Section D. Safety Practices Aimed Primarily at Hospitalized Elders

Chapter 19. Preventing In-Facility Falls

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How Important Is the Problem?

The rate of falls in acute-care hospitals is estimated to range from 1.3 to 8.9 per 1,000 bed-days,[1] which translates into well over 1000 falls per year in a large facility. Higher rates are reported in particular sites or wards, such as those specializing in neurology, geriatrics, and rehabilitation. Because falls are believed to be underreported, most estimates are assumed to be overly conservative.[1] However defining what is a "fall" is itself a challenge, as there is variability in the research literature and among older adults about what constitutes a fall.[2,3] Authoritative bodies have definitions (e.g., the NQF defines a fall as "an unplanned descent to the floor without injury"[4] and WHO defines a fall as "an event which results in a person coming to rest inadvertently on the ground or floor or some lower level"[5])but even after accepting a conceptual definition of a fall, there is a difference between any fall, a fall with injury, the proportion of a population who has a fall, and the number of falls. Nevertheless, there is widespread agreement that falls, however defined, occur frequently and can have serious physical and psychological consequences. Between 30 percent and 50 percent of in-facility falls are associated with reports of injuries. Hip fractures occur in 1 percent to 2 percent of falls. Inpatient falls are also associated with increased health care utilization, including increased length of stay and higher rates of discharge from hospitals into institutional or long-term care facilities. In one recent analysis in three hospitals in Missouri, operational costs for patients who have fallen with serious injuries were $13,000 higher than for control patients without falls, and patients who have fallen had an additional 6.3 days' length of stay.[6] Even falls that do not cause severe injuries can trigger a fear of falling, anxiety, distress, depression, and reduced physical activity. Family members, caregivers, and health care professionals are also susceptible to overly protective or emotional reactions to falls, which can also impact the patient's independence and rehabilitation.

What is the Patient Safety Practice?

Most in-facility fall prevention programs are multicomponent interventions. Unfortunately, the individual components vary across each published evaluation, with the same combination of components never being evaluated in more than one application. Therefore, in terms of identifying and reviewing the evidence for fall prevention interventions, the best that can be done is to describe the components most commonly included in interventions that have been evaluated. The Prevention of Falls Network Europe (ProFaNE) proposed a detailed classification of fall risk assessment components (see Appendix C for the complete list),[7] which map closely to the descriptions provided in this chapter. According to a review by Oliver and colleagues, the following were the most common components of successful interventions:

- Post fall review: to assess potential reasons for a specific instance of a fall and to remediate possible contributing factors
- Patient education
- Staff education
- Footwear advice
- Scheduled and supervised toileting
- Medication review: to assess for use of medication(s) that can affect mental alertness and balance (see ProFANE taxonomy for further details, Appendix C).

The most recent Cochrane review notes a "striking variability in type, targeting, intensity, and duration" within the fall prevention programs and does not attempt to draw conclusions about which components might be most effective.[8] Table 1 lists all the studies in the reviews by Cochrane and by Oliver, as well as new studies from our update search, and the components included in the intervention.

All multicomponent interventions also included an assessment of falls risk. In about 60 percent of studies this was a formal falls risk assessment tool such as the Morse Fall Scale or STRATIFY, and the remainder used informal or idiosyncratic or unstated methods for assessing patients at increased risk of falls.

Other single intervention components include use or removal of bedrails, use of physical restraints, movement alarm devices, low-low beds (beds closer to the floor), exercise or additional physical therapy, increased observation or assistance, calcium or vitamin D, hip protectors, and prevention of delirium (this last topic is covered in Chapter 20). Since most reviews conclude that multi-component interventions are more effective than single components, in this chapter we will consider only multi-component interventions. Multicomponent interventions are also referred to in the literature as multifaceted or multifactorial interventions. Although some authors draw distinctions between these labels, we will not do so here, and refer to all of them as multicomponent.

Table 1, Chapter 19. Components of multi-factorial falls prevention trials in hospitals, 1999 to 2009[a]

References	Environment Modified	Alert Wristband	Bedside Risk Sign	Hip Protectors	Staff Education	Patient Education	Bedrail Review	Vest/Belt/Cuff Restraint	Footwear	Toileting Schedules	Exercise	Movement Alarms	Medication Review	Urine Screening	Postfall Review	Other Interventions[b]
Ang et al, 2011 [9]*	√	√	√		√	√				√			√			*Low beds; interventions specific to each risk factor in model used.* Used Hendrich II Falls Risk Model
Barker et al, 2009[10]			√							√		√				Low beds; Introduction of a computerized falls reporting and analysis system[c] Used STRATIFY falls risk assessment tool
Barry et al, 2001[11]	√			√	√								?		√	"Risk Factors assessed"
Brandis, 1999[12]	√	√	√	√												Falls history and continence assessment added to standard admission documentation / Unstated method of risk assessment
Cumming et al, 2008[13]					√	√	√				√	√				Modification of tool developed the Centre for Education and Research on Ageing in Sydney, Australia
Dykes et al, 2010[14]*			√			√										*Tailored plan of care; computerized Fall Prevention Tool Kit (FPTK)* Used Morse Fall Scale
Fonda et al, 2006[15]	√	√						↓	√	√		√	?		√	Low beds, volunteer observers Used Falls Risk Assessment Scoring System
Grenier-Sennelier et al, 2002[16]						√		√	√				√		√	Improved assessment of mobility and self-efficacy Unspecified method for assessing risk
Haines et al, 2004[17]				22%		√					√					Used the Peter James Centre falls risk assessment tool
Healey et al, 2004[18]						√	√		√	√			√	√	√	Vision testing, lying and standing blood pressure Brief falls risk factor screen
Koh et al, 2009[19]		√	√		√											"Stand by me" notices to prompt staff to wait outside toilets ready to assist. Mobility level signs at bedside Unstated method of risk assessment
Krauss et al, 2008[20]		√	√		√	√						√	(√)			Used Morse Falls Scale
Oliver et al, 2002[21]													?			Nursing and medical checklist for remediable risk factors, content not described and compliance poor Used STRATIFY falls risk assessment tool
Schwendimann et al, 2006[22]			√	√		√	↓			√	√		√		√	"Briefly screened for falls risk" using 3 items
Stenvall et al, 2007[23]					√									√	√	Additional therapy and nurse staffing Routine dietary protein supplementation Protocol driven delirium screening No clear risk assessment instrument, but population can be assumed to all be at elevated risk
Uden et al, 1999[24]						√	↑		√			√				Career education A new formal risk assessment instrument created for the study
Van der Helm et al, 2006[25]	(√)					↑	↑									Identification of high risk patients on the basis of a recent fall or 4 other criteria

