

A Review of the Literature on Best Practices in Falls Prevention for Residents of Long-term Care Facilities

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Approximately 51 percent of residents in long-term care (LTC) facilities fall at least once each year with a fall incident rate of approximately 1.6 falls per bed annually [1]. Between 10 to 25 percent of these falls result in serious injuries that require medical treatment [1]. The risk of sustaining a hip fracture is 10.5 times higher for women who are in facilities than if they were living in the community, and less than 15 percent of facility residents who sustain a hip fracture regain pre-injury ambulation status [2].

The following is a review of the literature on falls prevention strategies for long-term care settings. It is presented as a practical guide for those who work with residents of LTC facilities to help in planning and implementing falls prevention strategies. The literature on prevention strategies is presented in order of the research quality of the studies used to generate the evidence and on the strength of the findings. For example, studies that tested a prevention strategy using random assignment to one or more intervention groups and a control group (a randomized clinical trial¹ or RCT) and those that included falls or fall injury as an outcome measure are given more importance than studies that only used fall risk factors as outcome measures or those that used a weaker research design. In addition, studies that demonstrated statistically significant² reductions in falls, fall-related injury or fall risk factors are given more emphasis than studies that did not demonstrate significant reductions.

The goal of this review is to glean information from the literature to assist practitioners faced with implementing programs in settings where there may be limited support and few resources. For each study, the following review lists the main strategy tested, the primary target group(s), major outcomes and suggested practical considerations. The practical considerations are posed to reflect potential challenges and strengths that may be found in a typical LTC facility that have the potential to influence the implementation and sustainability of the falls prevention strategy. A brief overview is also provided on the cost effectiveness of falls prevention strategies.

The information outlined in this review is intended as one of many sources of information that may be used to design a comprehensive falls prevention program. Other sources include the opinion of those who work and live in LTC facilities, existing policies and procedures and literature from other disciplines. A comprehensive prevention program

¹ A randomized clinical trial is a study design where subjects are randomly assigned to groups, an experimental treatment is introduced to the intervention group(s), and the effects of the treatment is observed in comparison to those in the control group(s).

² Statistical significance means that the results were unlikely to have occurred by chance

should be inclusive of many sources of information and should reflect new best practices evidence as it is generated. Components of a comprehensive falls prevention plans typically include the following [3]:

- a facility-wide collaborative approach to falls prevention including a multidisciplinary team with direct responsibility for the implementation and evaluation of fall prevention activities
- an education and awareness raising program for all staff, support staff, residents, family members and visitors
- a falls surveillance system for monitoring the nature and severity of falls and contributing factors
- a system for assessing fall and injury risk upon admission and over time
- a visual mechanism for identifying high risk falls, such as a bracelet or colour coding on charts or above beds
- a formal process for investigating individual falls and implementing tailored prevention plans
- a policy for investigating facility-wide fall and injury patterns and using a collaborative process for prioritizing and implementing appropriate preventions
- an evaluation plan designed to determine the effectiveness of specific strategies and overall approaches to falls prevention
- a process for recognizing and rewarding the efforts of staff and residents for their falls prevention efforts

Together, these components are seen as a dynamic model of falls prevention programming that includes input from those affected by the problem and those with the capacity to reduce the risk of falling. Literature on prevention strategies can be used to support some or all of the above components. Selecting the appropriate prevention strategies from the tables below is best done through a collaborative process that reflects the risk profiles of individual residents, as well as unique characteristics of the facility, and involves key stakeholders with the ability to build on the existing strengths and capacities of each setting.

The evidence is presented under the following headings:

- A. Strong Evidence for Falls Reduction
- B. Strong Evidence For Fall-Related Injury Reduction
- C. Strong Evidence for Risk Factor Reduction
- D. Promising Fall And Risk Factor Reduction Strategies
- E. Common Sense Strategies
- F. Cost Effectiveness of Falls and Fall Injury Reduction Strategies

A. Strong Evidence for Falls Reduction

This section includes the findings of randomized clinical trials where the primary focus was to investigate the impact of prevention strategies on the falls among LTC residents. Other outcomes, such as injury or risk factor reduction may also have been an outcome of interest.

A. STRONG EVIDENCE FOR FALLS REDUCTION			
Strategy	Target group & Intervention	Outcomes	Practical considerations
Multifactorial intervention (Ray, 1997) [4]	To evaluate interventions designed to prevent falls and injuries among high-risk (all had 1 fall in the last year) LTC residents. Using a RCT groups assigned to: 1) usual care or 2) multifactorial interventions- 'Falls Consultation Service', including a comprehensive structured individual assessment with specific safety recommendations targeting suboptimal practices for environmental and personal safety, wheelchair use, psychotropic drug use, and transferring and ambulation. Providers included physicians, therapists, nurses and falls coordinator.	<ul style="list-style-type: none"> • Decrease in the number of recurrent fallers by 19% (statistically significant) • Decreased the number of injurious falls by 31% (but not statistically significant) 	<ul style="list-style-type: none"> • Findings clearly point to the benefits of targeted, multifactorial interventions administered by a multidisciplinary team of providers. • Compliance with intervention varied and the effect was greatest when compliance with the interventions was strongest • This type of intervention seemed to be best targeted towards individuals with >3 falls in the last year

