

Evidence *in* Context

Issue: Fall Prevention for Seniors in
Institutional Healthcare Settings
Released: April 2014

Health research — synthesized and contextualized for use in Newfoundland & Labrador

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

ONLINE COMPANION DOCUMENT

Newfoundland & Labrador Centre for
**APPLIED
HEALTH
RESEARCH**
www.nlcahr.mun.ca

Table of Contents

Appendix/ Parameters of the Review

A. Research Design & Publication Dates.....	1
B. Selection Criteria.....	1
C. Search Strategy & Article Selection.....	2
i. PubMed Search Strategy	2
ii. CINAHL Search Strategy	3
iii. EMBASE Search Strategy	3
D. Article Selection.....	6
i. Citations for Excluded Reviews	7
ii. Flow Chart or Article Selection	10
E. Critical Appraisal.....	10
Data Extraction Tables.....	14

Appendix: Parameters of the Review

A. Research Design & Publication Dates

Our synthesis includes two types of research articles:

1. Systematic reviews, meta-analyses or health technology assessments published between April 2008 and April 2013, inclusive. To be considered “systematic,” a given review had to provide three things:
 - i. a documented search strategy for identifying relevant primary studies;
 - ii. citation info for all included studies; and
 - iii. an aggregate description of included study characteristics that included participants, setting, intervention, outcomes.
2. Randomized controlled trials published between June 30 2012 and April 2013.

B. Selection Criteria

The research team collectively agreed on the following inclusion criteria for selection of review studies:

Setting:

1. A primary study was selected if
 - a. both the intervention(s) *and* evaluation, measurement or observation were carried out in an institutional setting (e.g., acute care, long-term care, rehab units, etc.), or
 - b. in the case of a multi-site study, interventions delivered in institutional settings were analyzed and evaluated separately from the others, such that the reviewer could discern a finding or findings specific to interventions delivered in institutional settings
2. A systematic review was selected if
 - a. 100% of its included studies satisfied condition #1, or
 - b. included studies that satisfied condition #1 were analyzed separately from the others, such that the reviewer could discern a finding or findings specific to interventions delivered in institutional settings – e.g., subgroup analysis in the case of meta-analyses.

Population:

3. A primary study was selected if
 - a. at least 75% of study participants were ≥ 65 years old,
 - b. the mean age of study participants was ≥ 65 years old, or
 - c. in the case of a multi-site study, interventions delivered exclusively to a patient population such as those described in #3 a & b were analyzed and evaluated separately from the others, such that the reviewer could discern a finding or findings specific to interventions for older patients
4. A systematic review was selected if
 - a. 100% of its included studies satisfied condition #3, or
 - b. included studies that satisfied condition #3 were analyzed separately from the others, such that the reviewer could discern a finding or findings specific to interventions for older patients— e.g., subgroup analysis in the case of meta-analyses.

Intervention:

5. Articles on prescription medications or surgical interventions were not included. However, articles on prescription medication review and/or modification were eligible for inclusion.

Outcome

6. Primary studies/systematic reviews were selected only if they measured the effect of interventions on the frequency of falls, severity of falls and/or fall-related injuries. For example, primary studies or reviews that evaluated fall risk assessment instruments were *not* included, *unless* they directly measured the effect of such instruments on falls and/or fall-related injury (as opposed to measuring just the reliability, validity and/or feasibility of a given assessment tool).

C. Search Strategy & Article Selection

To identify relevant articles in PubMed, CINAHL and EMBASE we used the Boolean operator “AND” to combine three sets of search terms: (1) subject headings and keywords related to older persons (population), (2) subject headings and keywords relating to falls and/or fall-related injuries (outcome), and (3) a validated search filter for retrieving either systematic reviews or randomized controlled trials. Our search was limited to articles published in English. The following tables illustrate how the searches were constructed and provide the detailed search strings with the number of results obtained for each search.

PubMed Search Strategy

Population MeSH & Keywords	"Aged"[Mesh] OR "Age Factors"[Mesh] OR elder*[Title] OR old*[Title] OR senior*[Title] OR aged[Title]
Outcome MeSH & Keywords	"Accidental Falls/prevention and control"[Majr] OR "Fractures, Bone/prevention and control"[Majr] OR fall[Title] OR falls[Title] OR faller[Title] OR fallers[Title] OR falling[Title] OR (fracture*[Title] AND prevent*[Title])
Systematic Reviews	
Limits	Abstract available; Publication date from 2008/04/01 to 2013/04/30; English
Search string	(fall[Title] OR falls[Title] OR faller[Title] OR fallers[Title] OR falling[Title] OR (fracture*[Title] AND prevent*[Title]) OR "Accidental Falls/prevention and control"[Majr] OR "Fractures, bone/prevention and control"[Majr]) AND ("Aged"[Mesh] OR Age Factors[Mesh] OR elder*[Title] OR old*[Title] OR senior*[Title] OR aged[Title]) AND (meta analysis[Publication Type] OR meta analysis[Title/Abstract] OR meta analysis[MeSH Terms] OR review[Publication Type] OR search*[Title/Abstract] OR "systematic review"[Title])
Results	269 on April 21, 2013
RCTs	
Limits	Abstract available; Publication date from 2012/06/30 to 2013/04/30; English
RCT filter	randomized controlled trial[Publication Type] OR randomized[Title/Abstract] OR placebo[Title/Abstract]
Results	48 on April 25, 2013

CINAHL Search Strategy

Population Headings & Keywords	(MH "Aged+") OR (MH "Age Factors") OR TI elder* OR TI old* OR TI senior* OR TI aged
Outcome Headings & Keywords	(MM "Fractures+/PC") OR (MM "Accidental Falls/PC") OR TI falls OR TI fall OR TI faller OR TI fallers OR TI falling OR (TI fracture* TI AND TI prevent*)
Systematic Reviews	
Limits	Abstract Available; Published Date from: 20080401-20130430; English Language; Exclude MEDLINE records; Clinical Queries: Review - Best Balance
Search string	((MM "Accidental Falls/PC") OR (MM "Fractures+/PC") OR TI falls OR TI fall OR TI faller OR TI fallers OR TI falling OR (TI fracture* OR TI prevent*)) AND ((MH "Aged+") OR (MH "Age Factors") OR TI elder* OR TI old* OR TI senior* OR TI aged)
Results	168 on April 21, 2013
RCTs	
Limits	Abstract Available; Published Date from: 20120701-20130430; English Language; Exclude MEDLINE records; Clinical Queries: Therapy - Best Balance
Results	10 on April 25, 2013

EMBASE Search Strategy

Population Headings & Keywords	'aged'/exp OR aged:ti OR senior*:ti OR elder*:ti OR old*:ti
Outcome Headings & Keywords	'falling'/exp/mj OR 'fracture'/exp/mj OR fall:ti OR falls:ti OR faller:ti OR fallers:ti OR falling:ti OR (fracture*:ti AND prevent*:ti)
Systematic Reviews	
Limits	Abstract Available; Published Date from: 20080401-20130430; English Language; Exclude MEDLINE records; Cochrane Reviews, meta-analyses, systematic reviews
Search string	'falling'/exp/mj OR 'fracture'/exp/mj OR fall:ti OR falls:ti OR faller:ti OR fallers:ti OR falling:ti OR (fracture*:ti AND prevent*:ti) AND ('aged'/exp OR aged:ti OR senior*:ti OR elder*:ti OR old*:ti) AND ([cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim) AND [english]/lim AND [abstracts]/lim AND [embase]/lim AND [1-4-2008]/sd NOT [30-4-2013]/sd
Results	107 on April 21, 2013
RCTs	
Limits	Abstract Available; Published Date from: 20120630-20130430; English Language; Exclude MEDLINE records; Randomized Controlled Trials
Search string	'falling'/exp/mj OR 'fracture'/exp/mj OR fall:ti OR falls:ti OR faller:ti OR fallers:ti OR falling:ti OR (fracture*:ti AND prevent*:ti) AND ('aged'/exp OR aged:ti OR senior*:ti OR elder*:ti OR old*:ti) AND [randomized controlled trial]/lim AND [english]/lim AND [abstracts]/lim AND [embase]/lim AND [30-6-2012]/sd NOT [30-4-2013]/sd
Results	62 on April 25, 2013

A search of grey literature websites was also conducted in April 2013 in an attempt to identify any relevant systematic reviews:

I. Canada

CADTH (<http://www.cadth.ca/en/products>): search for “fall*” OR (“fracture* AND prevent*) in “All Products”, results: 25, selected: Brown (2008)

Evidence-Informed Healthcare Renewal Portal (www.eihrportal.org): search for “fall,” “falls,” “faller,” OR “fallers” OR (“fracture* AND prevent*) in title, abstract, and synonym fields, limited to 2008-2013, systematic reviews, results: 43, selected: Sherrington (2011), Choi (2011), Church (2011) [*Note: these 3 systematic reviews had already been selected from our searches of periodical indexes*]

healthevidence.org (<http://www.healthevidence.org/search.aspx>): search for “fall,” “falls,” “faller,” OR “fallers” OR (“fracture* AND prevent*), limited to 2008-2013, results: 50, selected: Gillespie (2010), Sawka (2010), Avenell (2011) [*Note: these 3 systematic reviews had already been selected from our searches of periodical indexes*]

PATH (<http://www.path-hta.ca/Publications-Presentations/Publications/AI.aspx>): manual search, selected: none

CHEPA (<http://www.chepa.org/research-products/search-for-documents>): search for “fall” in publications database, results: 14, selected: none

AETMIS (<http://www.inesss.qc.ca/index.php?id=49>): manual search, selected: none

TAU of the MUHC (<http://www.mcgill.ca/tau/publications>): manual search, selected: none

MCHP (<http://mchp-appserv.cpe.umanitoba.ca/deliverablesList.html>): manual search, selected: none

IHE (<http://www.ihe.ca/publications/library/>): manual search, selected: none

ARCHE (<http://www.ualberta.ca/ARCHE/publications.htm>): manual search, selected: none

CHSPR (<http://chspr.ubc.ca/pubs/pub-search>): manual search, selected: none

II. U.K.

National Health Service Evidence (<http://www.evidence.nhs.uk/>): search for “falls prevention,” limited to last 3 years, systematic reviews, HTAs, grey literature, results: 418, selected: Chua (2011), Chung (2011) [*Note: these 2 systematic reviews had already been selected from our searches of periodical indexes*]