Table 1, Chapter 19. Components of multi-factorial falls prevention trials in hospitals, 1999 to 2009[a] (continued)

References	Environment Modified	Alert Wristband	Bedside Risk Sign	Hip Protectors	Staff Education	Patient Education	Bedrail Review	Vest/Belt/Cuff Restraint	Footwear	Toileting Schedules	Exercise	Movement Alarms	Medication Review	Urine Screening	Postfall Review	Other Interventions[b]
Vassallo et al, 2004[26]		√				√	√		√				√			Medical Review/Used Downton fall risk assessment
Von Renteln-Kruse and Krause, 2007[27]			√	0.5%	√	√			√	√						Bedside commodes Used STRATIFY falls risk assessment tool

Table adapted from Oliver [1]

* New studies added from update search

"yes" = component included within the intervention; (yes) = component planned but not implemented; ? = component implied but not explicit; ↓ = intervention discouraged use of this component; ↑ = intervention encouraged use of this component.

[a] (yes) indicates intervention in design but not applied in practice (e.g., environmental hazards identified but not addressed). ? indicates that the article implies, but does not specify, that an intervention was included. For bedrails and body restraints, ↓ indicates the intervention was to discourage their use, ↑ indicates the intervention aimed to encourage their use, while "yes" indicates either direction not described or a neutral risk versus benefit review was required.

[b] Where interventions are described that would be considered very standard practice for control as well as intervention (e.g., call bell left in reach, walking aids provided as appropriate), these are not listed.

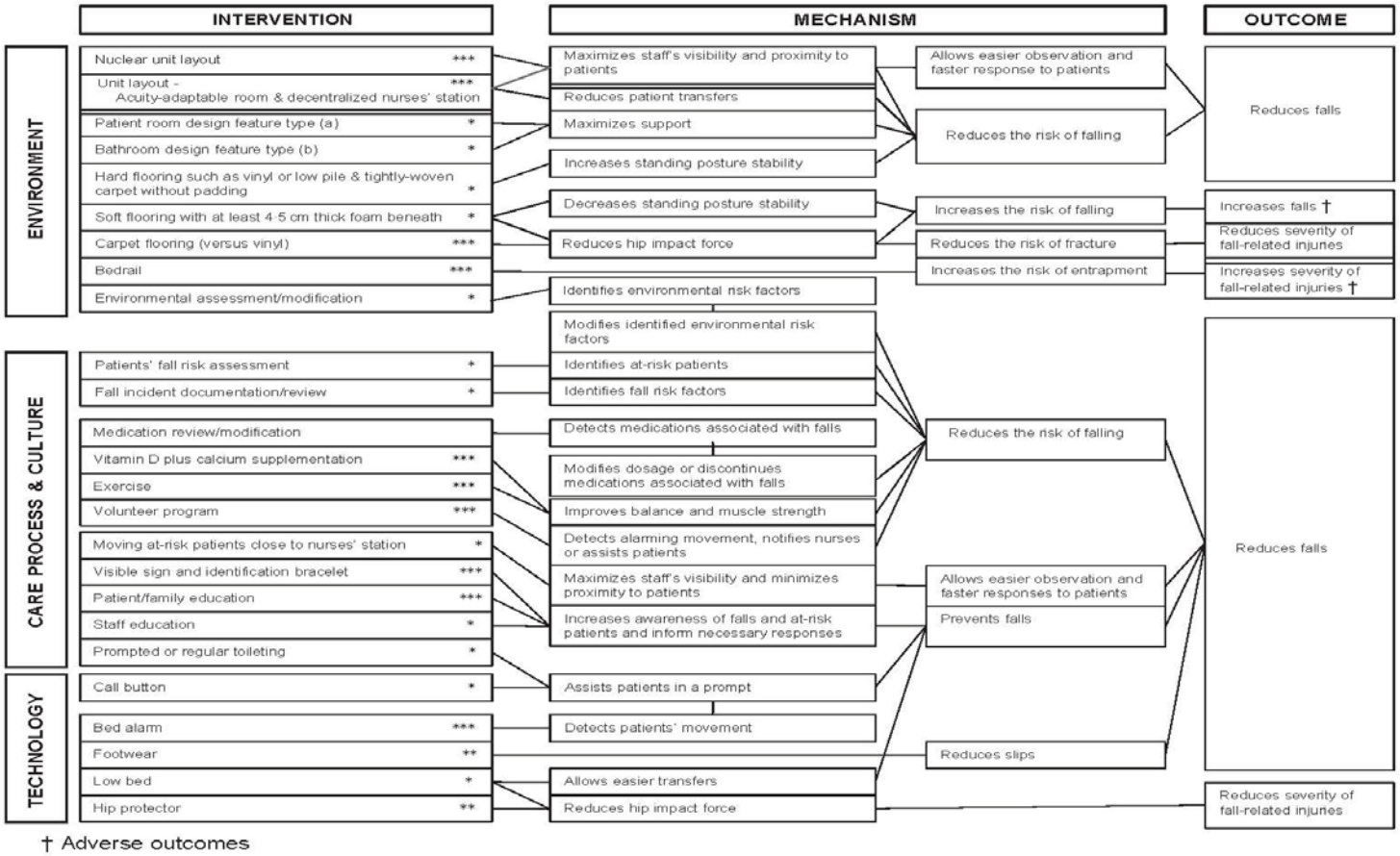
[c] This potentially confounded the findings as this changed the method of collecting outcome data on falls at the same time as the intervention was introduced.