STRONG EVIDENCE FOR FALLS REDUCTION con't

Strategy	Target group & Intervention	Outcomes	Practical considerations
<p>Falls risk factor identification (Rubenstein, 1990) [5]</p>	<p>To determine if post-fall assessments followed by referrals for treatment and prevention of falls. RCT: ambulatory LTC residents (excluding those with severe dementia) randomized to 1) usual care, 2) falls risk factor identification with recommendations passed on to the individual's physician. Included assessment of: neurological and musculoskeletal function, visual acuity, pulse and blood pressure, footwear and foot problems, balance and gait, and environment. Post-fall assessment included: possible causes of fall, complete physical, eye exam, footwear, environmental hazards, and recommendations to residents' primary care physician.</p>	<ul style="list-style-type: none"> • After a two-year follow-up period there was no difference in the number of falls between those individuals in the usual care group and those in the risk factor ID group • After a two-year follow up, the risk factor ID group had 25% fewer hospitalizations and 52% decrease in hospital days 	<ul style="list-style-type: none"> • Falls may be a marker of underlying disorders • Fall risk factor assessments were done by a nurse practitioner (<1 hr to complete) • Good physician compliance but unsure of how well the patients complied with the recommendations (i.e. we know that the physicians made the recommendations but we are not sure if the patient followed through)
<p>Calcium + Vitamin D (Bischoff, 2003) [6]</p>	<ul style="list-style-type: none"> • Women (ave. age 85 yrs) • Long-stay geriatric care • RCT – individuals randomized to receive (1) 1200 mg Ca + 800IU vitamin D or (2) 1200 mg Ca daily for 12 weeks. 	<p>A 3 month intervention of calcium + vitamin D reduced the risk of falling by 49% compared to calcium alone.</p>	<ul style="list-style-type: none"> • Ca+vitamin D group had significantly improved vitamin D status and improved musculoskeletal function. • No significant side effects. • While promising, the sample size was small and this study should be repeated with a larger sample.

STRONG EVIDENCE FOR FALLS REDUCTION con't

Strategy	Target group & Intervention	Outcomes	Practical considerations
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<p>Multi-factorial fall prevention program for LTC residents with higher and lower levels of cognition (Jenson, 2003) [7].</p>	<p>RCT: 9 LTC facilities (362 participants (men and women). Facilities randomized to: 1) Control: receiving usual care, 181 residents Mini Mental State Exam (MMSE) >19 = 79 and MMSE <19 = 102 2) Intervention group: 181 residents, MMSE>19 = 112 and MMSE<19 = 69 Intervention: multi-factorial fall prevention program comprising staff education, environmental adjustment, exercise, drug review, aids, hip protectors and post fall problem-solving conferences.</p>	<p>The intervention reduced the number of residents falling (34% fell in intervention group vs. 54% control, $p=.02$) and falls in residents with higher level of cognition but not by those with a lower level of cognition. In addition, femoral neck fractures were significantly higher in the control group ($p=.006$).</p>	<p>All members of perm. staff <i>regardless of profession</i> participated. In addition, 8 PT were employed part-time (total of 200 hrs/week) to end of intervention period, and 3 PT employed part-time (total of 10 h/wk) during the follow-up period. 273 nurses' aides or LPN, 20 RN worked at the 9 facilities</p>
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B. Fall-related Injury Reduction

The majority of evidence for fall-related injury reduction is provided by studies of hip fracture reduction through the use of hip protectors and strategies for enhancing bone strength. Studies show that the mechanisms likely involved in bone loss in institutionalized older adults include lack of exercise, low dietary intakes of calcium and vitamin D, as well as lack of sun exposure. However, there is little research done to support the role of exercise, calcium D, and sun exposure in reducing fractures among residents of LTC facilities.

There are also notable gaps in the literature on strategies for reducing to reduce fractures other than for the hip and no studies that address prevention of the more common fall-related injuries that occur among LTC residents including skin tears, bruises, sprains and strains. Although minor injuries are usually less traumatic, for the very frail and medically compromised a cut or skin tear has a greater chance of infection. A bruise or sprain can cause pain and a fear of falling that leads to reduced activity with subsequent muscle weakness that puts the person at an increased risk of falling again.

B. STRONG EVIDENCE FOR FALL-RELATED INJURY REDUCTION			
Strategy	Target group & Intervention	Outcome	Practical considerations (for all studies on energy shunting)
Hip protector (energy shunting) (Lauritzen, 1993) [8]	<ul style="list-style-type: none"> • Men and women >69 years • Nursing home residents • 1/3 had mild to severe dementia • RCT- nursing home wards were randomized to receive 1) hip protectors or 2) no hip protectors 	<ul style="list-style-type: none"> • decrease in the number of hip fractures • no difference between the groups with respect to falls or non-hip fractures • hip fractures in the intervention group occurred only when the individual was NOT wearing the hip protector 	<p>There is strong evidence for hip fracture reduction with the use of the energy shunting designs made with hard shells worn over the hip in snugly fitting garments. However, there are some hip fractures reported among those wearing them at the time of their fall.</p> <p>Compliance is a problem, particularly at night and among those with dementia. Staff also report on issues of cleanliness due to incontinence, skin irritation and difficulties in dressing some residents in tight-fitting garments.</p>

STRONG EVIDENCE FOR FALL-RELATED INJURY REDUCTION con't

Strategy	Target group & Intervention	Outcomes	Practical considerations cont. (for all studies on energy shunting)
Hip protector (energy shunting) (Kannus, 2000) [9]	<ul style="list-style-type: none"> • Men and women (avg. age 82 yrs) • Nursing home residents • RCT- nursing home wards were randomized to receive 1) hip protectors or 2) no hip protectors 	<ul style="list-style-type: none"> • Fewer hip fractures in the hip protector group compared to no hip protector group • Trend towards fewer pelvic fractures in the hip protector group compared to no hip protector group • No difference in arm fractures between the two groups • Need to have 41 individuals wearing the hip protector for 1 year to prevent 1 hip fracture (or 5 individuals for 5 years) • Good compliance 	<p>High cost is also an issue. A study of hip protector cost effectiveness points to use among high-risk females 65+ and high risk males 85+ years as most beneficial . [10]</p> <p>One study found attitude, education and motivation of LTC staff key in achieving good compliance [11].</p>
Hip protector (energy shunting) Harada, 1999 [12]	<ul style="list-style-type: none"> • Women (avg. age 83 yrs) • High level LTC residents (i.e. frail) • Included all levels of dementia • RCT- women were randomized to 1) hip protectors or 2) no hip protectors 	<ul style="list-style-type: none"> • Significant decrease in the rate of hip fractures in the hip protector group compared to the no hip protector group • No difference between the groups in number of falls or in number of overall fractures 	