Healthcare Improvement Scotland

(http://www.healthcareimprovementscotland.org/welcome_to_healthcare_improvem.aspx): search for “Caring for older people” OR “Injuries, accidents and wounds” in HTA reports, results: 11, selected: none

NIHR HTA Programme (<http://www.hta.ac.uk/project/htapubs.asp>): manual search, selected: none

University of Birmingham Health Services Management Centre

(<http://www.birmingham.ac.uk/schools/social-policy/departments/health-services-management-centre/publications/index.aspx>): manual search, selected: none

III. U.S.

CTAF (<http://www.ctaf.org/assessments>): manual search, selected: Tice (2011) [*Note: this systematic review had already been selected from our searches of periodical indexes*]

AHRQ (<http://www.ahrq.gov/research/findings/index.html>): manual search of EPC Evidence-based Reports, selected: 0; manual search of Full Research Reports, selected: 0; manual search of Technology Assessments, selected: 0

NY Academy of Medicine Library Catalog (<http://nyam.waldo.kohalibrary.com/cgi-bin/koha/opac-search.pl>): search for “fall*” OR “fracture*” in title keywords, English, 2008-2013, results: 14, selected: 0

CMS (<http://www.cms.gov/medicare-coverage-database/indexes/technology-assessments-index.aspx?bc=BAAAAAAAAAAA&>): manual search, selected: 0

IV. Australia/New Zealand

Australia and New Zealand Horizon Scanning Network

(<http://www.horizonscanning.gov.au/internet/horizon/publishing.nsf/Content/technologies-assessed-lp-2>): manual search of Technologies Assessed, selected: 0

Medical Services Advisory Committee (Gov of Australia)

(<http://www.msac.gov.au/internet/msac/publishing.nsf/Content/completed-assessments>): manual search of Completed Assessments and Reviews, selected: 0; manual search of Historical Resources – Past publications, selected: 0; manual search of Publications, selected: 0

National Health and Medical Research Council (<http://www.nhmrc.gov.au/guidelines-publications>):

search for “fall prevention”, results: 23, selected: 0; search for “fall” Results: 1, selected: 0; manual search for Aged Care category publications, selected: 0

D. Article Selection

Our searches for systematic reviews retrieved 545 unique citations – 544 from PubMed, CINAHL, and EMBASE, and one from the grey literature – and our searches for randomized controlled trials (RCTs) on those databases retrieved 120 citations. The title and abstracts of the retrieved systematic review citations were screened by one reviewer (SO) and checked by a second reviewer (RK). The title and abstracts of the retrieved RCT citations were screened by the 2 reviewers, although the list was divided such that RK screened PubMed and CINAHL and SO reviewed EMBASE. On this basis, 114 papers – 62 systematic reviews and 52 RCTs – were selected for full-text review. All papers were reviewed by RK and SO who, through a process of mutual consent, selected 19 systematic reviews to be included in the synthesis. Excluded reviews and reasons for their exclusion are listed below in addition to a flow chart that illustrates the selection process.

<u>Excluded Articles</u>							
<i>Did not meet criteria for population OR did not provide enough information on age of participants*</i>	<i>Did not meet criteria for setting</i>	<i>Did not meet criteria for population or setting</i>	<i>Did not provide citations for some primary studies used in synthesis</i>	<i>Did not use institutional studies in meta-analysis</i>	<i>Older version of an updated systematic review</i>	<i>Did not meet our criteria for systematic reviews</i>	<i>No Full-Text Version available</i>
Anderson (2012) (1) Brown (2008) (2) Choi (2011) (3) Combes (2013)* (4) Healey (2008) (5) Hempel (2013) (6) Jensen (2011) (7) Miake-Lye (2013) (8) Quigley (2010) (9) Spoelstra (2012) (10)	Gregory (2009) (11) Gschwind (2011) (12) Hill (2012) (13) Low (2009) (14) Wooton (2010) (15)	Holt (2012) (16) Martin (2013) (17) Schleicher (2012) (18) Scragg (2012) (19)	Balzer (2012) (20) Beauchet (2011) (21) Sherrington (2011) (22)	Logghe (2010) (23)	Cameron (2010) (24) Sherrington (2008) (25)	Becker (2010) (26) Bischoff-Ferrari (2011) (27) Bradley (2011) (28) Clyburn (2011) (29) Cooper (2009) (30) Cozart (2009) (31) Daly (2010) (32) Granacher (2011) (33) Huang (2012) (34) Messinger-Rapport (2009) (35) Moncada (2011) (36) Ringe (2012) (37) Rose (2010) (38) Ross (2012) (39) Segev-Jacobovski (2011) (40) Wang (2010) (41)	Gatto (2011) (42) Leung (2011) (43)

Finally, we searched the reference lists of our included studies but did not identify any further relevant systematic reviews.