Why Should This Patient Safety Practice Work?

None of the controlled trials of fall prevention programs explicitly articulate the conceptual framework for their intervention. However, underlying each is the stated or implied understanding that falls have a multifactorial etiology and that attention to multiple risk factors will be more effective than an intervention that targets any single risk factor. A fall is usually the result of interactions between patient-specific risk factors and the physical environment. Patient-specific risk factors include patient age (particularly age over 85, sometimes called the "oldest old"), male sex, a history of a recent fall, muscle weakness, behavioral disturbance, urinary incontinence or frequency, certain medications, and postural hypotension or syncope. Environmental causes include poor lighting; 'trip" hazards (such as uneven flooring or small objects on floor); suboptimal chair heights; and staff availability, attitude, and skills. Given the multifactorial nature of falls, a patient safety practice designed to assess and remediate multiple factors is believed to be more likely to be effective. Indeed, the list of successful components in multi-component fall prevention interventions matches well with this list of patient and environmental contributors to falls. We identified one published logic model for why individual fall prevention components should work (Figure 1). For example, a bed alarm detects patient movements, which can allow a faster response to patients and reduce falls. Similarly, use of a visible sign or identification bracelet increases awareness of falls and at-risk patients and inform necessary responses, which in turn should reduce falls.

The second underlying assumption of most fall prevention programs in the published literature is that fall risk assessment is primarily a nursing function, but that insufficient attention is currently paid to this task due to other demands for nursing time, and that some method of reminder, checklist, or similar tool can be effective to ensure the assessment of fall risk.

Figure 1, Chapter 19. Multi-systemic fall prevention model



(a) Firm mattresses; low beds; appropriate chair heights and depths for easy transfer; chairs with arm rests; and secured handrails throughout the movement of a patient. (b) Non-slip surfaces in floors/bathtubs; shower seats; grab bars next to the toilet/bathtub; toilet seats that allow easy transfer; door magnets that hold doors in the open position; and arm rests next to the toilet.

*An intervention or a factor whose efficacy was NOT tested as a single factor in any healthcare setting. **An intervention or a factor whose efficacy was tested as a single factor in other healthcare settings but NOT specifically in a hospital setting. ***An intervention or factor whose efficacy was tested in a hospital setting.

Figure taken from Choi et al, 2011[28]

What Are the Beneficial Effects of the Patient Safety Practice?

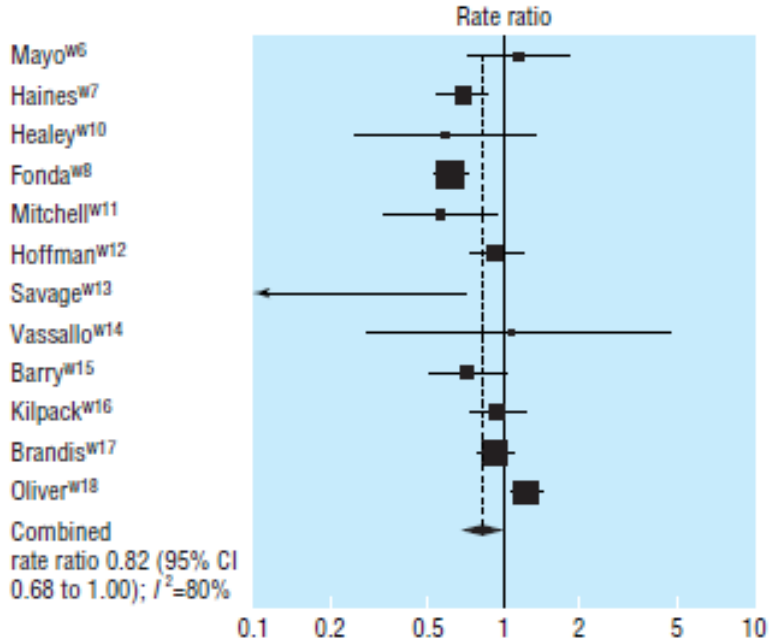
The primary sources of evidence about multi-component in-facility fall prevention programs are three systematic reviews: a 2008 review from the Cochrane Collaboration by Cameron and colleagues,[8] a review by Coussement and colleagues also published in 2008,[29] and a review by Oliver and colleagues originally published in 2006,[30] which was updated in 2010 as a narrative review.[1] All three reviews scored well on the AMSTAR criteria for systematic reviews (11/11, 10/11, and 10/11 respectively).[31] The Cochrane review searched a number of databases through November 2008 for randomized trials to assess the effectiveness of falls reduction interventions for older adults in nursing care facilities and hospitals.[8] Of the 41 trials they included, 11 were conducted in hospital settings, of which four addressed multifactorial interventions. The review by Coussement identified four studies, three of which were included in the Cochrane review.[29] The Oliver and colleagues review also searched multiple databases for relevant literature through January 2005.[30] This review's objective was to evaluate the evidence for fall prevention strategies in care homes and hospitals, with an additional focus on the effect of dementia and cognitive impairment on fall risk. Broader inclusion standards than the Cochrane review led to the inclusion of 43 trials, case-control studies, and observational cohort studies. Thirteen of these studies addressed multicomponent inpatient interventions. The updated narrative review focused directly on inpatient fall prevention and discussed 17 multifactorial studies spanning 1999-2009, which include the four trials found by the Cochrane group.[1]