STRONG EVIDENCE FOR FALL-RELATED INJURY REDUCTION con't

<p>Hip protector (energy shunting) Villar, 1998 [13]</p>	<ul style="list-style-type: none"> • Women (>64 yrs) • LTC residents • RCT- women were randomized to 1) hip protectors or 2) no hip protectors (this study examined the compliance of wearing hip protectors) 	<ul style="list-style-type: none"> • 27% wore the hip protectors for the full 12-weeks • Largest drop-out (non-compliance) was in the 1st week. • Reasons for non-compliance included discomfort, poor fit, physical difficulty in putting the hip protectors on, changed mind and illness 	
<p>Hip protector (energy shunting-SafeHip) Cameron, 2001 [14]</p>	<ul style="list-style-type: none"> • Women (avg. age 85 yrs) • LTC residents • All had 2+ falls in the previous 3 months • Severe disability and cognitive impairment • RCT- women were randomized to receive 1) hip protector or 2) no hip protector 	<ul style="list-style-type: none"> • No difference in the number of hip fractures between the two groups • No hip fractures occurred in the hip protector group when the hip protector was on • SafeHip was not very comfortable for night wear for the thin, severely disabled and cognitively impaired women 	
<p>Hip protector (energy shunting- SafeHip) Van Schoor, 2003 [15]</p>	<ul style="list-style-type: none"> • Men and women (70+ yrs) • Low BMD • High risk for falls • LTC residents • RCT- individuals were randomized to receive 1) hip protectors or 2) no hip protector 	<ul style="list-style-type: none"> • No difference between the two groups in time to first hip fracture • 4 hip fractures in the hip protector group occurred while the individual was wearing the hip protector • poor compliance 	

STRONG EVIDENCE FOR FALL-RELATED INJURY REDUCTION con't

Strategy	Target group & Intervention	Outcomes	Practical considerations
Hip protector (energy absorbing) Chan 2000 [16]	<ul style="list-style-type: none"> • LTC residents • High risk for falls (based on staff perception) • RCT- individuals were randomized to receive 1) hip protector or 2) no hip protector 	<ul style="list-style-type: none"> • Fewer hip fractures in the hip protector group compared to no hip protector group • 50% compliance • Dementia was one reasons noted for non-compliance • Lack of perceived risk of falling/fracturing in the non-compliers 	<p>The evidence for the energy absorbing hip protectors is not as strong as that for the energy shunting, or hard shelled, design.</p> <p>Most consist of dense foam pads. The cost tends to less than for the hard shell designs and compliance may be higher due to the comfort of the pads versus the hard shells. Garments come in a variety of designs, including open gussets for those with incontinence.</p>
Vitamin D + Calcium (Chapuy, 1992) [17]	<ul style="list-style-type: none"> • Women (ave. age 84 yrs) • LTC and ambulatory • RCT- individuals randomized to receive 1) daily Vitamin D3 (800 IU) and Calcium (1.2 g-tricalcium phosphorus powder); or 2) placebo 	Women receiving vitamin D and Calcium had fewer hip fractures (43%) and fewer non-vertebral fracture (32%) over the 18 months	<ul style="list-style-type: none"> • No significant side effects • Inexpensive • Need to treat patients for 2 months to prevent non-vertebral fractures • Need to treat patients for 10 months to prevent hip fractures
Vitamin D (Heikinheimo et al., 1992)	<ul style="list-style-type: none"> • Men & women (ave. age 79 yrs) in LTC • RCT – individuals randomized to receive an annual injection of 150,000 to 300,000 IU of vitamin D or to serve as a control for 2 to 5 yrs. 	Fracture rate of vitamin D group (16.9%) was lower than controls (24.2%). The effect was most pronounced in bones of the upper limb and ribs (4.2% vs. 10.7%).	<ul style="list-style-type: none"> • Avoids difficulties of compliance
Bisphosphonate alendronate (Adachi 1998 – review article) [18]	Large study conducted with postmenopausal women of varying ages	Studies showed a 51% reduction in hip and wrist fractures	Study not conducted with LTC residents. Not known if bone enhancing effect is the same for older women as for younger women.

C. Strong Evidence for Risk Factor Reduction

The studies reported in the following section reflect the evidence for investigations where the reduction of risk factors for falling was the target outcome measure. Risk factors are those conditions or circumstances that are shown to be associated with being at high risk for sustaining a fall. This includes factors that are not amenable to change, such as age and sex, and factors that can be targeted for change, such as poor balance, muscle weakness, medication use, etc. It is the latter group of potentially changeable factors that are the focus of the studies reported below. However, knowledge of all risk factors can help in identifying those at greatest risk and for designing appropriate prevention strategies.