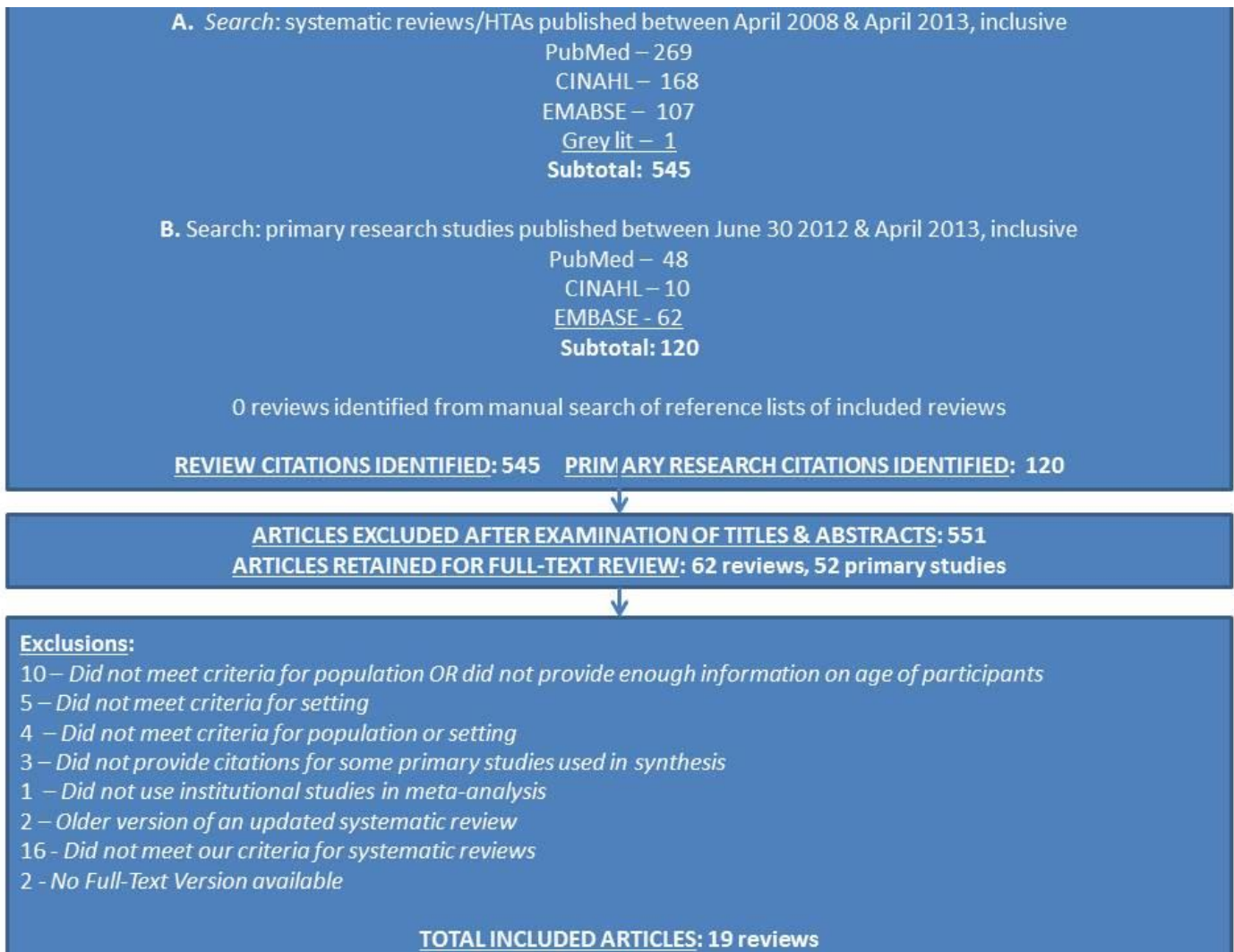
Citations for Excluded Reviews

- (1) Anderson O, Boshier PR, Hanna GB. Interventions designed to prevent healthcare bed-related injuries in patients. *Cochrane Database Syst.Rev.* 2012 Jan 18;1:CD008931.
- (2) Brown A, Coyle D, Cimon K, Farrah K editors. *Hip Protectors in Long-Term Care: A Clinical and Cost-Effectiveness Review and Primary Economic Evaluation.* Ottawa: CADTH; 2008.
- (3) Choi YS, Lawler E, Boenecke CA, Ponatoski ER, Zimring CM. Developing a multi-systemic fall prevention model, incorporating the physical environment, the care process and technology: a systematic review. *J.Adv.Nurs.* 2011 Dec;67(12):2501-2524.
- (4) Combes M, Price K. Hip protectors: are they beneficial in protecting older people from fall-related injuries? *J.Clin.Nurs.* 2013 Mar 29.
- (5) Healey F, Oliver D, Milne A, Connelly JB. The effect of bedrails on falls and injury: a systematic review of clinical studies. *Age Ageing* 2008 Jul;37(4):368-378.
- (6) Hempel S, Newberry S, Wang Z, Booth M, Shanman R, Johnsen B, et al. Hospital fall prevention: a systematic review of implementation, components, adherence, and effectiveness. *J.Am.Geriatr.Soc.* 2013 Apr;61(4):483-494.
- (7) Jensen LE, Padilla R. Effectiveness of interventions to prevent falls in people with Alzheimer's disease and related dementias. *Am.J.Occup.Ther.* 2011 Sep-Oct;65(5):532-540.
- (8) Miake-Lye IM, Hempel S, Ganz DA, Shekelle PG. Inpatient fall prevention programs as a patient safety strategy: a systematic review. *Ann.Intern.Med.* 2013 Mar 5;158(5 Pt 2):390-396.
- (9) Quigley P, Bulat T, Kurtzman E, Olney R, Powell-Cope G, Rubenstein L. Fall prevention and injury protection for nursing home residents. *J.Am.Med.Dir.Assoc.* 2010 May;11(4):284-293.
- (10) Spoelstra SL, Given BA, Given CW. Fall prevention in hospitals: an integrative review. *Clin.Nurs.Res.* 2012 Feb;21(1):92-112.
- (11) Gregory H. The effectiveness of Tai Chi as a fall prevention intervention for older adults: a systematic review. *International journal of health promotion and education* 2009 -08-01;47(3):94; 94-100; 100.
- (12) Gschwind YJ, Wolf I, Bridenbaugh SA, Kressig RW. Basis for a Swiss perspective on fall prevention in vulnerable older people. *Swiss Med.Wkly.* 2011 Nov 21;141:w13305.
- (13) Hill KD, Wee R. Psychotropic drug-induced falls in older people: a review of interventions aimed at reducing the problem. *Drugs Aging* 2012 Jan 1;29(1):15-30.
- (14) Low S, Ang LW, Goh KS, Chew SK. A systematic review of the effectiveness of Tai Chi on fall reduction among the elderly. *Arch.Gerontol.Geriatr.* 2009 May-Jun;48(3):325-331.

- (15) Wooton AC. An integrative review of Tai Chi research: an alternative form of physical activity to improve balance and prevent falls in older adults. *Orthop.Nurs.* 2010 Mar-Apr;29(2):108-16; quiz 117-8.
- (16) Holt KR, Haavik H, Elley CR. The effects of manual therapy on balance and falls: a systematic review. *J.Manipulative Physiol.Ther.* 2012 Mar-Apr;35(3):227-234.
- (17) Martin JT, Wolf A, Moore JL, Rolenz E, Dininno A, Reneker JC. The Effectiveness of Physical Therapist-Administered Group-Based Exercise on Fall Prevention: A Systematic Review of Randomized Controlled Trials. *J.Geriatr.Phys.Ther.* 2013 Feb 27.
- (18) Schleicher MM, Wedam L, Wu G. Review of Tai Chi as an effective exercise on falls prevention in elderly. *Res.Sports Med.* 2012 Jan;20(1):37-58.
- (19) Scragg R. Do we need to take calcium with vitamin D supplements to prevent falls, fractures, and death? *Curr.Opin.Clin.Nutr.Metab.Care* 2012 Nov;15(6):614-624.
- (20) Balzer K, Bremer M, Schramm S, Luhmann D, Raspe H. Falls prevention for the elderly. *GMS Health.Technol.Assess.* 2012;8:Doc01.
- (21) Beauchet O, Dubost V, Revel Delhom C, Berrut G, Belmin J, French Society of Geriatrics and Gerontology. How to manage recurrent falls in clinical practice: guidelines of the French Society of Geriatrics and Gerontology. *J.Nutr.Health Aging* 2011 Jan;15(1):79-84.
- (22) Sherrington C, Tiedemann A, Fairhall N, Close JC, Lord SR. Exercise to prevent falls in older adults: an updated meta-analysis and best practice recommendations. *N.S.W.Public.Health.Bull.* 2011 Jun;22(3-4):78-83.
- (23) Logghe IH, Verhagen AP, Rademaker AC, Bierma-Zeinstra SM, van Rossum E, Faber MJ, et al. The effects of Tai Chi on fall prevention, fear of falling and balance in older people: a meta-analysis. *Prev.Med.* 2010 Sep-Oct;51(3-4):222-227.
- (24) Cameron ID, Murray GR, Gillespie LD, Robertson MC, Hill KD, Cumming RG, et al. Interventions for preventing falls in older people in nursing care facilities and hospitals. *Cochrane Database Syst.Rev.* 2010 Jan 20;(1):CD005465. doi(1):CD005465.
- (25) Sherrington C, Whitney JC, Lord SR, Herbert RD, Cumming RG, Close JC. Effective exercise for the prevention of falls: a systematic review and meta-analysis. *J.Am.Geriatr.Soc.* 2008 Dec;56(12):2234-2243.
- (26) Becker C, Rapp K. Fall prevention in nursing homes. *Clin.Geriatr.Med.* 2010 Nov;26(4):693-704.
- (27) Bischoff-Ferrari HA. The role of falls in fracture prediction. *Curr.Osteoporos Rep.* 2011 Sep;9(3):116-121.
- (28) Bradley SM. Falls in older adults. *Mt.Sinai J.Med.* 2011 Jul-Aug;78(4):590-595.

- (29) Clyburn TA, Heydemann JA. Fall prevention in the elderly: analysis and comprehensive review of methods used in the hospital and in the home. *J.Am.Acad.Orthop.Surg.* 2011 Jul;19(7):402-409.
- (30) Cooper JW, Burfield AH. Medication interventions for fall prevention in the older adult. *J.Am.Pharm.Assoc.(2003)* 2009 May-Jun;49(3):e70-82; quiz e83-4.
- (31) Cozart HC, Cesario SK. Falls aren't us: state of the science. *Crit.Care Nurs.Q.* 2009 Apr-Jun;32(2):116-127.
- (32) Daly RM. Independent and combined effects of exercise and vitamin D on muscle morphology, function and falls in the elderly. *Nutrients* 2010 Sep;2(9):1005-1017.
- (33) Granacher U, Muehlbauer T, Gollhofer A, Kressig RW, Zahner L. An intergenerational approach in the promotion of balance and strength for fall prevention - a mini-review. *Gerontology* 2011;57(4):304-315.
- (34) Huang AR, Mallet L, Rochefort CM, Egualé T, Buckeridge DL, Tamblyn R. Medication-related falls in the elderly: causative factors and preventive strategies. *Drugs Aging* 2012 May 1;29(5):359-376.
- (35) Messinger-Rapport B, Dumas LG. Falls in the nursing home: a collaborative approach. *Nurs.Clin.North Am.* 2009 Jun;44(2):187-195.
- (36) Moncada LV. Management of falls in older persons: a prescription for prevention. *Am.Fam.Physician* 2011 Dec 1;84(11):1267-1276.
- (37) Ringe JD. The effect of Vitamin D on falls and fractures. *Scand.J.Clin.Lab.Invest.Suppl.* 2012 Apr;243:73-78.
- (38) Rose DJ, Hernandez D. The role of exercise in fall prevention for older adults. *Clin.Geriatr.Med.* 2010 Nov;26(4):607-631.
- (39) Ross MK, Egan E, Zaman M, Aziz B, Dewald T, Mohammed S. Falls in the inpatient rehabilitation facility. *Phys.Med.Rehabil.Clin.N.Am.* 2012 May;23(2):305-314.
- (40) Segev-Jacobovski O, Herman T, Yogev-Seligmann G, Mirelman A, Giladi N, Hausdorff JM. The interplay between gait, falls and cognition: can cognitive therapy reduce fall risk? *Expert Rev.Neurother* 2011 Jul;11(7):1057-1075.
- (41) Wang J, Chen Z, Song Y. Falls in aged people of the Chinese mainland: epidemiology, risk factors and clinical strategies. *Ageing Res.Rev.* 2010 Nov;9 Suppl 1:S13-7.
- (42) Gatto S, Gimigliano F, Gimigliano R, Iolascon G. Prevention of falls and role of calcium and vitamin D. *Aging Clin.Exp.Res.* 2011 Apr;23(2 Suppl):20-21.
- (43) Leung DP, Chan CK, Tsang HW, Tsang WW, Jones AY. Tai chi as an intervention to improve balance and reduce falls in older adults: A systematic and meta-analytical review. *Altern.Ther.Health Med.* 2011 Jan-Feb;17(1):40-48.

Flow Chart of Article Selection



E. Critical Appraisal

As stated in the main report, our critical appraisal methodology for systematic reviews employs AMSTAR¹, a validated measurement tool for evaluating the methodological quality of systematic reviews. AMSTAR scores range from 0 to 11. Higher scores can be taken as an indicator that the various stages of the review – e.g., literature searching, pooling of data, critical appraisal, etc. – were conducted appropriately. Each included systematic review was scored independently by both Rob Kean (RK) and Stephanie O’Brien (SO) using the AMSTAR tool. RK and SO then met and compared their appraisals, review by review, and resolved any discrepancies in score via a consensus procedure. Each then took a separate portion of the reviews and extracted relevant data into a table. Subsequently, each reviewed the other’s table entries to ensure accuracy.

¹ See: Shea, B.J., Bouter, L.M., Peterson, J., Boers, M., Andersson, N., et al. 2007. External Validation of a Measurement Tool to Assess Systematic Reviews (AMSTAR). PLoS ONE 2(12): e1350. doi:10.1371/journal.pone.0001350

Using the selection criteria outlined above in Section B of this appendix, we selected 19 systematic reviews for inclusion in the synthesis. When we totalled up all the studies included in our selected reviews and eliminated duplicates, we determined that the primary research base covered by our synthesis encompasses 290 different studies. A certain number of these studies appeared in more than one review (see Table 1 below).