The three reviews reached similar conclusions. The Oliver and Cochrane reviews found that multi-component in-facility fall prevention programs result in statistically and clinically significant reductions in rates of falls (see Table 2). The Cochrane pooled analysis of four fall prevention programs in 6,478 participants found a 31 percent decrease in the rate of falling (pooled rate ratio [RR]0.69 (95% CI, 0.49 to 0.96) and a 27 percent decrease in the incidence of falls among three trials involving 4,824 participants (RR 0.73; 95% CI, 0.56 to 0.96).[8] The Coussement review found a similar pooled rate ratio as the Oliver review; however, this effect was not quite statistically significant.[29] Principal results from the Oliver meta-analysis are reproduced below (see Figure 2).[30] The other systematic reviews and meta-analyses identified in the Oliver update review were "surprisingly consistent" (p. 679) and support the argument that multi-factorial interventions reduce fall rates more effectively does than any single intervention in acute care settings.[1]

Table 2, Chapter 19. Meta-analytic estimate of the effect of multicomponent fall intervention programs on inpatient fall rates

Meta-Analysis (First Author)	Number of Included Studies	Pooled Rate Ratio
Cameron, 2010 [8]	4	0.69 (95% CI 0.49 – 0.96)
Coussement, 2008 [29]	4	0.82 (95% CI 0.65 - 1.03)
Oliver, 2007 [30]	12	0.82 (95% CI 0.68 – 1.00)

Figure 2, Chapter 19. Meta-analysis from Oliver et al. 2006 for multifaceted interventions in hospital falls (random effects model)[30]



Reproduced from Strategies to prevent falls and fractures in hospitals and care homes and effect of cognitive impairment: systematic review and meta-analyses. Oliver D, Connelly JB, Victor CR, et al. 334(7584):82. 2007 with permission from BMJ Publishing Group Ltd.

The Cochrane and Oliver reviews were supplemented with an update search (described below) and an additional search by Hempel and colleagues (discussed in more detail later), which addressed the prevention of inpatient falls. After using 15 existing reviews and reports to identify pertinent sources, which included the two reviews in this chapter, Hempel then searched multiple databases for relevant literature. The search covered January 2005 to August 2011 and included randomized controlled trials, non-randomized trials, and before-after studies in English-language publications that addressed falls in the hospital setting. Details of the search strategy are in Appendix C.

In the update search, we focused on studies with large sample sizes (at least N=1,000), that assessed multi-component interventions in acute-care hospitals, in the general population or older adult population. We were looking for "pivotal studies," as defined by Shojania and colleagues (see Methods, Chapter 2 p.ES-4) that could provide a signal when an existing systematic review is out of date.[32] We identified two new relevant studies, both of which showed statistically significant improvements in intervention groups when compared with controls, and which we discuss briefly here. A third study is reviewed because of its unique design. Data for all studies included in the Oliver review, the Cochrane review, and our update search are in an evidence table in Appendix D. Table 3 provides an abbreviated description of each study.

Table 3, Chapter 19. Abridged evidence tables, adapted from Oliver and colleagues

Author, year	Study design	Setting	Participants	Quality Score**	Outcomes[+]
*Ang et al, 2011 [9]**	*RCT*	*8 medical wards; acute care; Singapore*	*1822 patients.*	*25*	*SFF*
Barker et al, 2009[10]	Before/After	Small; acute care; Australia	271,095 patients	16	SFI
Barry et al, 2001[11]	Before/After	Small; long-stay and rehab; Ireland	All patients admitted to 95 beds for 3 years	15	SFI
Brandis, 1999[12]	Before/After	Acute, Australia	All patients admitted to 500 beds for 2 years	11	NFF
Cumming et al, 2008[13]	Cluster RCT	24 wards; acute and rehab; Australia	3999 patients	27	NFF
*Dykes et al, 2010 [14]**	*Cluster RCT*	*8 units; medical; urban U.S.*	*All patients admitted or transferred to units over 6 month study period*	*27*	*SFF*
Fonda et al, 2006[15]	Before/After	4 wards; elderly acute and rehab; Australia	3961 patients	20	SFF
Grenier-Sennelier et al, 2002[16]	Before/After	400 bed; rehab; France	All admitted patients over 4 years	11	SFF
Haines et al, 2004[17]	RCT	3 wards; subacute rehab and elderly; Australia	626 patients	26	SFF
Healey et al, 2004[18]	Cluster RCT	8 wards; acute and rehab; 3 hospitals; UK	3386 patients	26	NFF
Koh et al, 2009[19]	Cluster RCT	2 hospitals; acute; Singapore	All admissions during 1.5 years	14	NFF
Krauss et al, 2008[20]	Before/After	General medicine; acute academic hospital	All admissions over 18 months	18	NFF
Oliver et al, 2002[21]	Before/After	Elderly medical unit; acute hospital; UK	3200 patients admitted annually; data over 2 years	8	NGF
Schwendimann et al, 2006[22]	Before/After	300 bed; internal medicine, geriatric and surgical; Switzerland	34,972 admissions	15	NFF
Stenvall et al, 2007[23]	RCT	3 wards; orthogeriatric, geriatric, orthopedic; Sweden	199	25	SFF
Uden et al, 1999[24]	Before/After	Geriatric dept; acute hospital; Sweden	379 patients	12	NGF
Van der Helm et al, 2006[25]	Before/After	Internal med ward and neurology ward; acute hospital; Netherlands	2670 patients	11	NGF
Vassallo et al, 2004[26]	Cohort Study	3 wards; rehab; UK	825 patients	25	NFF
Von Renteln-Kruse et al, 2007[27]	Before/After	Elderly acute and rehab wards; Germany	7254 patients	17	SFF