C. STRONG EVIDENCE FOR RISK FACTOR REDUCTION			
Strategy	Target group & Intervention	Outcome	Practical considerations
Exercise (Mulrow 1994) [19]	<ul style="list-style-type: none"> RCT conducted in 9 facilities with frail (dependent in 2+ ADL) LTC residents with disabilities due to multiple conditions. PT sessions 1:1, 3x per week, for 45 min. ROM, balance, strength, mobility over 4 months. 	<ul style="list-style-type: none"> Significant reduction in mobility aid use and 15% improvement in mobility scale compared to control group. There were no significant differences in falls or fall injuries between the intervention and control groups. 	<p>Program based on standard exercises used by PTs. Results point to the ability of frail seniors to benefit from an intense exercise program.</p> <p>Not all facilities have access to PT time, particularly for the frequency and duration used for this study.</p> <p>Not tested on those with dementia.</p>
Exercise training (Crilly 1989) [20]	<ul style="list-style-type: none"> RCT conducted with LTC residents assigned to one of two groups: 1) usual care, or 2) exercise Exercise: 3x per week, group exercise lead by PTs, exercises concentrated on balance, strength, flexibility and relaxation Progressive exercise- started with 15 min and progressed to 35 min. 	<ul style="list-style-type: none"> No change in postural sway between the groups Some improvement in gait speed Sway in these participants was not significantly different from the sway of normal elderly adults 	<ul style="list-style-type: none"> PT lead interventions are expensive Targeted intervention necessary (e.g. target those with postural sway problems)

STRONG EVIDENCE FOR RISK FACTOR REDUCTION cont.

Strategy	Target group & Intervention	Outcomes	Practical considerations
<p>Exercise training and nutritional supplement (Fiatarone 1994) [21]</p>	<p>RCT with frail LTC residents assigned to one of 4 groups: 1) control, 2) strength training, 3) nutritional supplement, or 4) combined strength training / supplement</p> <ul style="list-style-type: none"> • Exercise group received progressive 45 min. of resistance training 3 days/wk. for 10 weeks. Nutritional groups given a multinutrient supplement daily (Exceed: 360 kcal). • Control group given placebo supplement and 3 recreational activities of choice per week. • Exercise conducted 1:1 with single exercise trainer <p>Exercises concentrated on the lower limb, hip/ knee extensors</p>	<ul style="list-style-type: none"> • Exercise groups showed a statistically significant improvement in muscle strength, improved gait velocity, stair climb ability and overall level of physical activity. • Combined supplement and exercise group showed statistically significant gain in body weight but no differences were seen in the primary outcome measures for the supplement only group. 	<p>High resistance training is shown to be effective in counteracting muscle weakness and physical frailty among LTC residents. However, multinutrient supplements without exercise are not shown to be effective.</p> <p>Equipment used in this study is expensive, perhaps could be modified to use more inexpensive equipment (e.g. TheraBands)</p>
<p>Exercise training and falls risk identification (Sherrington 1997) [22]</p>	<ul style="list-style-type: none"> • Individuals with previous hip fracture • 60+ yrs • RCT- individuals randomized to receive 1) exercise or 2) usual care • Exercise program: home based, stepping exercises using telephone books as a platform, 1x/day for 1 month 	<ul style="list-style-type: none"> • Improved quad strength, increased gait speed, decreased considered risk of falling and increased weight bearing abilities in the exercise group compared to the usual care group 	<p>Inexpensive, however only tested in those with previous hip fracture and in the home environment (community dwelling).</p> <p>However, the inexpensive nature of the equipment and the frequency of the intervention may make this strategy worth considering in the LTC environment.</p>

STRONG EVIDENCE FOR RISK FACTOR REDUCTION con't

Strategy	Target group & Intervention	Outcomes	Practical considerations
<p>Strength training and aerobic training (Sauvage 1992) [23]</p>	<ul style="list-style-type: none"> • RCT conducted with LTC males (60+ yrs) assigned to one of two groups: 1) usual care and falls risk factor identification, or 2) falls risk factor identification and strength training and aerobic training. • Conducted by physical therapist. • Exercise: 3x/week for 12 weeks, 20 min on stationary bicycles, and weight machines (hip flexors and extensors, hip adductors and abductors, knee extensors and ankle plantar flexors) (total time ~ 45-75 min) • RCT limited to LTC residents able to walk without assistive device who had gait and balance difficulties. 	<p>Significant improvements in scores for mobility, muscle strength, and stride length, gait and velocity compared to control group.</p>	<p>Findings show an improvement in strength and balance following a 12-week exercise program. However, this study had a small sample size and restrictions on inclusion criteria limits application of findings to residents who do not use assistive devices.</p>

D. Promising Fall and Risk Factor Reduction Strategies

The following strategies include those based on reviews of other studies or from studies with evidence that is less strong than for large randomized controlled trials. Limitations of these studies could include any of the following: small sample sizes, weaker research designs, lack of control for potential confounding factors or outcome measures that did not include falls or key risk factors in LTC settings.

D. PROMISING FALL AND RISK FACTOR REDUCTION STRATEGIES			
Strategy	Target group & Intervention	Outcome	Practical considerations
Seated exercise (McMurdo 1993) [24]	RCT conducted with LTC residents assigned to one of two groups: <ul style="list-style-type: none"> • reminiscence sessions, and • twice weekly seated exercise to music over 7 months to improve balance, flexibility, strength and functional capacity. 	Significant improvements in grip strength, spinal flexibility, chair to stand time, ADL score and depression score compared to control group.	Findings are encouraging for such a low intensity exercise program. However, a number of study weaknesses make the findings questionable. For example the sample was small and inclusion criteria were not reported. Therefore, don't know if this strategy is effective for the general population in LTC or only for a subgroup. Also, don't know if factors other than the exercise program influenced the results. If used, this strategy should be carefully evaluated for effect.

