessary falls in its healthcare facilities and the suffering that results there from. It should continue to build on that momentum.

Implications for Decision Makers

The implications we have listed below are based on the synthesis findings as refracted through the professional perspectives of the clinicians, administrators, and decision makers on the project team, most of whom currently work within the provincial health system. Given the nature of our methodology and the limitations of the evidence in our synthesis, we cannot recommend particular programs, services, or interventions. Instead, the reader should regard the implications that follow as considerations that decision makers may wish to bear in mind as they contemplate the local relevance and applicability of the research-based evidence synthesized in the first part of this report. These implications are not listed in any particular order.

1. There is no 'one-size-fits-all' model of fall prevention that is guaranteed to work in any and all practice settings; rather, decision makers are well-advised to tailor their interventions to specific

[18] As discussed earlier, the exceptions are those with kidney stones, kidney disease, or high existing levels of blood calcium. These residents should seek medical advice before taking dietary supplements.

[19] To this end, the reader may wish to examine tools that have been used in other jurisdictions to guide prescribing practices and enhance the uptake of vitamin D. We have included in the Appendix materials used by the Fraser Health Authority in British Columbia, including information sheets for physicians and pharmacists, and a leaflet for LTC residents, families, and staff.

care settings and resident populations, and to educate their staff to ensure faithful and consistent implementation of these interventions.

2. The effectiveness of fall-prevention programming is heavily dependent on the availability of sufficient allied health resources – particularly PTs, OTs, and pharmacists – and decision makers should ensure that any planned interventions can be feasibly delivered with the resources at hand.

3. The ongoing construction of new LTC facilities in various parts of the province provides an opportunity for decision makers to assess the ways that the design and organizational layout of older facilities may have heightened or failed to reduce the risk of resident falls, and to apply any lessons learned to the design of new sites.

4. Decision makers should carefully examine established care processes – such as safe patient-handling protocols, least-restraint policies, and the prescription of behavior-changing drugs – to ascertain their impacts on the risk of client falls, and take steps to harmonize any new fall-prevention initiatives with existing practices.

5. Regular collection and analysis of client feedback can help to ensure the success of interventions like hip protectors, which require a high degree of acceptance and adherence on the part of individual in order to be effective.

6. Given the confusion and mixed messages surrounding the safety and effectiveness of vitamin D and calcium, decision makers who wish to expand the use of these supplements may need to further educate clinicians and build consensus on their health effects.

7. Certain forms of balance training demonstrate real promise in preventing falls among LTC residents; decision makers may wish to stay abreast of the research in this area in the event that new and more affordable modalities emerge.

8. Given the important groundwork that has already been laid in this area, decision makers should now focus on ensuring that existing fall-prevention policies are carried out consistently across their respective regions, in part by continuing to foster a sense of accountability among providers, senior healthcare managers, and decision makers.