# of Primary Studies	Primary studies that appeared in:										
	13 reviews	10 reviews	9 reviews	8 reviews	7 reviews	6 reviews	5 reviews	4 reviews	3 reviews	2 reviews	1 review
	2: Flicker, 2005 (1) Law, 2006 (2)	1: Grant, 2005 (3)	2: Bischoff, 2003 (4) Pfeifer, 2000 (5)	4: Broe, 2007 (6) Chapuy, 2002 (7) Trivedi, 2003 (8) Harwood, 2004 (9)	3: Chapuy, 1994 (10) Porthouse, 2005 (11) Lyons, 2007 (12)	4: Prince, 2008 (13) Lips, 1996 (14) Pfeifer, 2009 (15) Meyer, 2002 (16)	4: Gallagher, 2001 (17) Dawson-Hughes, 1997 (18) Becker, 2003 (19) Jensen, 2002 (20)	11: Bischoff-Ferrari, 2006 (21) Latham, 2003 (22) Jackson, 2006 (23) Burleigh, 2007 (24) Dyer, 2004 (25) McMurdo, 2000 (26) Dukas, 2004 (27) Ray, 1997 (28) Meyer, 2003 (29) Sanders, 2010 (30) Smith, 2007 (31)	12: Graafmans, 1996 (32) Schnelle, 2003 (33) Mulrow, 1994 (34) Kerse, 2004 (35) Komulainen, 1998 (36) Neyens, 2009 (37) Rubenstein, 1990 (38) Zermansky, 2006 (39) Ishida, 2004 (40) Tilyard, 1992 (41) Harada, 2001 (42)	45	202

Table 1: Summary of the appearance of primary studies in the reviews synthesized in this report

It should also be noted that some of the reviews in our synthesis included studies conducted in the community as well as studies that were conducted in institutional health care settings. We included such reviews only if they analyzed the institutionally-based studies separately from the rest, such that it was possible to discern a finding or findings specific to interventions delivered in those settings. For that reason, the reader may be confident that our findings accurately reflect the existing literature on falls prevention in hospitals, residential care facilities, and the like. Nevertheless, a large proportion of the 290 studies included in the reviews we synthesized were conducted in the community. Because we did not retrieve full-text versions of the individual studies, and because there was some inconsistency in the way these studies are described in the review literature, we are unable to state with total confidence the proportion that were conducted in institutional as opposed to community settings. After much careful analysis, we estimate that roughly 105 took place within institutional settings; ultimately, it is these studies that furnish the evidentiary basis for all of our findings.

Below we provide a blank version of the AMSTAR scoring sheet, a table that illustrates how each review was scored, and the data extraction tables.

REFERENCE:

AMSTAR Item	Answer
<p>1. Was an 'a priori' design provided? The research question and inclusion criteria should be established before the conduct of the review.</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't answer <input type="checkbox"/> Not applicable
<p>2. Was there duplicate study selection and data extraction? There should be at least two independent data extractors and a consensus procedure for disagreements should be in place.</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't answer <input type="checkbox"/> Not applicable
<p>3. Was a comprehensive literature search performed? At least two electronic sources should be searched. The report must include years and databases used (e.g. Central, EMBASE, and MEDLINE). Key words and/or MESH terms must be stated and where feasible the search strategy should be provided. All searches should be supplemented by consulting current contents, reviews, textbooks, specialized registers, or experts in the particular field of study, and by reviewing the references in the studies found.</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't answer <input type="checkbox"/> Not applicable
<p>4. Was the status of publication (i.e. grey literature) used as an inclusion criterion? The authors should state that they searched for reports regardless of their publication type. The authors should state whether or not they excluded any reports (from the systematic review), based on their publication status, language etc.</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't answer <input type="checkbox"/> Not applicable
<p>5. Was a list of studies (included and excluded) provided? A list of included and excluded studies should be provided.</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't answer <input type="checkbox"/> Not applicable
<p>6. Were the characteristics of the included studies provided? In an aggregated form such as a table, data from the original studies should be provided on the participants, interventions and outcomes. The ranges of characteristics in all the studies analyzed e.g. age, race, sex, relevant socioeconomic data, disease status, duration, severity, or other diseases should be reported.</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't answer <input type="checkbox"/> Not applicable
<p>7. Was the scientific quality of the included studies assessed and documented? 'A priori' methods of assessment should be provided (e.g., for effectiveness studies if the author(s) chose to include only randomized, double-blind, placebo controlled studies, or allocation concealment as inclusion criteria); for other types of studies alternative items will be relevant.</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't answer <input type="checkbox"/> Not applicable
<p>8. Was the scientific quality of the included studies used appropriately in formulating conclusions? The results of the methodological rigor and scientific quality should be considered in the analysis and the conclusions of the review, and explicitly stated in formulating recommendations.</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't answer <input type="checkbox"/> Not applicable
<p>9. Were the methods used to combine the findings of studies appropriate? For the pooled results, a test should be done to ensure the studies were combinable, to assess their homogeneity (i.e. Chi-squared test for homogeneity, I²). If heterogeneity exists a random effects model should be used and/or the clinical appropriateness of combining should be taken into consideration (i.e. is it sensible to combine?)</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't answer <input type="checkbox"/> Not applicable
<p>10. Was the likelihood of publication bias assessed? An assessment of publication bias should include a combination of graphical aids (e.g., funnel plot, other available tests) and/or statistical tests (e.g., Egger regression test).</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't answer <input type="checkbox"/> Not applicable
<p>11. Was the conflict of interest stated? Potential sources of support should be clearly acknowledged in both the systematic review and the included studies.</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't answer <input type="checkbox"/> Not applicable

Review	AMSTAR Item											Total
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	
Avenell 2009	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	9/11 (82%)
Cameron 2012	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	9/11 (82%)
Gillespie 2010	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	9/11 (82%)
Murad 2011	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	9/11 (82%)
Kalyani 2010	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	8/11 (73%)
Sawka 2010	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	8/11 (73%)
Cusimano 2008	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	7/11 (64%)
DiBardino 2012	No	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	6/11 (55%)
Church 2011	No	Yes	Yes	No	Yes	Yes	No	No	Yes	No	No	5/11 (45%)
Tice 2011	No	No	Yes	No	No	Yes	Yes	Yes	Yes	No	No	5/11 (45%)
Bischoff-Ferrari 2009a	No	No	Yes	No	No	Yes	No	No	Yes	Yes	No	4/11 (36%)
Bischoff-Ferrari 2009b	No	No	Yes	No	No	Yes	No	No	Yes	Yes	No	4/11 (36%)
Neyens 2011	No	Yes	Yes	No	No	Yes	No	No	Yes	No	No	4/11 (36%)
Choi 2012	No	No	No	No	No	Yes	No	No	Yes	Yes	No	3/11 (27%)
Chung 2011	Yes	No	No	No	No	Yes	No	No	Yes	No	No	3/11 (27%)
Chung 2011	Yes	No	No	No	No	Yes	No	No	Yes	No	No	3/11 (27%)
Bischoff-Ferrari 2012	No	No	No	No	No	Yes	No	No	Yes	No	No	2/11 (18%)
Chua 2011	No	No	No	No	No	Yes	No	No	Yes	No	No	2/11 (18%)
Lai 2010	No	No	No	No	No	Yes	No	No	Yes	No	No	2/11 (18%)
Stern 2009	No	No	No	No	No	No	No	No	Yes	No	No	1/11 (9%)

E. Data Extraction

The information contained in the “Review authors’ assessment...” and “Main Findings” columns below include mainly direct quotations from the review articles included in our synthesis. The claims of primary study quality, the strengths and weaknesses of the review articles, and the evidence findings are those as stated by the review authors and have not been interpreted or altered by the CHRSP project team members.

Citation, AMSTAR score, type & number of included studies	Setting(s)	Intervention(s)	Review authors’ assessment of review & included study quality	Main Findings
<p>Cameron (2012)</p> <p>9 (82%) (Cochrane)</p> <p>60 RCTs</p>	<p>Care facilities (high-level, intermediate and mixed levels of care) and hospitals (acute and sub-acute care)</p>	<p>Care facilities: Single, multiple or multifactorial interventions including one or more of</p> <ul style="list-style-type: none"> • exercise • medication (medication review, vitamin D supplementation with or without calcium co-supplementation) • environment or assistive technology • social environment (staff training, service model change) • lavender olfactory stimulation • sunlight exposure • multisensory stimulation <p>Hospitals: single or multifactorial interventions including one or more of</p> <ul style="list-style-type: none"> • exercise 	<p>“This review containing 60 trials (60,345 participants) does not provide robust evidence regarding effective interventions for reducing falls.... Studies in this review varied widely in quality. Risk of bias for sequence generation was judged to be low in 40 of the 60 trials. For concealment of allocation prior to group assignment risk of bias was low in 26 (43%) and unclear in 28 (47%)” (p16).</p>	<p>Care Facilities</p> <ul style="list-style-type: none"> • “Currently, there is no evidence overall that exercise reduces falls in care facilities of high level or intermediate level care [Rate of falls: RaR 1.03, 95% CI 0.81–1.31, 8 trials, n=1844; Risk of falling: 1.07, 95% CI 0.94–1.23, 8 trials (Faber 2006, Mulrow 1994, Rosendahl 2008, Schoenfelder 2000, Kerse 2008, Sakamoto 2006, Shimada 2004, Sihvonen 2004)] (p1) but may be more effective in less frail residents. Of the exercise types tested [see p10], only balance training using mechanical apparatus in intermediate level care facilities was effective, but the adoption of these interventions may be problematic. These interventions were supervised perturbed gait exercises on a treadmill and balance training using computerized visual feedback. • Results relating to medication review by pharmacists are equivocal, and we cannot draw any conclusions for clinical practice from this review. • The prescription of vitamin D in care facilities is effective in reducing rate of falls (RaR 0.63, 95% CI 0.46–0.86, 5 trials, n=4603) [see p2]. • There is currently no evidence of effect from interventions targeting staff and the organisation of care [see p15]. • Some falls prevention programmes that target multiple individual risk factors (classified as multifactorial interventions) may be effective but the evidence is not conclusive [Rate of falls: RaR 0.78, 95% CI 0.59–1.04, 7 trials (Becker 2003, Dyer 2004, Jensen 2002, Kerse 2004, McMurdo 2000, Neyens 2009, Rubenstien 1990), n=2876; Risk of falling: RR 0.89, 95% CI 0.77–1.02, 7 trials (Becker 2003, Dyer 2004, Jensen 2002, Kerse 2004, McMurdo 2000, Rubenstien 1990, Shaw 2003), n=2632] (see pp12&16). <p>Hospitals</p> <ul style="list-style-type: none"> • Providing additional physiotherapy (supervised exercises) in subacute wards may reduce risk of falling [RR 0.36, 95% CI 0.14–0.93, 2 trials (Donald 2000, Jarvis 2007), n=83] • There is currently no evidence of effect from interventions targeting staff and the