PROMISING FALL AND RISK FACTOR REDUCTION STRATEGIES con't

Strategy	Target group & Intervention	Outcome	Practical considerations
<p>Restraint reduction (Tinetti, 1992) [25]</p>	<ul style="list-style-type: none"> • 397 persons who were mobile and unrestrained at baseline in 12 nursing facilities were tracked over one year for the effects of restraint use on falls and fall injuries. • 122 (31%) became restrained, 83 intermittently and 39 continually • A mechanical restraint was defined as: “any mechanical device, material or equipment attached or adjacent to the individual’s body that the person cannot remove easily and is used to inhibit free, independent movement. These devices include vest and chest jackets or harnesses, waist belts and sheets, let ties, full-length bed side rails, wheelchair safety bars, and geri-chairs with fixed tray tables (Tideiksaar, 2002, p. 127) [3]. 	<ul style="list-style-type: none"> • A serious fall-related injury was experienced by 5% (15 of 275) of unrestrained, compared with 17% (21 of 122) of restrained, for a statistically significant difference. • Restraint use was independently associated with serious injury after adjusting for other factors. • The authors concluded that mechanical restraints were associated with continued, and perhaps increased, occurrence of serious fall-related injuries after controlling for other injury risk factors. • Study results suggest the need to consider whether restraints provide adequate, if any, protection. 	<p>Consequences of inappropriate restraint use include physical and psychological deconditioning that reduce muscle strength through lack of use, reduce circulation to limbs and promote agitated behaviour. Restraint use may also contribute to a sense of abandonment and loss of positive self-image, leading to depression. All of these effects are known to contribute to a risk for falling.</p> <p>Most facilities in B.C. have already put least restraint use policies in place. However, the practice still exists, due in part to a lack of a standard definition of restraints.</p> <p>Chemical restraints include the misuse of psychoactive medications, e.g., when used without specific indications, prescribed in excessive dosages, used without investigation of alternative behavioural interventions or administered for the purposes of discipline or convenience of the staff (p.124) [3]. For more information on least restraint use, policies and guidelines see: http://www.rnplus.com/newsletter</p>

PROMISING FALL AND RISK FACTOR REDUCTION STRATEGIES con't

Strategy	Target group & Intervention	Outcome	Practical considerations
<p>Bed alarms (Tideiksaar, 1993) (Morton, 1989) [26, 27]</p>	<p>Study examined the effectiveness of a bed alarm for reducing falls among geriatric patients identified as having mobility problems getting in and out of bed.</p>	<ul style="list-style-type: none"> • Fewer falls occurred, both from bed and during ambulation or transferring from a chair or toilet, among patients who received the bed alarm system compared to patients who did not receive the bed-alarm system. • However, despite trends indicating that the bed alarms were effective in reducing falls, the small number of falls in both the experimental and control conditions precluded any meaningful conclusions. 	<p>Support for bed alarm use among LTC staff is mixed. Anecdotal problems noted include, false alarms, noise from alarms disturbing other residents and over dependence on alarms to detect problems rather than taking proactive approaches, such as scheduled toileting.</p> <p>Those in favor of bed alarm use point to the benefits for high-risk fallers, who can be monitored for getting out of bed at night when they don't call for assistance.</p> <p>Newer models now claim to have fewer false alarms and more user-friendly designs, such as features to deter tampering by residents with dementia.</p>

PROMISING FALL AND RISK FACTOR REDUCTION STRATEGIES cont.

Strategy	Target group & Intervention	Outcome	Practical considerations
<p>Identifying residents at high risk for falling (Tinetti, 1986; Butler, unpublished) [28, 29]</p>	<p>This study was designed to identify individual chronic characteristics associated with falling among elderly persons and to test the hypothesis that risk of falling increases as the number of chronic disabilities increases. 79 consecutive admissions to 3 intermediate care facilities were evaluated.</p>	<ul style="list-style-type: none"> • 25 subjects became recurrent fallers. The nine risk factors included in the fall risk index were mobility score, morale score, mental status score, distant vision, hearing, postural blood pressure, results of back examination, post-admission medications, and admission activities of daily living score. A subject's fall risk score was the number of index factors present. The proportions of recurrent fallers increased from 0% (0 of 30) in those with 0 to three risk factors, to 31% (11 of 35) in those with four to six factors, to 100% (14 of 14) in those with seven or more factors. See the Tinetti Fall Risk Index. • Another recent, unpublished study found the following 4 risk factors to be highly predictive of falling in LTC settings: age \geq 80 years, previous falls, mental impairments and frequent toileting increased the risk of falling from 57% to 66% (Butler, unpublished). 	<p>Although risk assessment profiles are generally tailored to the needs and population of each institution, they often target similar risk factors such as age, mobility, cognitive status, mental status and medications being taken. Based on the number and types of risk factors, a score is derived for each person denoting the level of risk for falling.</p> <p>There are a number of validated tools for assessing risk and for taking baseline measures – many of these are listed on the BCIRPU web site under Tool Repository at: www.injuryresearch.bc.ca</p> <p>Other studies point to different risk factors for identifying high risk fallers – see the attached Table (Butler, unpublished) outlining risk factors identified in the medical literature compared to the nursing literature. However, the findings in this table are not limited to LTC settings, pointing to the need for further research.</p>

PROMISING FALL AND RISK FACTOR REDUCTION STRATEGIES cont.