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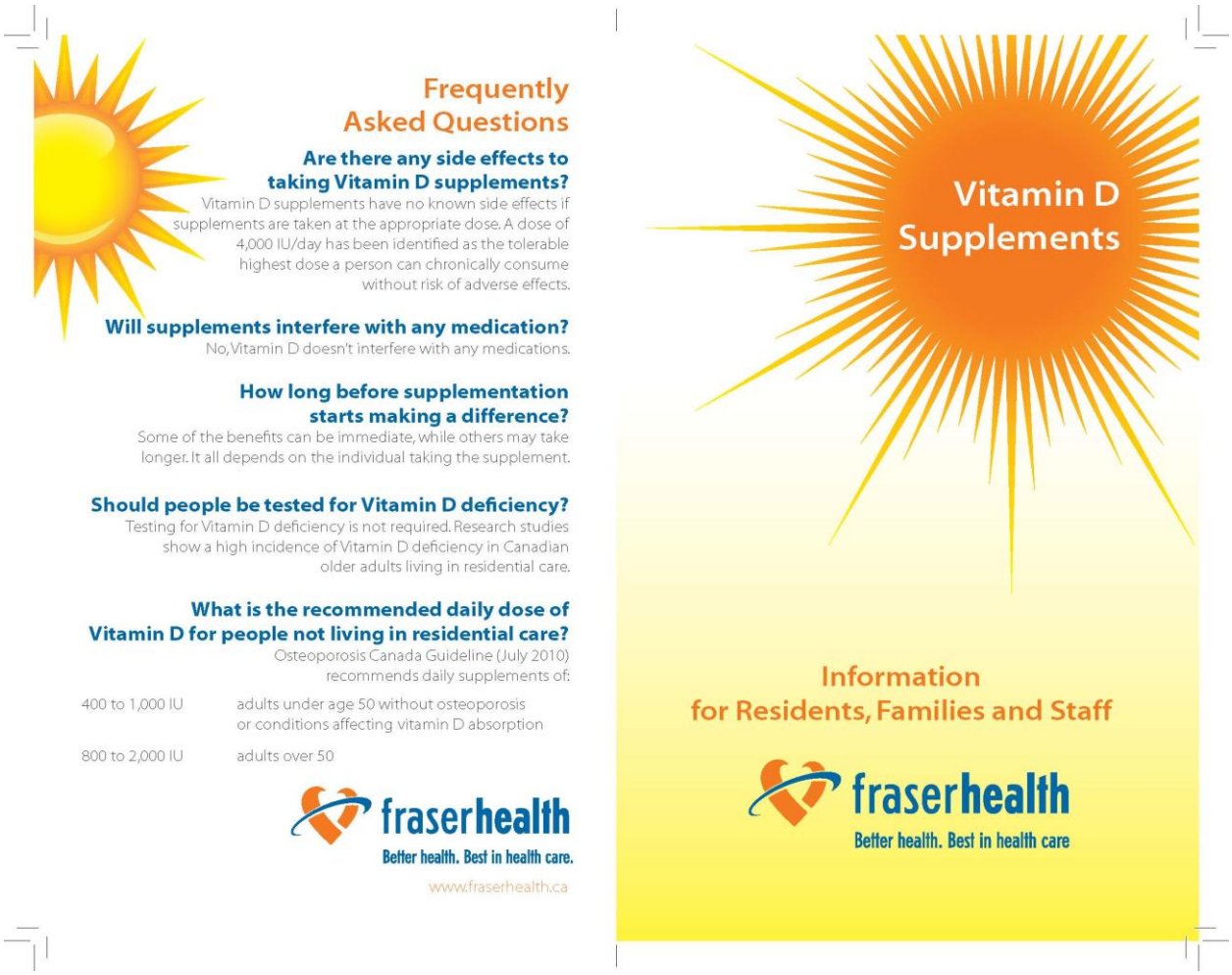
Appendix:
Fraser Health Authority Vitamin D Protocols



Frequently Asked Questions

Are there any side effects to taking Vitamin D supplements?
Vitamin D supplements have no known side effects if supplements are taken at the appropriate dose. A dose of 4,000 IU/day has been identified as the tolerable highest dose a person can chronically consume without risk of adverse effects.

Will supplements interfere with any medication?
No, Vitamin D doesn't interfere with any medications.

How long before supplementation starts making a difference?
Some of the benefits can be immediate, while others may take longer. It all depends on the individual taking the supplement.

Should people be tested for Vitamin D deficiency?
Testing for Vitamin D deficiency is not required. Research studies show a high incidence of Vitamin D deficiency in Canadian older adults living in residential care.

What is the recommended daily dose of Vitamin D for people not living in residential care?
Osteoporosis Canada Guideline (July 2010) recommends daily supplements of:

400 to 1,000 IU	adults under age 50 without osteoporosis or conditions affecting vitamin D absorption
800 to 2,000 IU	adults over 50

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Vitamin D Supplements

Information for Residents, Families and Staff

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Vitamin D: A Proven D-fence

Background

Vitamin D is an important factor in maintaining strong muscles and bones. It's not uncommon for Vitamin D levels to decrease with age – especially when less time is spent outdoors in the sun, which is one of the main natural sources of Vitamin D. Taking Vitamin D supplements is therefore a positive way to boost Vitamin D levels and strengthen muscles and bones.