Citation, AMSTAR score, type & number of included studies	Setting(s)	Intervention(s)	Review authors' assessment of review & included study quality	Main Findings
		<ul style="list-style-type: none"> • medication (Vitamin D + calcium) • environment of assistive technologies (furnishings or adaptations, communication aids) • social environment (staff training, service model change) • knowledge interventions 		<p>organisation of care [see p15].</p> <ul style="list-style-type: none"> • Increasing patients' awareness of their falls risk and teaching risk reduction strategies may reduce risk of falling in the acute setting [RR 0.29, 95% CI 0.11–0.74, 1 trial (Ang 2011), n=1822] • Multifactorial programmes for patients who have longer lengths of stay are effective, but no recommendations can be made regarding any particular component of these programmes" (p18). <p>Additionally:</p> <ul style="list-style-type: none"> • WRT to environment/assistive technology interventions in hospital: "Carpet flooring in a sub-acute ward appeared to significantly increase falls compared with vinyl flooring. There was no effect on falls of low-low beds or using identification bracelets for patients at high risk" (p15).
<p>Avenell (2009)</p> <p>9 (82%)</p> <p>n=45 RCTs (two were quasi-randomized & one was cluster randomized)</p>	<p>Mixed settings but subgroup analysis for studies conducted in institutions.</p>	<p>Supplemental vitamin D (D₂ or D₃) or related analogues (alfacalcidol, calcitriol) with or without calcium co-supplementation</p>	<p>"Reporting of the attributes which made up the methodological evaluation varied widely. Allocation concealment was adequately reported in 17 (38%) of the included trials, unclear in 26 and not adequate in two. Five trials did not provide the number of participants allocated to groups at randomisation, and one trial provided this information after contacting the author. One large trial provided results but very sparse methodological data. Adequate details of withdrawals and exclusions after treatment assignment were provided in 21 trials (47%). No attempt was reported to blind assessors to treatment assignment in 13 trials (29%). The intervention and control groups were demonstrably comparable in 26 trials (58%). In</p>	<p>Apartment Houses for the Elderly</p> <p>"...there is evidence supporting the hypothesis, examined in a pre planned subgroup analysis, that Vitamin D in doses of 700-800 IU daily, with co-administration of 1000 mg calcium, is effective in reducing the rate of hip fractures in frail older people in institutional care (two trials, 3853 participants, RR 0.75, 95%CI 0.62–0.92). Both these studies [Chapuy et al, 1994 & 2002], reported 10 years apart, were from the same research group in France. It remains unclear whether the results are generalisable to other health and social care systems" (pp10-11).</p> <p>"A larger body of evidence from the UK and USA, again synthesized in a pre-planned subgroup analysis, suggests that administration of Vitamin D with co-administration of calcium may not be effective when offered to older people living in the community (six trials, 42,805 participants, RR 0.91, 95% CI 0.76–1.08). This is a reasonably robust finding. Given the greater costs per person of this combined regimen, and the continuing doubt about its effectiveness in this setting, its implications require thoughtful consideration. Some caution is required in the interpretation of these results as the risk ratios for the two subgroups were not statistically significantly different" (p11).</p>

Citation, AMSTAR score, type & number of included studies	Setting(s)	Intervention(s)	Review authors' assessment of review & included study quality	Main Findings
			62% and 60% of trials respectively, the participants and/or providers were blinded to treatment allocation. In the majority of trials (N = 36, 80%) the comparable nature of the care programs, other than the trial interventions, was not reported. The inclusion and exclusion criteria were clearly defined in 36 trials (80%). Only 18 trials (40%) collected outcome data on fractures as they occurred and confirmed them by interview and radiograph" (p6).	
<p>Gillespie (2010)</p> <p>9 (82%) (Cochrane)</p> <p>16 RCTs/quasi-RCTs</p>	Mixed settings but subgroup analysis for studies conducted in institutional care	Hip protectors	<p>"Despite the contribution of large numbers of researchers, carers and participants over twenty years, we found the quality of evidence to be, overall, limited.... The large proportion of 'Unclear' assessments reflects the detail of reporting, a matter not always in the hands of the trialists, since it may also reflect editorial policy and revision.... Blinding of participants and of carers has usually not been possible, leaving open always the possibility of ascertainment bias. Bias associated with poor adherence was assumed in all studies, and we did not record it in the risk of bias summary data. The risk of selection bias is high in any cluster-randomised trial where participants are recruited over time; their admission to a particular nursing home or ward may not have been a random event. While we felt confident that</p>	<p>Nursing or Residential Care Settings</p> <p>"Inclusion of all eligible randomised and quasi-randomised studies continues to indicate, overall, that a policy of providing hip protectors may reduce the incidence of hip fractures in older people. However, measured by pooled risk ratio, this finding is only marginally statistically significant, and significance is lost on exclusion of studies highly susceptible to bias in the key domain of allocation concealment. There is no evidence that provision of hip protectors significantly changed the incidence of pelvic fracture, other fractures, or falls" (p11).</p> <ul style="list-style-type: none"> • "...provision of hip protectors to older people who are residents of nursing care facilities may reduce the number of hip fractures [RR 0.81, 95%CI 0.66-0.99, 13 trials (Jantti 1996, Chan 2000, Hubacher 2001, Cameron 2001, Van Schoor 2003, Lauritzen 1993, Ekman 1997, Kannus 2000, Harada 2001, Meyer 2003, O'Halloran 2004, Kiel 2007, Koike 2009)] The statistical, and thus the clinical, significance of the protective effect is unclear. • Provision of hip protectors does not reduce the incidence of hip fractures in older people who remain ambulant in the community [3 pooled studies]. • Poor acceptance and adherence by older people offered hip protectors have been key factors contributing to the continuing uncertainty [see pp8-9 for a discussion of a&a]" (p13).

Citation, AMSTAR score, type & number of included studies	Setting(s)	Intervention(s)	Review authors' assessment of review & included study quality	Main Findings
			<p>most studies provided robust hip fracture data, we were less confident about the data on falls. The heterogeneity between studies [that measured falls] may represent selection bias, through failure of allocation concealment, or ascertainment bias in the recording of fall events. But it may also reflect systematic differences in other aspects of care between individual nursing homes or wards, introducing co-intervention bias" (p12).</p>	
<p>Murad (2011) 9 (82%) 26 RCTs</p>	<p>Mixed settings but subgroup analysis for studies conducted in institutional settings</p>	<p>Vitamin D, D₂, or D₃ with or without calcium co-supplementation</p>	<p>"Two studies used cluster randomization, and clusters were geographically defined [separate parts of residential care facilities in one study and outpatient public social service centers in the second study]. Allocation was concealed in 18 of 26 trials, and both patients and caregivers were blinded in 18 of 26 trials. Loss to follow-up was not reported in nine of 26 trials, and the proportion of patients lost to follow-up ranged from 0–52% with a mean of 10%. Funding included for-profit resources in 34% of studies" (p2999).</p> <p>"The overall quality (risk of bias) of this evidence is graded as moderate due to the moderate unexplained heterogeneity noted in the meta-analysis and the possibility of publication bias" (p3005).</p>	<p>Geriatric Rehab/Nursing Homes "Vitamin D was associated with statistically significant reduction in the risk of falls (OR for the risk of suffering at least one fall, 0.86; 95% CI, 0.77–0.96; I² = 66%; 26 studies; Fig. 2).... We found no significant subgroup-effect interactions for analyses based on patients' dwelling (institutionalized: n=10, OR 0.87, 95% CI 0.71–1.07, P interaction test 0.51).... A statistically significant interaction between the risk of fall and calcium co-administration status was found ($P = 0.01$), suggesting that the reduction in the risk of fall was greater when calcium was administered to both study arms." (p2999).</p> <p>"Bischoff-Ferrari <i>et al.</i> conducted a meta-analysis that evaluated the effects of vitamin D supplementation on falls that was updated in 2009 ["Fall prevention with..."]. Our estimate of the risk of falls is similar to theirs (OR of 0.84 vs. 0.87), which validates both estimates" (p3003).</p> <p>"The existing body of evidence supports a reduction in the risk of falls caused by vitamin D.... The appropriate dose and duration of vitamin D treatment, as well as the target population for this intervention are yet to be fully defined.... Vitamin D combined with calcium reduces the risk of falls. The reduction in studies without calcium co-administration did not reach statistical significance" (p3004).</p>

Citation, AMSTAR score, type & number of included studies	Setting(s)	Intervention(s)	Review authors' assessment of review & included study quality	Main Findings
<p>Kalyani (2010)</p> <p>8 (73%)</p> <p>17 RCTs (10 in primary analysis, 7 in post hoc analysis)</p>	<p>Mixed settings but subgroup analysis for studies conducted in hospital or institutional settings</p>	<p>Vitamin D with or without calcium co-supplementation</p>	<p>“In general, methodological quality of included studies was good. All studies had clearly defined eligibility criteria and therapies and reliable fall ascertainment. All studies were double-blind except for one, which did not clearly mention the method of blinding and may have been subject to detection bias; in this study, a subgroup of participants was followed as part of a larger, observational study and randomized to vitamin D treatment. Sequence generation was adequately described in all studies except four. In three of these studies there was insufficient information on allocation concealment, which may have made them vulnerable to selection bias. At least one of the following was absent or unclear in three studies. Incomplete outcome data addressed, similar rates of follow-up, and reasons for loss to follow-up, rendering these studies vulnerable to attrition bias. Reasons for exclusion were described in all studies except one. Baseline characteristics were dissimilar between study arms in two studies because of differences in previous fracture rate or anticoagulant use and were unclear in two studies. Statistical methods were described in all studies. Prospective sample size justification was not clearly stated</p>	<p>Residential Care Homes/Acute Care/Rehab</p> <p>Relative risk of falling (95% CI) for hospitalized or institutionalized subgroup (n=5) was 0.9 (0.8—1.01).</p> <p>“An overall RR of 0.86 (95% CIT = 0.79—0.93) suggested a 14% lower risk of falls. The effect of vitamin D on fall reduction was significant in several subgroups of individuals: community-dwelling participants with a mean age younger than 80, adjunctive calcium therapy, no history of fracture or fall, duration longer than 6 months, dose of 800 IU or greater, and cholecalciferol therapy, although no evidence was found of a linear association between higher doses of vitamin D or longer duration of vitamin D therapy and treatment effect (p1308).</p>