Strategy	Target group & Intervention	Outcome	Practical considerations
<p>Medical assessments (Rubinstein, 2001) [30]</p>	<p>Quality indicators for medical fall risk assessment are described in a recent paper, reflecting an extensive review of the literature in this area and groups medical assessments into three broad categories:</p> <ul style="list-style-type: none"> • <i>detection</i> of the problem(s) • <i>diagnosis or evaluation</i> of the problem(s), and • <i>treatment</i>, with an aim toward preventing recurrence. <p>However, this review was primarily focused on community care, and not on institutionalized elderly.</p>	<ul style="list-style-type: none"> • Through this review it was determined that if no injury has occurred, patients and providers alike often ignore falls, thus missing important opportunities for potentially life-saving evaluation and treatment. • A cornerstone of most fall-prevention programs is identifying risk factors, one of the strongest of which is previous falling. 	<p>Inquiring regularly about recent falls can help detect this risk factor and lead to appropriate intervention.</p> <p>Facility staff might want to consider passing on the clinical guidelines for medical fall risk assessments to the residents' physicians. For guideline on quality indicators for geriatric medical assessment of fall risk, see the AGS/BGS Guidelines for Prevention of Falls in Older People [31]. Also, see attached algorithm of clinical decision making for falls assessment by Rubinstein et al.</p>

PROMISING FALL AND RISK FACTOR REDUCTION STRATEGIES cont.

Strategy	Target group & Intervention	Outcome	Practical considerations
<p>Reducing fear of falling (Tennstedt, 1998) [32]</p>	<p>An RCT conducted with community-based seniors living in seniors' housing who reported a fear of falling and associated activity restriction.</p> <p>The intervention consisted of 8 two-hour sessions over 4 weeks including education, group discussion, mutual problem solving, role playing, exercise training, assertiveness training, home assignments and behavioural contracting. Focus was given to changing attitudes and self-efficacy prior to attempting behaviour change.</p>	<ul style="list-style-type: none"> • Compared with contact control group, intervention group reported significantly increased levels of intended activity and greater mobility control immediately after the intervention. • Effects at 12 months included improved social function and mobility range. The intervention had immediate but modest beneficial effects that diminished over time in the setting with no booster intervention. 	<p>No studies found on reducing fear of falling in LTC settings. However, these results are encouraging and aspects of the intervention could be transferred to LTC settings.</p> <p>Another aspect of fear of falling is helping residents to know what to do after they fall. Some residents are so worried about this that they are reluctant to take part in normal activities. Issues include how to call for help after a fall when unable to get up, how to get up after falling, how to know when not to try and get up, and how and when to move someone who has fallen.</p> <p>Physical therapists are a good resource for teaching on how to fall and how to get up. Personal alarms that are common in the community might be considered in LTC for persons to use to let staff know they cannot get up when they cannot reach a call bell.</p>

E. Common Sense Strategies

Common sense strategies include practical solutions that have not yet been tested using rigorous research methods or have only been tested as part of a package of multiple strategies and not yet shown to be independently effective in reducing falls or fall risk factors. However, many of these strategies are in common usage in institutional settings and are supported in the non-scientific literature, such as in books on falls prevention by Tideiksaar (2002) [3] and Lord et al (2001) [33]. Given the high costs of research and the challenges of isolating the effects of individual strategies, it is not always practical to wait for the definitive evidence before putting common sense approaches into action. However, it is recommended when using such strategies to apply strict evaluation procedures to determine the benefits, or lack of benefit, within each setting. By sharing such evaluation results the evidence for the advantages or disadvantages of these strategies will mount, giving more credibility to their recommended use.

E. COMMON SENSE STRATEGIES		
Strategy	Target group & Intervention	Practical considerations
General physical activity (Tideiksaar, 2002) [3]	<p>In addition to the research results listed above, there are a number of strategies to promote physical activities that have not been tested. These include:</p> <ul style="list-style-type: none"> • daily floor ambulation • walking groups • wheelchair walking programs, and • general mobility programs. 	<p>Daily floor ambulation: for ambulatory residents, encouraged to walk up to 3 times daily for 30 to 45 minutes in total, or as tolerated. Ambulatory aids to be used where necessary, but wheelchair use is discouraged.</p> <p>Walking groups: also for ambulatory residents. Can be done in groups or individually. Best with individually set goals, e.g., certain number of laps of the corridor. Walkers can be encouraged by rewards for achieving each goal.</p> <p>Wheelchair walking: non-ambulatory residents encouraged to move their wheelchairs along with their legs. Remove footrests (this makes it easier to use propel with the legs and discourages their use).</p> <p>Mobility program: generally encouraging all residents to weight-bare or ambulate to their ability, e.g., all those who are able to stand at least 3 times a day. A gait belt (broad belt with handles worn by the resident) may be of help for those who are high-risk fallers. All those who can ambulate to walk when ever possible. Teach caregivers and visitors how to help with active and passive (range of motion) exercises.</p>