*New studies added from update search

** Downs and Black Quality Score,[33] evaluated by the authors

[+]SFF= significantly fewer falls; SFI=significantly fewer injuries; NFF= nonsignificantly fewer falls; NGF= nonsignificantly greater falls

Dykes and colleagues compared the fall rates of four intervention units to matched control units in four urban United States hospitals over a 6-month period.[14] Control units received usual care, which included fall risk assessments, signage for high-risk patients, patient education as needed, and manual documentation in patient records. The intervention group tested the Fall Prevention Tool Kit (FPTK), which was developed by the study team. The FPTK is a health information technology application that includes a risk assessment and tailored signage, patient education, and plan of care components. The FPTK is integrated with, and seeks to enhance, existing workflow and communication patterns. Adjusted fall rates in the intervention units (3.15 per 1,000 patient days [95% CI, 2.54 to 3.90]) were significantly lower than in control units (4.18 per 1,000 patient days [95% CI, 3.45 to 5.06]), with a particularly strong impact among patients aged 65 or older (rate difference of 2.08 per 1,000 patient days [95% CI: 0.61 to 3.56]). This study was judged to have a low risk of bias using the criteria of the Effective Practice and Organizational Organisation of Care (EPOC) Cochrane Group (score of 8 of 9 components). [34]

In the second study, Ang and colleagues [9] randomized patients in eight medical wards of an acute-care hospital in Singapore over a 9-month interval. They used an assessment tool to match high-risk patients with appropriate interventions, in addition to a tailored educational session, in the intervention group. Both the intervention and control groups in this study received usual care, which included environmental modifications, review of medications and fall history, and educational sessions. The proportion of patients with at least one fall in the intervention group was 0.4 percent (95% CI, 0.2 to 1.1) while in the control group this was 1.5 percent (95% CI, 0.9 to 2.6) for a relative risk reduction of 0.29 (95% CI, 0.1 to 0.87). Using the EPOC criteria, this study was judged to be at low risk of bias (score of 8 of 9 components).[34]

One additional study was identified and is noted here because of its unique design. The study by van Gaal and colleagues evaluated a program that targeted three patient safety practices (pressure ulcers, urinary tract infections, and falls prevention) simultaneously and found an overall positive effect on the development of any adverse event, a composite measure of pressure ulcers, urinary tract infections, and falls.[35,36] The study was not powered to assess falls separately, yet it is worth noting that the point estimate for the relative risk reduction in falls was 0.69, which is within the range of results reported in other studies and meta-analyses. The value of this study is the demonstration of simultaneous improvements in several intervention targets.

Thus, new large controlled trials continue to support the conclusion of existing meta-analyses that multifactorial falls prevention programs are effective in reducing inpatient fall rates.

What Are the Harms of the Patient Safety Practice?

Most trials of fall prevention programs have not reported any harms. The Cochrane review reported none.[8] It is not clear whether the possibility of harms was explicitly assessed in these trials. However, concern exists that some falls prevention interventions may lead to harms. The review by Oliver and colleagues detailed a number of potential harms, including an increased use of restraints or sedating medications. However, Oliver and colleagues also note “so little empiric evidence on adverse effects of fall prevention activities on other clinical activities has been incorporated into clinical trials that one has very little with which to substantiate or refute these concerns.”[1]

How Has the Patient Safety Practice Been Implemented, and in What Contexts?

The ways in which falls prevention programs have been implemented and a description of contexts are lacking in most reports. The limited evidence available is summarized below.

Structural Organizational Characteristics

Fall prevention programs have been implemented in both acute-care hospitals and nursing homes. For this report, we focused on inpatient interventions, with a mix of acute-care, rehabilitation, long-term care, and geriatric wards and facilities represented. All but two of the studies came from outside the United States: five from Australia, three from the United Kingdom, two each from Sweden and Singapore, and one each from France, Switzerland, the Netherlands, and Germany. Six studies mentioned having an academic affiliation or being a teaching hospital. Of the 15 studies that reported the size of the setting, three were under 100 beds, five were between 100 and 500 beds, and two were over 500 beds. Three other studies described size using alternative measures: 24 wards in 12 hospitals, a staff of 641, and 2300 inpatients annually. Thus, falls prevention programs have been successfully implemented in hospitals of varying size, location, and academic/teaching status.

No studies reported on financial concerns (e.g., how patients' care or the interventions were financed), although one U.S. study mentioned the potential impact of reimbursement on the emphasis on falls prevention.[14] Since some countries where these studies have been conducted have national health insurance, this context may be less applicable, and therefore not reported.