Citation, AMSTAR score, type & number of included studies	Setting(s)	Intervention(s)	Review authors' assessment of review & included study quality	Main Findings
			in three studies, whereas intention-to-treat analysis was clearly stated in all but one study" (p1302).	
<p>Sawka (2010)</p> <p>8 (73%)</p> <p>20 RCTs (12 not included in Cameron, 2012)</p>	<p>Institutions (nursing homes, homes for the aged, geriatric hospitals)</p>	<ul style="list-style-type: none"> • Hip protectors • exercise/behavioral or multimodal interventions • vitamin D with or without calcium sun exposure 	<p>"This scoping review is subject to several limitations, including a relative paucity of large trials... the relatively small size of some of the included studies, the imputation of intra-cluster correlation coefficients for pooled cluster randomized studies not reporting this value, the inherent methodologic limitations of many of the primary studies (such as poor reporting of compliance rates, a lack of placebo or sham interventions for trials of some interventions, and the lack of reporting of intention-to-treat analyses for some studies), the possibility of reporting bias, and the potential for publication bias (as only published studies were included).... The strengths of this review include the relatively broad scope of interventions examined, the use of systematic search strategies, duplicate reviews and duplicate abstraction of data, and the use of a Bayesian meta-analysis model designed for pooling of data from individually and cluster-randomized trials, and the examination of a clinically important outcome" (p9).</p>	<p>Nursing Homes</p> <ul style="list-style-type: none"> • "In pooling data from trials of oral vitamin D compared to placebo or usual care (12,875 individuals) [Chapuy 1994 & 2002, Flicker 2005, Law 2006, Lyons 2007, Meyer 2002, Sato, 2005], the odds ratio (OR) for hip fracture in the vitamin D-treated group was 0.86, 95% credibility interval, 0.74–0.98" (p3) • "The pooled odds ratios (with 95% CRI) for hip fracture in the treatment group according to type and dose of vitamin D are as follows: vitamin D3 (any dosage) - OR 0.78, CI 0.63–0.93 (data from 3 trials [Chapuy 1994 & 2002, Meyer 2002], n = 4997), vitamin D3 at a dosage of ≥800 IU/day (with 1.2 g elemental calcium daily) – OR 0.71, CI 0.55–0.87 (data from 2 trials [Chapuy 1994 & 2002], n= 3853), vitamin D2 – OR 0.99, CI 0.79–1.22 (data from 4 trials [Flicker 2005, Law 2006, Lyons 2007 Sato, 2005], n= 7878)" (p3) • "...we found evidence that supplementation with Vitamin D, particularly Vitamin D₃ ≥800 IU [orally] daily, reduces the risk of hip fracture in elderly nursing home residents. These results are in keeping with prior results of meta-analyses by Bischoff-Ferrari et al. [2009-"Prevention..."], particularly for doses of vitamin D3 exceeding 400 IU per day..." (p8). • "...sunlight exposure... was [not] found to significantly reduce hip fractures" (p8); [OR 0.43, 95% CI 0.10–1.83, n =522, data from 2 studies, Sato 2003 & 2005] (p3) • "...we also found some evidence that hip protectors may reduce the risk of hip fracture in institutionalized elderly in a pooled analysis of 2-sided devices" [5 studies, all included in Gillespie, 2010- Sakamoto 2006, Ekman 1997, Harada 2001, Jantti 1998, Meyer 2003, Koike, 2009]," [OR 0.40, 95% credibility interval 0.27–0.56, n= 2,594] though "[c]ontinued debate and uncertainty about the efficacy of hip protectors is expected, given the heterogeneity of findings between studies of 2-sided and 1-sided devices" (p8). • Falls were reduced in 2 of 3 studies of multimodal interventions [RR 0.55, CI 0.41–0.73, n = 981 (Becker 2003); Risk Ratio 0.78, CI 0.64–d 0.96, n=384 (Jensen 2002)] (p8); the authors noted that the ineffective multimodal intervention lacked the following components: <ul style="list-style-type: none"> ○ Environmental hazard checks ○ Exercise training ○ Provision of hip protectors to targeted residents (p8) • Fractures were reduced in 1 of 3 studies [RR 0.23, CI 0.06–0.94, n=384 (Jensen 2002)] (p8) of multimodal interventions; the authors noted that the ineffective multimodal interventions lacked the following components:

Citation, AMSTAR score, type & number of included studies	Setting(s)	Intervention(s)	Review authors' assessment of review & included study quality	Main Findings
				<ul style="list-style-type: none"> ○ Ongoing support on falls prevention (post-fall problem-solving conferences, ongoing discussion about safety issues re: fall-prone residents) ○ Supply and repair of mobility aids ○ Medication adjustments
<p>Cusimano (2008)</p> <p>7 (64%, 5 RCTs (all included in Cameron)</p>	Residential care facilities	<ol style="list-style-type: none"> 1) Risk assessment 2) Staff/resident education 3) Environmental modification 4) Exercise 5) Medication review 	<p>“All of the included studies were controlled and had random assignments to control and intervention groups. Four of the five included studies performed analyses appropriate for cluster randomization” (p121).</p>	<p>Residential Care</p> <ul style="list-style-type: none"> • “This review found evidence that multifaceted falls-intervention programs can significantly reduce the number of recurrent fallers among the elderly living in residential care facilities.” (p121) • “The best available evidence, albeit limited in quantity and quality, suggests that a multifaceted intervention program comprising resident-specific, group-specific, and general intervention strategies designed for residents living in residential care facilities is likely to be effective in reducing falls (p121) • “Resident-specific intervention strategies include drug regimen reviews for residents with specific side effects believed to increase the risk of falling. Group-specific strategies commonly take the form of group exercise sessions. General intervention strategies include resident and staff education on falls prevention and environmental modification to the nursing home to reduce safety hazards, which may increase the risk of falling.... In a setting of limited resources, a reasonable approach for practitioners would be to focus on high risk groups such as recurrent fallers because they contribute substantially to the overall health burden caused by falls in the elderly. Studies included in this review showed that multifaceted programs significantly reduce the number of recurrent fallers. These studies shared common general intervention strategies including environmental modification and education on falls prevention and specific strategies tailored to the needs of individual residents, such as medication reviews and the provision of hip protectors for recurrent fallers” (p121).
<p>DiBardino (2012)</p> <p>6(55%)</p> <p>1 RCT (included in Cameron, 2012), 1 quasi-experimental design, and 4 pre-post</p>	Institutional (general medicine or geriatric wards)	<p>Multifactorial intervention based on an initial fall risk assessment followed by one or more of the following:</p> <ul style="list-style-type: none"> • mobility assessment and assistance • Mobility aid • medication modification • education 	<p>“The quality assessment results scores ranged from 11 to 14 out of a possible 20. None of the studies explicitly used an intention-to-treat statistical model, as the nature of inpatient care largely prevents drop-out or crossover, and all patients were included in individual study results” (p498).</p> <p>“Our study has several limitations; most notably, the available evidence is limited in quality and</p>	<p>Acute Care</p> <p>“Our major finding is that multidisciplinary fall prevention strategies have a statistically significant impact on fall rates with a combined OR of 0.90. While this review demonstrates a significant benefit to multidisciplinary fall prevention strategies in the acute inpatient population, the clinical impact of these efforts may be limited. Based on rates ranging from 1.7 to 9.5 falls per 1000-patient days, multidisciplinary interventions would reduce falls by 1 to 10 falls per 10,000-patient days using the combined OR calculated of 0.9. Using other available incidence data regarding inpatient falls, a reasonable baseline frequency to consider would be 8 falls per 1000 patient-days. Assuming that prevalence, the number needed to treat (NNT) to prevent a single inpatient fall is 1250 patient days. Furthermore, based on available data, only approximately one-third of these falls result in injury and only a minor fraction of these results in serious injury. The magnitude of this apparent benefit in the context of fall incidence rates raises some concerns about cost-effectiveness given the</p>

Citation, AMSTAR score, type & number of included studies	Setting(s)	Intervention(s)	Review authors' assessment of review & included study quality	Main Findings
		<ul style="list-style-type: none"> fall risk sign/warning in chart bedside tools (bed alarm, rail adjustment, bed location/position, etc.) toileting schedule exercise program other (sitter, reassess patients who fell, detailed system to track falls, ward modifications based on OT assessment, frequent bed checks) 	<p>quantity.... [I]t is difficult to adequately blind when studying a multidisciplinary fall intervention that depends on patient and provider participation. As a result, none of the papers reviewed met criteria for high quality. However, almost all available data examined in this review came from large sample sizes in which thoughtful interventions were used.... However, each study used risk assessment tools, which are poor indicators of who will and will not fall in the hospital. This may suggest a need for improved risk assessment tools, or be further evidence to include all patients in fall prevention regardless of risk" (p501).</p>	<p>high staffing and systems needs that multidisciplinary prevention programs require" (p500).</p> <p>"The complexity of the interventions used may help explain the limited impact.... Adoptability of a multidisciplinary intervention will clearly impact adherence and the intervention's ultimate effectiveness. Single intervention strategies, not analyzed in this review, are simpler to execute and adhere to..." (p500-1).</p> <p>"In contrast to our findings, a modest risk reduction has been demonstrated in several primary articles and meta-analyses in the subacute, rehabilitation, and long-term care populations.... One important difference between these settings and the acute inpatient populations may be the amount of time and energy that can be dedicated to fall prevention and overall care planning. Another likely factor is the added challenge of preventing falls in patients with more active medical illnesses" (p501).</p>
<p>Church (2011)</p> <p>5 (45%)</p> <p>131 RCTs [31 on residential care]</p>	<p>Mixed settings but subgroup analysis for studies conducted in residential aged care facilities</p>	<p>Single, multiple or multifactorial interventions include one or more of:</p> <ul style="list-style-type: none"> Exercise Tai chi vitamin D with or without calcium hip protectors clinical medication review 	<p>"The evidence for the effectiveness of some interventions is based on limited data from a small number of studies or studies with few participants. Sensitivity analysis has been conducted to test any uncertainty but caution is still warranted in interpreting the results. Another consideration is that some interventions are targeted at specific patient groups; therefore extrapolating the effectiveness results to a general population may yield different results" (p66).</p>	<p>Residential Care</p> <p>"Those interventions that significantly (statistically significant at the 95% level) reduce the risk of falling were; vitamin D, hip protectors, medication review, multiple interventions and multi-factorial interventions" (p30 in the 2010 publication).</p> <p>Statistically significant rate ratios (95% CI)</p> <ul style="list-style-type: none"> Vitamin D supplementation – daily 1000 IU dose plus 600 mg of calcium [0.86, 0.83–0.9] Hip Protectors [0.78, 0.73–0.84] Medication review – medication management review by a GP and a residential medication management review by an accredited pharmacist [0.59, 0.49–0.7] Multiple interventions – PT visit, consultation with a residential aged care nurse, falls prevention information, occupational therapist visit, participation in a group-exercise program and hip protectors [0.52, 0.47–0.57] Multi-factorial intervention – falls risk assessment and follow-up visit by a physician, hip protectors, and hazard modifications by an occupational therapist [0.76, 0.59–0.97] (pp 62 & 64 and pp30-31 in the 2010 publication). <p>Non-significant rate ratios:</p> <ul style="list-style-type: none"> Exercise (0.79, 0.56–1.11)