COMMON SENSE STRATEGIES con't

Strategy	Target group & Intervention	Practical considerations
<p>Appropriate footwear [3, 33]</p>	<p>There is little evidence to support the use of one type of footwear over another in LTC settings to reduce falls. However, it is commonly accepted that loose fitting footwear and footwear that slides easily is more hazardous than snugly fitting footwear with treads that have good traction.</p>	<p>Shoes: residents should be encouraged to wear properly fitting shoes rather than loose-fitting slippers or socks. The best shoe designs are those that are easy to get on and off, are snug-fitting without being too tight, have low heels, have soles that are so thick that the wearer is unable to 'feel' the surface while walking, and have soles that are slip-resistant. However, soles with too much traction may be inappropriate for those who walk with a shuffle, particularly in settings where flooring changes from linoleum to carpet. In these cases, smooth, leather soles may be best.</p> <p>Therapeutic footwear: may be necessary for those with foot problems such as hammertoes, bunions or calluses. A referral to a podiatrist may be necessary.</p> <p>Non-skid socks: snugly fitting sock with rubberized treads are particularly good for residents who get up frequently in the night.</p>
<p>Environmental modifications [3, 33, 34]</p>	<p>Although few studies demonstrate the unique contribution of environmental modifications in reducing fall risk in LTC settings, environmental factors are seen as important components to the success of many multifactorial interventions.</p>	<p>Strategies can be applied to environmental hazards that contribute to a fall by an individual resident such as lack of a grab bar in a bathroom, no hand rail on a staircase or a slippery floor. Another approach is to conduct an environmental inventory of the entire facility using a safety checklist. There are two possible approaches:</p> <ul style="list-style-type: none"> • Conduct a facility-wide safety audit to record items that need correction such as furnishings, illumination, flooring, grab bars, handrails, rest areas, etc. (see http://www.victoriafallsproject.com/resources). <p>Conduct a dynamic risk assessment to determine the safety of the resident as they interact within their environment – such as the “Performance-Oriented Environmental Mobility Screen” (POEMS), which includes thorough assessment guidelines for general fall risk as well as potential environmental contributors [3].</p>

COMMON SENSE STRATEGIES con't

Strategy	Target group & Intervention	Practical considerations
<p>Ambulation devices [3, 35]</p>	<p>The use of canes, walkers and wheelchairs are obvious requirements for those with mobility problems but there is little evidence to support use in preventing falls. Furthermore, some evidence may point to an increased risk with the misuse of such devices. It is therefore recommended that such aids to mobility be prescribed by appropriate health professionals to meet the individual needs of each resident and that these needs be reassessed on a regular bases and with any changes in mobility status.</p>	<p>Canes: come in a number of styles, including standard canes, ortho canes with off-set shafts and molded handles for more support, and quad canes with four legs for greater stability. Not all styles are appropriate for all residents and in some cases the wrong style can create a fall hazard. An example is the use of a quad cane by someone with dementia as these canes can be very unstable if the handle is not held in the right direction. People with low vision my also trip over the protruding legs of a quad cane [3]. All canes must be properly fitted for height and appropriate grip. Those with rubber tips on the end can reduce slipping and devices can be attached to the cane so that it will rest on a counter when not in use. This avoids the problem of having to reach for a cane that falls to the floor.</p> <p>Walkers: also come in a number of styles, including those with no wheel, two or four wheels. All are designed for those who cannot stand or walk without support. Those without wheels require more upper strength than the wheeled varieties. However, those with wheels are less easily controlled if the user looses their balance. Height and weight are also a consideration. Some wheeled walkers come with weight activated brakes, which help to avoid falls.</p> <p>Wheelchairs: should only be used by those who are unable to ambulate as inappropriate use will enhance muscle loss and decrease bone strength, thereby promoting falls and injuries. For those who require wheelchairs but are able to weigh bare, this should be encouraged as often as possible. Wheelchairs should be fitted for individual needs and body sizes by a physical or occupational therapist. See “Wheelchair problems and modifications checklist” by Tideiksaar (2002) [3] for suggestions on avoiding falls from wheelchairs.</p>

COMMON SENSE STRATEGIES cont.

Strategy	Target group & Intervention	Practical considerations
<p>Education [36]</p>	<p>This strategy has not been demonstrated to be effective when used alone. However, it is a key component of a successful, integrated, collaborative and multifaceted approach. Target groups who would benefit from falls prevention education include all of those who work, live in or visit long-term care settings.</p> <p>The first step in education on falls prevention is to increase awareness of magnitude of the problem and the risks associated with falls and fall-related injuries. This is followed by the selection and prioritizing of appropriate prevention strategies. It is recommended that all educational strategies be seen as part of a larger collaborative process that involves all those affected by the issue and all those with the ability to reduce the risk factors. This should include family members, visitors, cleaning, maintenance staff and food service staff.</p>	<p>Education is a continuous process throughout the cycle of risk identification, prevention planning, program implementation and evaluation. Educational resources attached here include overheads on the nature and magnitude of the problem of falls, summary data from surveillance data collected in your facility, this review of the literature, and other educational materials, such as books and checklists.</p> <p>Educational theorists tell us to consider who gives the message – with the most effective teachers often being peers of the learners. For residents, this would include other residents or seniors from the community, for health professionals or support staff, other health professionals or support staff. Physical and occupational therapists are well trained in safety and mobility for older adults and are valuable resources for conducting ‘train-the-trainer’ sessions to prepare peer trainers for effective presentation of appropriate materials. Educational literature also emphasizes that the message must be delivered clearly, simply and many times before it is accepted – usually over 20 times is considered necessary.</p> <p>Another important aspect of education is timing. Learning opportunities are often a combination of a readiness to learn and confidence that the change can be accomplished. Another way of looking at readiness is to consider the importance of ‘learning opportunities’, such as immediately following a fall incident. Confidence to change is tied to an individual’s ability to visualize a new way of doing things and seeing that the benefits outweigh potential disadvantages. It would seem obvious that there are clear benefits to avoiding a fall injury. However, many older adults do not ever think that it will happen to them. Successful learning is often associated with a focus on the positive aspects of independence and quality of life rather than on the potential negative aspects such as possible permanent disabilities, pain, suffering or death, that can result from a fall.</p>

COMMON SENSE STRATEGIES cont.