Existing Infrastructure

Five studies reported on the existing quality and safety infrastructure. Here we describe this infrastructure in terms of factors that may affect implementation of a patient safety practice, which could include presence of electronic health records or prior experience with quality improvement or patient safety practices. The five studies included text that captured this concept; of these, four described their usual fall prevention care. The fifth study provided a more explicit statement, namely, "prior to this study none of the wards carried out specific fall assessments or interventions, and investigations such as lying and standing blood pressure or ophthalmology referral occurred on an 'ad hoc' basis. There was no specialist falls clinic or other falls service available at this hospital."[18] Another explanation was less explicit, and was embedded in the authors' explanation of the intervention, which noted that the two control wards "continued with the regular fall prevention policy used at the hospital (i.e., daily assessment of fall risk, review of fall prevention with the patient and/or their family, use of fall prevention signage, and implementation of other prevention strategies as needed)."[20] Two other reports of randomized controlled trials discussed usual care in a similar fashion when contrasting it with the intervention.[9,14] These descriptions illustrate the potential diversity that may exist in the "control" sites in terms of "usual care."

In addition to a description of the current fall prevention care, a second type of infrastructure description addressed an inadequate information system, reporting that "the existing information system was not useful for producing data that we could use to analyze the causes of falls."[16] A further example of this type of explanation is presented by Dykes and colleagues, who suggest that "including hospitals with diverse clinical information and documentation systems enhanced the [intervention] generalizability."[14] The remaining studies do not mention existing quality and safety infrastructure.

Consequently, a dearth of data exists regarding the infrastructure needed to support fall prevention programs or how the effectiveness of implementation may vary as a result of infrastructure differences.

External Factors

Although a few studies briefly mentioned patient safety culture, teamwork, or leadership, only four studies presented expanded explanations that merited mention. Grenier-Sennelier[16] use a framework from Shortell and colleagues[37,38] to analyze safety on the unit level, teamwork at both the organizational and unit level, and leadership on the organizational and unit level. Stenvall discusses teamwork at the unit level in Table 2 of their article (See Appendix D).[23] Koh discusses leadership on the organizational and unit level: "Successful implementation is mediated by strong leadership and environmental support, which are integral to building positive attitudes among nurses, ensuring that the sociocultural environment is conducive to the process of change. In our study, the multifaceted strategy targeting barriers to change exemplified the commitment of the leadership and environmental support."[19] (p. 429) Van der Helm made multiple observations addressing leadership on both the organizational and unit level:

- "Although the clinical ward management underlined the importance of implementing the guideline at the outset of the project, the actual support given was too weak to be effective. Some managers expressed doubt about the project's chances for success to the project leader, stating that implementation "had already failed before." Ward staff often regarded improvement activities as unwanted additional work that hindered daily operations. The two senior nurses often displayed a delegating rather than a directive management style, for example, in terms of ensuring that the risk assessment tool was completed or all incidents reported." (p.157)
- "nurses told us that the medical center did not take the falls problem seriously, which therefore undermined their own motivation to contribute to the project's success." (p.158)
- A measure in the Questionnaire Regarding Knowledge of the Guideline and Attitude Toward Implementation, "There is enough support from the management for guideline implementation" scored 44% to 53%.[25]

Implementation

The most commonly reported implementation details were patient characteristics (17 studies) and an initial plan, or what was going to be done in the intervention (17 studies). Slightly less often (14 studies), studies reported the intended roles of project staff, or by whom the intended plan components were to be completed. The majority of studies reported the recipients of any training component (15 studies), with slightly fewer reporting the type of training or giving a description of the training (12 studies), and even fewer studies reporting the length of training (5 studies).

Another characteristic that distinguished studies was who conducted the risk assessments and performed the interventions. In the reviews by Oliver and colleagues and the Cochrane group, among the 17 studies of inpatient fall prevention programs, the risk assessments were performed by the existing ward staff in 15 and by research staff in two. In 15 studies, the intervention was performed by the ward staff: seven involved the nursing staff only, seven were multiprofessional, and two involved physical therapy. In both of the new studies, clinicians or nurses from the wards performed the risk assessments. The study with nurse risk assessments had research team

nurses provide the intervention, whereas the other study relied mainly on ward nurses, although reference was made to clinicians more generally.

Thirteen studies provided the tools or materials used in the program implementation. Whereas eight reported on adherence or fidelity to the designed initiative, only five described how and why the plan evolved. Adherence or fidelity was most often characterized in a qualitative statement, as with Brandis: "The strategies implemented… had high acceptance by staff… it is suggested that the higher reductions occurred in areas where the multidisciplinary team enthusiastically embraced the project."[12] An example from a less positive characterization comes from Cumming: "The lack of effect was evident in both… wards and occurred despite the planned nursing and physiotherapy interventions being successfully implemented."[13] Dykes and colleagues provided a strong example of adherence reporting, where protocol adherence was measured by the completion of components in both control (81%) and intervention wards (94%). Measures of adoption and reach were usually provided in the form of a flow chart: Six studies presented these data for providers, and eight presented the data for patients.

For additional information on implementation, we used our update search and sought suggestions of additional studies from experts. All of these studies had pre-post designs or were a time series. Six were post-study evaluations of of falls implementations that reported a great deal of detail about the potential reasons for effectiveness or lack thereof. Nine of the eleven studies assessed implementation at only one or two facilities. Four of the studies did not report beneficial effects of the fall prevention program and the article highlighted potential implementation factors that might account for the lack of success. One study explicitly assessed the effect of some contextual factors on intervention success across 34 facilities.[39] One study explicitly assessed sustainability. Details of these studies are presented in Appendix D.