Citation, AMSTAR score, type & number of included studies	Setting(s)	Intervention(s)	Review authors' assessment of review & included study quality	Main Findings
				<ul style="list-style-type: none"> Tai Chi (0.96, 0.79—1.17) Assessment and referral alone, in the absence of other multi-factorial intervention components (1.34, 1.06—1.69)
<p>Tice (2011)</p> <p>5 (45%)</p> <p>25 RCTs or “pseudo-RCTs”</p>	<p>Mixed settings but subgroup analysis for studies conducted in institutional settings</p>	<p>Vitamin D₂ or D₃ with or without calcium co-supplementation</p>	<p>“The quality of the randomized trials was uneven. Four of the trials used pseudo-randomization by birthdate to allocate patients to either vitamin D or the control group which may have introduced some selection bias as the staff and investigators could predict a potential participant’s allocation based on their birthdate. Another two trials used cluster randomization, but one had a small number of clusters and neither adjusted for clustering effects in their primary analysis. Seven of the trials did not use a placebo in the control group, effectively unblinding the study. Despite randomization, five of the trials had significant differences between the intervention and control groups. In addition, eleven of the trials did not blind their outcome assessment or did not report blinding for the assessment of study outcomes” (p24).</p>	<p>“For studies that sampled participants living in institutional settings, daily vitamin D plus calcium reduced all fractures by 26% (RR 0.74, 95% CI 0.62 to 0.88, p = 0.001)...” (p33).</p> <p>“In summary, daily vitamin D plus calcium significantly reduced the risk of incident fractures for individuals living in either an institutional or community setting.... The results did not change during sensitivity analyses that dropped each study individually and dropped the poor quality studies” (p37).</p> <p>“Using meta-regression, calcium supplementation was the only characteristic found to significantly change the effect of vitamin D on incident fractures. Vitamin D therapy alone was ineffective, but vitamin D plus calcium reduced total fractures by 14% and hip fractures by 18%. There were trends towards greater relative benefit for patients living in institutional settings and in patients with lower baseline 25(OH)D blood levels, but these were not statistically significant. The form of vitamin D used and the dose used did not change the efficacy of vitamin D plus calcium therapy. All of the trials of vitamin D plus calcium used a daily dosing schedule, so the efficacy of less frequent dosing when combined with calcium therapy remains unknown. There was no evidence in support of interactions by age, sex, or prior fracture history. Based on these studies, 400 to 800 IU of vitamin D taken daily with 1000 to 1200 mg of calcium supplementations reduces fractures by approximately 14%. Other recent meta-analyses agree with this conclusion. The greatest absolute benefits are for individuals at high risk for fracture, such as those over the age of 70 or those with prior osteoporotic fractures” (p44).</p>
<p>Bischoff-Ferrari (2009a – “Fall...”)</p> <p>4 (36%)</p> <p>n=17 (10 RCTs in meta-</p>	<p>Mixed settings but subgroup analysis for studies conducted in institutions.</p>	<p>Supplemental (D₂ or D₃) or active forms of vitamin D with or without calcium co-supplementation</p>	<p>“With respect to trial quality, our primary analysis was restricted to trials with a double blind design and sufficient quality fall assessment to address the efficacy of vitamin D for fall prevention. In our sensitivity analysis that included additional trials with an open study design or insufficient fall assessment, study variation was larger than expected for the</p>	<p>Residential Care/Nursing Homes/Apt Houses for Elderly</p> <p>“Daily [supplemental] vitamin D doses in the range of 700 IU to 1000 IU or achieved serum concentrations between 60 nmol/l and 95 nmol/l reduced the risk of falling by 19%. Given the absence of data beyond these beneficial ranges, our analyses don’t preclude the possibility that higher doses of vitamin D or higher achieved 25 (OH)D concentrations would have been even more efficient in reducing falls.... Notably, fall prevention with a high dose might not depend on additional calcium supplementation...” (p8).</p> <p>“The benefits of 700-1000 IU vitamin a day on risk of falls were present in both ambulatory and institutionalized older individuals” (p6). [institutionalized group, n=3 (Broe, 2007; Flicker, 2005; Bischoff, 2003): RR 0.86, 95% CI 0.7—1.07, P value (diff between subgroups)]</p>

Citation, AMSTAR score, type & number of included studies	Setting(s)	Intervention(s)	Review authors' assessment of review & included study quality	Main Findings
analysis, 7 controlled trials with an open design or insufficient fall assessment in sensitivity analysis)			pooled result from all 15 trials. Even within the 14 high dose trials, variation between trials was larger than expected, supporting our pre-defined strategy of focusing on fall efficacy from double blind trials with sufficient fall assessment" (p9).	0.46] "...good adherence is essential as the effect of vitamin D on falls will not be proportional below 700 IU a day. Furthermore, it is possible that greater benefits may be achieved with the use of vitamin D ₃ instead of vitamin D ₂ . Finally, active forms of vitamin D do not appear to be more effective than 700-1000 IU of supplemental vitamin D for fall prevention in older persons." (p9)
Bischoff-Ferrari (2009b – "Prev...") 4 (36%) <i>n</i> =23 (19 RCTs + 4 open study designs in sensitivity analysis)	Mixed settings but subgroup analysis for studies conducted in institutions	Supplemental vitamin D (ergocalciferol or cholecalciferol) with or without calcium co-supplementation	"We performed sensitivity analyses, including 4 open study design trials.... [T]he study variation was larger than expected for the pooled result from all 16 trials. Even within the higher received dose, adding 3 open study design trials to the 9 double-blinded trials, variation was larger than expected (pooled RR, 0.83; 95% CI, 0.74-0.95) supporting our predefined strategy of focusing on fracture efficacy from double-blinded trials" (p559).	Residential Care/Nursing Homes/Apt Houses for Elderly "...the antifracture efficacy of supplemental vitamin D increased significantly with higher received dose or higher achieved 25-hydroxyvitamin D levels for any nonvertebral fractures and for hip fractures. No fracture reduction was observed for a received dose of 400 IU/d or less, whereas a higher received dose of 482 to 770 IU/d of supplemental vitamin D reduced nonvertebral fractures by 20% and hip fractures by 18%.... Nonvertebral fracture reduction with the higher received dose was significant among all subgroups by age and dwelling [institutionalized group: <i>n</i> =4 (Chapuy, 1994 & 2002; Flicker, 2005; Lyons, 2007), RR 0.85, 95% CI 0.76—0.94, P value (difference between subgroups) 0.09]..." (pp555-7). "To our knowledge, the type of supplemental vitamin D was not addressed previously. With a higher received dose, the pooled effect of cholecalciferol was significant with 23% fracture reduction, whereas the pooled effect with ergocalciferol was not significant with 10% fracture reduction" (p559).
Neyens (2011) 4 (36%) 20 RCTs	Institutions (nursing homes, care homes, residential care facilities, etc.)	One or more of: <ul style="list-style-type: none"> • assessment (CGA, transfer & ambulation, medication review, environment/personal safety, use of aids) • exercise/PT • staff education • improving environmental/personal safety • resident education 	"The methodological quality of the studies was variant. Most of the studies were cluster randomized; some studies used individual randomization. Blinding of participants and care staff delivering the interventions was generally not possible. The outcome assessment varied enormously... The follow-up duration varied from 4 to 24 months. The compliance of target population with the intervention varied from 37% to 100%.... In general, design, conduct, and analyses of the individual RCTs	Long-term Care Facilities "Because of the limited number of included trials, the evidence is inconclusive for multifaceted and single interventions in residential care facilities and nursing homes. Most of the reviewed studies did not find a significant positive effect on fall incidents.... [Furthermore] [a]n intervention that may be effective in itself, might not yield favorable effects if the intervention is not implemented according to plan, is badly complied with, and/or encounters serious obstacles in daily practice.... Yet our data support Gillespie et al's [2003] findings that multifactorial interventions seem more likely to be beneficial in long-term care populations, [although] single interventions may be effective.... We recommend that health care professionals who wish to reduce fall incidents in long-term care facilities develop interventions specifically tailored to their long-term care setting and residents. These interventions can be based on the findings of this study. In our opinion, it is extremely important that tailor-made intervention programs are tested first on a small scale to assess their implementation aspects for a particular setting and to improve program weaknesses. Special attention must go to actively monitoring correct implementation, improving compliance, and safeguarding the availability of human and material resources" (pp417 &