Strategy	Target group & Intervention	Practical considerations
Falls surveillance system [5, 37]	Facility-wide surveillance systems for reporting resident falls, fall-related injuries and circumstances surrounding the incident are not yet show to be effective in reducing falls prevention program.	Comprehensive surveillance tools, such as the one developed by Scott, Kozak, Gallagher & Johnson (2002) [37] are relatively new and as yet unproven. However, such tools are an integral component of an integrated falls. With such tools, falls can be monitored over time, compared to other facilities, and contributing factors can be isolated for individual fallers as well as for the facility as a whole. They provide key information for designing and implementing prevention strategies as well as for monitoring outcomes.
Electronic surveillance systems [26, 33]	These are relatively new systems that have not yet been thoroughly tested for their effectiveness in reducing falls. However, their use is increasing in many facilities and staff who work in those facilities report many benefits when the systems operate as intended.	<p>Electronic surveillance systems are particularly helpful in monitoring high-risk individuals. These systems can consist of video cameras, position sensors on beds or chairs or sensors attached to a resident's leg [33]. They are designed to alert staff to movement by the residents and can be set to only send an alert when the activity is abnormal or potentially dangerous. For example the system can be set to alert the staff to the type of movement in the bed typical for that person prior to their getting out of bed so that the staff can be there to help them get out of bed and go to the bathroom.</p> <p>Disadvantages of these systems include high cost of installation and maintenance, system errors and faults and the need for staff education and acceptance to the change.</p>

F. Cost Effectiveness of Falls and Fall Injury Reduction Strategies

Cost effectiveness of falls prevention program is determined by a complex array of factors, including duration, intensity, nature of the target population and the availability of existing resources and expertise. Most reviews that address cost effectiveness show agreement on cost benefits when the intervention is targeted to high-risk fallers (RAND, 2003; Segui-Gomez, 2002). However, few studies conducted in LTC facilities report on the costs associated with implementation of the fall reduction strategies or the costs saved as a result of these interventions. The exceptions are two studies that reported costs and potential savings through risk assessment and tailored prevention plans, using Calcium and Vitamin D, exercise training and absorbent flooring.

F. COST EFFECTIVENESS			
Strategy	Target group & Intervention	Outcomes	Practical considerations
Fall risk assessment & tailored intervention plan. (Rubinstein, 1990) [5]	Within 7 days of a fall ambulatory LTC residents were assessed by nurse practitioner for fall risk, followed by recommendations for prevention of future falls	<ul style="list-style-type: none"> Less than \$300 (U.S.) spent for each 1 hour standardized assessment and development of prevention recommendations. At the end of 2 years, the intervention group also had 9% fewer falls (NS) and 17% fewer deaths (NS). Intervention group also had 26% fewer hospitalizations and 52% reduction in hospital days, estimated to equal \$800 (U.S.) savings per LTC faller. 	There were no significant reductions in falls or fall injuries in this study. Actual costs of implemented prevention strategies not reported. However, findings point to considerable savings due to an increase in overall health associated with thorough fall risk assessments and tailored fall-prevention plans designed by a nurse practitioner.
Calcium + Vitamin D (Lilliu, 2003)[39]	Assessed the cost-effectiveness of calcium (1.2 g) and vitamin D (800 IU) in elderly, institutionalized European women.	Supplementation to prevent hip fractures resulted in a net benefit of 79,000 – 711,000 pounds per 1000 women.	Considerable cost savings and proven effectiveness in fall injury reduction point to this strategy as cost effective for the LTC population.

COST EFFECTIVENESS OF FALLS AND FALL INJURY REDUCTION STRATEGIES cont.

Strategy	Target group & Intervention	Outcomes	Practical considerations
Exercise training with physical therapist (Mulrow, 1994) [19]	Individually tailored exercises conducted by physical therapist for LTC residents dependent in at least two ADL	<ul style="list-style-type: none"> • Cost of 4 months physiotherapy \$1,220 (U.S. 1993 dollars) per resident compared to \$189 for friendly visits for control group residents. • Physiotherapy group showed a reduction in assistive device use but no significant differences found between groups for falls, ADL or overall Physical Disability index 	Not shown to be cost effective due to the high cost of using physical therapists for tailored exercises done with frail, institutionalized elderly. Other interventions, designed by PTs but delivered by exercise aids, may prove to be more cost effective. More studies are needed to determine the most effective exercises for this population.
Energy-absorbing flooring (Zacker & Shea, 1998) [38]	Simulated study of a typical 200-bed LTC facility tracked over 40 years	<ul style="list-style-type: none"> • Estimated that hip fractures would be reduced from 2% to 1% with safety floor, resulting in approximately 6.86 fewer hip fractures and 15.44 life-years saved over 40 years. • Direct medical costs saved = \$123,545 and total direct and indirect savings estimated at \$1.2 million after subtracting flooring cost of \$75,391 (1995 U.S. dollars). 	Flooring needs to be tested in an actual LTC facility with attention to durability and appropriateness for use in institutional conditions. Canadian costs and availability of safety flooring not known.

Summary

An overall consensus among a number of literature reviews on falls prevention is that multifactorial falls prevention strategies are most effective in demonstrating a reduction in the number of fallers and the frequency of falling. And that these approaches are implemented as part of an overall, comprehensive falls prevention program. According to the RAND report on falls prevention among the U.S. Medicare population, the strongest trend for success focuses on fall risk assessment followed by tailored interventions, which depending upon identified risk factors, can range from single interventions to a multifactorial approach [40]. Strong effect from isolated single strategies is seen from exercise interventions. Environmental modifications are seen as an important component with other interventions. There is little evidence for educational strategies when given in isolation of other interventions. However, education is seen as an important component of other strategies. There is little evidence to support the isolated effects of assistive devices, medication reviews or staff and organizational changes. However, more research is needed on the comparison of single item interventions, and their effect on different sub-populations of seniors, before conclusions can be drawn about these strategies.

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