We used five of the implementation articles to develop themes regarding effective implementation and then reviewed all articles for these themes. The following are the most consistently supported themes:

- **Leadership support** is critical, both at the facility level and at the unit level (e.g. "clinical champions").
- **Engagement of front line clinical staff** in the design of the intervention helps ensure that it will mesh with existing clinical procedures.
- M**ultidisciplinary committees** guided or oversaw most interventions developed/guided/overseen by
- **Pilot testing** the intervention helps identify potential problems with implementation
- **Informational technology systems** capable of providing data about falls can facilitate evaluations of the causes, compliance with the intervention components, and (in one case) be a crucial facilitator of the intervention.
- **Changing the prevailing attitude** that "falls are inevitable" and "nothing can be done about them" is required to get buy-in to the goals of the intervention
- **Education and training** of clinical staff is necessary to help ensure compliance does not diminish.

Table 4, below, presents textual support from the implementation articles for five of the seven themes (pilot testing and information technology systems are not presented due to space limitations).

Table 4, Chapter 19. Implementation themes highlighted in implementation studies

Author/Year	Leadership Support	Frontline Engagement	Multidisciplinary Committees	Pilot Testing	Information Technology Systems	Attitude Change	Education and Training	Results of Intervention and Implementation
Browne et al., 2004[40]	--	--	Falls Committee; quarterly meetings	Once the tool was developed, it was piloted and validated. The results were presented to the MHS Falls Committee, who gave permission for automated implementation system-wide.	"the redesign of an adult inpatient falls program using a computerized information system…the tool provides an accurate assessment of the fall risk of each patient. Indicators are embedded into routine assessment documentation, eliminating added chargting time. The program allows tailored interventions for specific patient risks."	--	"Nurses were taught about the redesigned falls program by 'fall and restraint fairs' that coincided with its implementation.	Successful

Table 4, Chapter 19. Implementation themes highlighted in implementation studies (continued)

Author/Year	Leadership Support	Frontline Engagement	Multidisciplinary Committees	Pilot Testing	Information Technology Systems	Attitude Change	Education and Training	Results of Intervention and Implementation
Capan et al., 2007[41]	A unit champion was selected to "act as a staff resource… who was respected as a mentor and passionate about patient safety"	Staff involved in choosing equipment	"the hospital quality council chartered a multidisciplinary falls prevention task force. The team included nurses, nursing management, a physician/geriatrician, nursing educators, a psychiatric clinical specialist , risk management staff, performance improvement/measurement staff, and representatives from physical therapy and pharmacy."	A pilot test of the new tool was conducted in "a medical/neurology unit with a high fall incidence rate." The original plan to roll the tool out one unit at a time was modified to "an immediate hospital-wide implementation" after the success of the pilot program.	--	"Nurses were reluctant to impose the interventions… [but] they came to recognize the importance of each step" "As the staff began using the interventions… falls began to decline"	The research team "educated the staff about falls and the importance of fall prevention," including background information on falls and how the new tool was to be used. "95% of staff completed the education prior to the implementation of the tool."	Successful
Dempsey, 2004[42]	--	Raised concern over nurses' power to induce change	--	A tool was developed and "tested for inter-rater reliability in a pilot study when five nurses of different experience levels assessed the same patient." "On the basis of the results of the research project, the Falls Prevention Programme became standard practice for medical patients…"	--	"In the pilot study….a number of nurses expressed the belief that falls were inevitable and that there was nothing that could be done to change this. Although the study demonstrated that it was possible to reduce the rate of patient falls, the remarks of the nurses support the suggestion…that the successful reduction of patient falls lay in the attitude of the nurses themselves. "	"The Falls Prevention programme consisted of an assessment tool, an alert graphic, and education (patient and staff)" " Staff education commenced at the introduction of the study and continued intermittently though formal and informal means."	Mixed results, initial success followed by deterioration over five years.

Table 4, Chapter 19. Implementation themes highlighted in implementation studies (continued)

Author/Year	Leadership Support	Frontline Engagement	Multidisciplinary Committees	Pilot Testing	Information Technology Systems	Attitude Change	Education and Training	Results of Intervention and Implementation
Gutierrez, 2008[43]	Identify clinical champions; leadership on unit agreed to send a nurse to the Evidence-Based Practice Institute	"project design included soliciting staff and physician feedback"	--	--	--	--	Yes, one key component was a brief "elevator speech" for engaging and educating staff	Successful
Kolin et al., 2010[44]	Leadership formed a team to address falls issue, team was led by a senior vice president, information was presented to leadership throughout project	--	"The fall team meets regularly, with in-depth analysis… at regular intervals…"	Multiple tools were tested before the redesign team developed their own, which was also tested.	Currently, the team is are "working on an interface to connect the system electronic medical record with the event reporting system." The system had a combination of paper documentation and electronic record sites, which had separate program roll out.	"Implementation means changing the way nurses think about falls… accepting that 'all' patients are at risk."	"Comprehensive nursing education was conducted"	Successful

Table 4, Chapter 19. Implementation themes highlighted in implementation studies (continued)

Author/Year	Leadership Support	Frontline Engagement	Multidisciplinary Committees	Pilot Testing	Information Technology Systems	Attitude Change	Education and Training	Results of Intervention and Implementation
McCollam, 1995[45]	Nursing Administration involved in full implementation	--	"Research in Practice Committee" oversaw the project	Problems identified during the pilot included inconsistent and incomplete reassessment, identification of secondary diagnoses, and score consistencies between shifts. Adjustments were made for full implementation.	--	Compliance for care plans and interventions lagged behind risk assessment, which could be due to skepticism about the program. "Some nurses may question the instrument's findings or not believe the problem serious enough to address."	Training sessions were conducted for nursing; video tape was shown about tool; understanding checked using evaluation	Successful
Neily, 2005[39]	"Senior leadership support helps remove organizational barriers to change and provides resources needed to implement change" "The four sites that reported spreading changes to other facilities also indicated that leadership was a major success factor."	--	"…teamwork skills are an important component of sustained success" Interdisciplinary or multidisciplinary falls team was a core component of all four high performing sites.	--	--	--	--	Successful