Citation, AMSTAR score, type & number of included studies	Setting(s)	Intervention(s)	Review authors' assessment of review & included study quality	Main Findings
		<ul style="list-style-type: none"> • change in medication • referral to relevant discipline • hip protector • supplying/repairing g aids • other (recommendations to GP, incontinence care) 	<p>were adequately described. However, differences in target groups, interventions, and outcome measures may explain the inconsistent results" (p424).</p>	<p>424).</p>
<p>Choi (2012) 3(27%) 17 RCTs</p>	<p>Mixed settings but subgroup analysis for studies conducted in nursing homes</p>	<p>Single or multifactorial interventions of varying intensities that may include one or more of the following:</p> <ul style="list-style-type: none"> • a comprehensive medical exam • occupational therapy assessment • activities of daily living • home environmental and behavior assessment • cognition assessment • gait stability • medication review • staff training • education for residents 	<p>"...in fall-intervention RCT studies, blinding the control group to such prevalent ambient sources of information about evolving practices and assistive equipment is nearly impossible. None of the studies reported blinding. Unlike blinding, studies with allocation concealment reported to reduce selection bias and protect the randomization were few.... Therefore, it is difficult to examine the literature in aggregate and derive an intervention, or set of interventions, that truly seems to lend itself to recommendations that providers can efficiently incorporate into their practice" (p188e20).</p> <p>"The variety of outcome measurement methods used to determine and report patient fall rates in our selected studies made it difficult to compare overall fall rates between institutions and patient care" (p188e20).</p>	<p>Nursing Homes "The subgroup analysis of all 17 studies demonstrated as follows:an inconceivable 54% fall reduction in nursing homes [<i>n</i>=3] (RR = 0.453; z = -9.366; 95% CI = 0.384—0.535; P = .000) with study variations between the groups.... Four of the 17 studies [including 2 of the 3 studies on nursing homes] showed large standard residuals ranging from -2.42 to 2.46. These studies were also identified as outliers whose effects were substantially different from others.... We removed these 4 studies one at a time from the analysis..." (p188e16).</p>

Citation, AMSTAR score, type & number of included studies	Setting(s)	Intervention(s)	Review authors' assessment of review & included study quality	Main Findings
<p>Chung (2011)</p> <p>3 (27%)</p> <p>16 RCTs</p>	<p>Mixed settings but subgroup analysis for studies conducted in institutional settings</p>	<p>Vitamin D with or without calcium co-supplementation</p>	<p>"Of [the 16 included RCTs], 3 RCTs were of good quality, 7 were of fair quality, and 4 were of poor quality" (p831).</p> <p>"Common limitations among the fair- or poor-quality RCTs were unclear reporting of randomization and outcome assessment, lack of allocation concealment.... [and] high rate of loss to follow-up (>10%)" (p832).</p>	<p>"The overall random effects meta-analysis found that vitamin D supplementation alone did not reduce fracture risk (pooled relative risk, 1.03 [CI, 0.84 to 1.26]), with high heterogeneity across studies... "The subgroup meta-analysis results according to setting (that is, institution vs. community) were similar to the overall effect estimate.... Our random-effects meta-analysis showed that combined vitamin D and calcium supplementation reduced the risk for total fracture as compared with placebo.... Subgroup meta-analysis results showed that the pooled effect estimates differed according to setting (P = 0.07): There was a significant risk reduction among institutionalized elderly persons (relative risk, 0.71 [CI, 0.57 to 0.89]). The risk reduction was smaller in community-dwelling elderly persons or postmenopausal women (relative risk, 0.89 [CI, 0.76 to 1.04])..." (p832).</p> <p>"...we concluded that combined vitamin D (300 to 1100 IU/d) and calcium supplementation (500 to 1200 mg/d), but not vitamin D supplementation alone, can reduce the fracture risk in older adults. However, the effects may vary according to setting, with smaller effects in community-dwelling elderly persons or postmenopausal women than in institutionalized elderly persons." (p834)</p>
<p>Bischoff-Ferrari (2012)</p> <p>2 (18%)</p> <p>n=12 RCTs [4 institutional: Chapuy, 1994; Meyer, 2002; Flicker, 2005; Lyons, 2007]</p>	<p>Mixed settings but subgroup analysis for studies conducted in institutional settings</p>	<p>Supplemental vitamin D with or without calcium co-supplementation</p>	<p>"The strengths of our pooled analysis are the large sample, the assessment of fracture risk by actual intake of vitamin D, and the consistency of the primary findings and the internal validation study. The principal limitation of our analysis is the unavailability of source data for 2 of the 14 qualifying trials; however, inclusion of the trial-level data from these studies in a random effects meta-analysis did not alter our findings" (p48).</p>	<p>"The findings suggest that only a high intake of vitamin D leads to a significant reduction in the risk of fracture – with a 30% reduction in the risk of hip fracture and a 14% reduction in the risk of any nonvertebral fracture; this reduction is independent of the assigned treatment dose of vitamin D, age group, sex, type of dwelling, and study" (p45). [Note to RK & SO: institutionalized group – 1863 participants; hip fracture RR 0.70, 95% CI 0.55–0.89, P value 0.004; nonvertebral fracture RR 0.74, 95% CI 0.62–0.87, P value <0.001]</p> <p>"...our data suggest that high-dose vitamin D supplementation (≥800 IU per day) may reduce the risk of hip fracture in persons 65 years of age or older, independently of type of dwelling, age, and sex. Furthermore, our data support a 25-hydroxyvitamin D level above 60 nmol per liter for the prevention of fractures" (p49).</p>
<p>Chua (2011)</p> <p>2 (18%)</p> <p>4 RCTs (Flicker, 2005; Law, 2006; Bischoff,</p>	<p>Long-term care</p>	<p>Vitamin D (ergocalciferol or cholecalciferol) dosing regimens (standard daily high doses or intermittent supratherapeutic doses) with or without calcium co-</p>	<p>"Trials included in this review have small population sizes, which could have undermined the power of this analysis. There is a potential for publication bias in this review, but analysis in this aspect was not performed due to limited technical support" (p97).</p>	<p>Long-Term Care</p> <p>"Regarding the number of falls, there was a significant 28% reduction (OR 0.72, 95% CI 0.55–0.95) with the magnitude of reduction further increased to 44% after taking dosing regimen into account [daily oral dose ranging from 800–1000 IU vs. doses every 3 months], and remained statistically significant (OR 0.56, 95% CI 0.33–0.93). This indicated that daily high dose of vitamin D is more effective than quarterly supratherapeutic doses in reducing fall rate" (p95).</p> <p>"However, vitamin D at any doses is not effective in reducing number of fallers. Such a</p>

Citation, AMSTAR score, type & number of included studies	Setting(s)	Intervention(s)	Review authors' assessment of review & included study quality	Main Findings
2003; Broe, 2007)		supplementation		difference could possibly be acknowledged by the fact that vitamin D is useful in preventing fall recurrence rather than first fall" (p98).
Lai (2010) 2 (18%) 27 studies – 7 RCTs (3), 17 case control (10), 3 cohort (0)	Mixed settings but subgroup analysis for studies conducted in institutional settings	Vitamin D with or without calcium co-supplementation	<p>RCTs "All studies reported adequate allocation concealment; one study did not use placebo and did not adequately blind intervention and two studies reported a loss to follow up over the course of the study of >25%. Further, one study did not report loss to follow up figures. Performing a sub-group analysis comparing these studies with the higher quality studies showed no evidence of heterogeneity..." (p3-4).</p> <p>Case control "Seven studies were identified as lower quality studies with a rating of either 1 or 2. Comparing these studies with the higher quality studies with ratings 3, 4, or 5, there were no signs of heterogeneity..." (p7).</p>	<p>Nursing Homes "This meta-analysis shows no significant difference in the risk of hip fracture between individuals randomised to receive either vitamin D supplements [ergocalciferol or cholecalciferol] or placebo/control. In particular, no significant benefit for hip fracture was shown in trials randomising participants to receive high dose vitamin D (i.e. doses of 800 IU per day or greater). In apparent contrast, case control studies show substantially and significantly lower serum 25(OH)D levels in persons with hip fractures compared to controls" (p12).</p> <p>"No significant variations were found between results of studies randomizing participants... between nursing home 1.11 (95%CI, 0.91—1.36) and community residents 1.14 (95%CI, 0.95—1.37)" (p4) [Note to RK & SO: the nursing home subgroup included three studies – Meyer, 2002; Law, 2006; and Lyons, 2007]</p>
Stern (2009) 1 (9%)	Elderly care wards (consisting of a combination of acute or sub-acute care)	<ul style="list-style-type: none"> • Vitamin D + calcium • exercise • patient education • targeted risk factor reduction plan • multifactorial interventions (included risk assessment, education of patients and staff, medication review, 	<p>"There were... methodological limitations to consider across the included studies including blinding of participants to treatment groups, to those assessing outcomes and concealment of allocation to treatment groups from the allocator. It must be noted, however, that it may have been impossible to undertake blinding because of the interventions assessed" (p247).</p>	<p>Acute Care Hospitals</p> <ul style="list-style-type: none"> • "There is some evidence to suggest that implementing the following interventions in acute hospitals may be effective in reducing the amount of falls of older adult inpatients; however, the age, morbidity, reason for hospitalisation and length of stay of a patient must be considered: <ul style="list-style-type: none"> ○ A multidisciplinary multifactorial intervention program consisting of a fall risk alert card, an exercise program, an education program and the use of hip protectors after approximately 45 days ○ A one-on-one patient education package entailing information on risk factors and preventative strategies for falls as well as goal setting (8.2 falls per 1000 participant days in intervention group vs. 16 falls per 1000 participant days in control group; p = 0.007 (p245)) ○ A targeted fall risk factor reduction intervention that includes a fall risk factor screen, recommended interventions encompassing local

Citation, AMSTAR score, type & number of included studies	Setting(s)	Intervention(s)	Review authors' assessment of review & included study quality	Main Findings
		environmental modifications, exercise and alarms)		<p>advice and a summary of the evidence” (p248) RR 0.79, 95% CI 0.65 – 0.95 (p246)</p> <ul style="list-style-type: none"> • “There is some evidence to suggest that implementing a multidisciplinary multifactorial intervention that consists of systematic assessment and treatment of fall risk factors, as well as active management of postoperative complications can reduce the amount of falls in patients with femoral neck fracture following surgery” (p248) (Incidence Rate Ratio (IRR) 0.38, 95% CI 0.20 – 0.76) (p246) <p>The effectiveness of the following interventions are currently not supported by the evidence:</p> <ul style="list-style-type: none"> ○ A multifactorial intervention program that includes fall risk assessment, staff and patient education, medication review, alterations to the ward environment, an exercise program and alarms for selected individuals ○ A fall-prevention exercise program as a stand-alone intervention, which comprises tai chi, functional movements and activity visualisation ○ Short-term (approximately 30 days) vitamin D and calcium supplementation” (p248).