Frequently Asked Questions

How does Vitamin D work to reduce the risk for falls and fractures?

Vitamin D has been shown to have a positive effect on strengthening muscles, which play an important role in balance and mobility. It also helps maintain healthy bones, by assisting with the absorption of calcium into bones.

Are there any other health benefits of taking Vitamin D supplements?

Low levels of Vitamin D have been linked to many serious chronic illnesses, including rheumatoid arthritis, multiple sclerosis, cardiovascular diseases, some cancers and diabetes.

Are all residents eligible for Vitamin D supplements?

Vitamin D supplements are available to residents, as long as the physician determines it is appropriate. Some residents with certain medical conditions may not be eligible.

Does everyone receive the same dose?

Yes, residents will be provided with a single weekly dosage of 20,000 IU of Vitamin D_3, unless changed by the physician.

What form does the supplement take?

The supplements come in tablet form. However, if swallowing becomes an issue, liquid or chewable forms are also available.

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Vitamin D Prescribing Criteria

Information for Pharmacists

Vitamin D supplementation has been extensively studied as a treatment to prevent both falls and fractures[1-3]. Vitamin D is an important nutrient involved in calcium metabolism, bone health, and muscle function. In addition, prospective epidemiologic studies have suggested that vitamin D may reduce the risk of cardiovascular disease and some forms of cancer, and may have positive effects on immune responses and anti-inflammatory benefits[4,5].

Despite the evidence that vitamin D is an important treatment for falls and fracture prevention, as well as potential cancer and cardiovascular benefits, vitamin D supplementation is not standard in most residential facilities and the prevalence of vitamin D deficiency is high in institutionalized people[6-8].

According to recommendations from the Fraser Health Specialist Advisory Group, the adequate safe and effective vitamin D dose for older adults living in residential care facilities is approximately 3,000 IU per day[9].

Prescribing Criteria for Residential Care Facilities

Inclusion Criteria: All seniors 65 years and older living in residential care facility

Exclusion Criteria: Those with hypercalcaemia and severe renal failure (GFR<20ml/ min)

Dosage: 2x 10,000 IU/week, no loading dose

The vitamin D protocol will be initiated by the physician within the first 6 weeks of a resident moving in or at first care conference, by completing and signing the vitamin D pre-printed order.

Pharmacists Role

Fraser Health is working with residential care facilities to increase vitamin D intake among residents. Pharmacist can aid in this new protocol by:

- Alerting residential care facilities you provide pharmaceutical services to about the FH Vitamin D Protocol
- During your visits to residential care facilities, helping to identify residents who may be suitable for supplementation (in line with the Prescribing Criteria)
- Supporting the residential care facility's doctors to prescribe vitamin D for suitable residents
- Dispensing vitamin D, when prescribed, for suitable residents
- Continuously monitoring and recommending vitamin D for suitable residents

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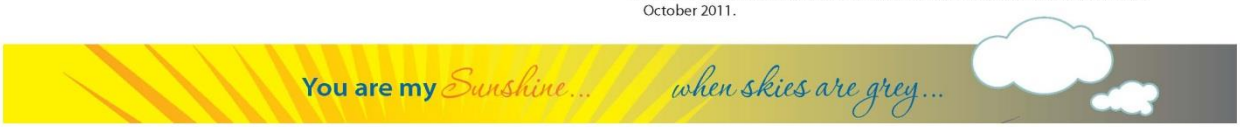

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According to recommendations from the Fraser Health Specialist Advisory Group, the adequate safe and effective vitamin D dose for older adults living in residential care facilities is approximately 3,000 IU per day[9].

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Exclusion Criteria: Those with hypercalcaemia and severe renal failure (GFR<20ml/ min)

Dosage: 2x 10,000 IU/week, no loading dose

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