Table 4, Chapter 19. Implementation themes highlighted in implementation studies (continued)

Author/Year	Leadership Support	Frontline Engagement	Multidisciplinary Committees	Pilot Testing	Information Technology Systems	Attitude Change	Education and Training	Results of Intervention and Implementation
O'Connell, 2001[46]	--	--	Team of researchers and clinicians	No pilot test was conducted.	--	Risk assessment tool difficulties may have undermined staff confidence and the program "may have lost some of its significance." Staff felt that they were already doing everything they could, and this program did not add anything	--	Unsuccessful
Rauch et al., 2009[47]	Leadership hired a consulting team. All levels of leadership were engaged and accepted ownership of the project. A champion was identified in each unit.	"It is imperative to obtain frontline staff input and feedback to ensure that successful change management occurs in the clinical arena" "If there are any words of advice here, they would be: never change a program without directly involving and getting buy-in from those it immediately affects."	"The Fall Team, multidisciplinary in nature and inclusive of managers and frontline staff [were involved in all phases of the project]" Weekly teleconferences during implementation; monthly fall team meetings after implementation	During the 30 day pilot, "staff were routinely questioned and encouraged to provide feedback on elements working well and elements that were failing… Changes were made as needed…the pilot was extended…to ensure a solid process before total hospital roll-out."	--	--	"…educational needs were identified and sessions were scheduled… [including] an introduction of the assessment tool and proper utilization"	Successful

Table 4, Chapter 19. Implementation themes highlighted in implementation studies (continued)

Author/Year	Leadership Support	Frontline Engagement	Multidisciplinary Committees	Pilot Testing	Information Technology Systems	Attitude Change	Education and Training	Results of Intervention and Implementation
Semin-Goossens, 2003[48]	Attempt to involve medical chiefs and nurse managers could have promoted implementation "In our case, efforts to reach and involve the people higher in the hierarchy such as the Medical Chiefs and nursing managers were not successful."	"We did not believe in a top-down strategy and so we involved the nurses in rewriting and implementing the guideline." Authors would have tried to get more buy-in from floor nurses if given another try, but they did receive feedback and modify the intervention accordingly.	A project team was formed consisting of 9 nurses in various positions, a clinical epidemiologist, and a consultant for quality improvement projects.	After a 3 month pilot, the guidelines were finalized.	--	"Nurses…frequently stated that it was simply impossible to prevent patients from falling. Falling was recurrently considered to be an inevitable part of aging, hospitalization, and illness, and therefore seen as an unavoidable accident, rather than something predictable and often preventable."	Dissemination of the guideline, including large posters.	Unsuccessful
Weinberg et al., 2011[49]	Hospital leadership initiated effort and prioritized fall prevention	--	Committee was formed by leadership and attendance was mandated; monthly fall reviews were attended by unit managers, staff involved in patient care, and fall prevention initiative co-chairs	The Fall Prevention Initiative was rolled out incrementally, using continuous quality improvement methods	--	Transforming the culture was integral to implementation; emphasis placed on building a "just culture" and having a "constructive, nonpunitive forum" for discussion	Yes	Successful

Are There Any Data About Costs?

The Cochrane review found no economic evaluations of the falls prevention programs that met inclusion criteria.[8] The review by Oliver and colleagues estimated the cost for specific combinations of components in terms of environment and equipment and in terms of staff. Fourteen of 17 trials were considered "low" cost in terms of equipment and environment (meaning some equipment costs like slippers, hip protectors, or alarms for a limited proportion of patients), and 14 of 17 were considered as "nil," meaning none or inconsequential, for extra staff FTE.

Are There Any Data About the Effect of Context on Effectiveness?

The study by Neily and colleagues was the only one identified that explicitly assessed the effect of context on effectiveness. Across 34 Veterans Affairs health centers, a mix of acute care and long-term care facilities, leadership support was cited as one of the strongest factors for success. At 1-year followup, high-performing sites reported greater agreement with questions assessing leadership support, teamwork skills, and useful information systems than low-performing sites.[39]

Conclusions and Comment

Inpatient multicomponent programs have been shown to be effective at reducing falls. The strength of evidence is high.

The effects of context have not been as well studied; however multicomponent interventions have been effective in hospitals that vary in size, location, and teaching status.

An assessment for themes in eleven implementation studies found the following to be most consistently supported:

- Leadership support is critical, both at the facility level and at the unit level (e.g. "clinical champions").
- Engagement of front line clinical staff in the design of the intervention helps ensure that it will mesh with existing clinical procedures.
- Most interventions were developed/guided/overseen by multidisciplinary committees
- A pilot test of the intervention helps identify potential problems with implementation
- An informational technology system capable of providing data about falls can facilitate evaluations of the causes and compliance with the intervention components, and (in one case) can be a crucial facilitator of the intervention.
- Changing the prevailing attitude that "falls are inevitable" and "nothing can be done about them" is required to get buy-in to the goals of the intervention
- Adequate time for education and training of clinical staff is necessary to help ensure compliance does not diminish.

By January 2013, AHRQ intends to make available a list of tool kits for inpatient fall prevention programs. A summary table is located below (Table 5).

Table 5, Chapter 19. Summary table

Scope of the Problem Targeted by the PSP (Frequency/Severity)	Strength of Evidence For Effectiveness of the PSPs	Evidence or Potential for Harmful Unintended Consequences	Estimate of Cost	Implementation Issues: How Much do We Know?/How Hard Is it?
Common/Low	High	Moderate (increased use of restraints and/or sedation)	Moderate	Moderate/Moderate

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