

**There is good evidence (level 1a) that hip protectors are not effective in reducing the incidence of hip fracture following a fall, in elderly people living in the community, but may be effective for elderly people with a previous history of hip fracture living in aged-care facilities.**

---

**Prepared by:** Kathryn Thorpe ([ktandca@tpg.com.au](mailto:ktandca@tpg.com.au))  
4<sup>th</sup> year undergraduate occupational therapy student,  
University of Western Sydney

**Date:** May 2004

**Review date:** May 2006

---

**CLINICAL SCENARIO:** Hip fractures are a major cause of morbidity and mortality for people over 65 years of age, and almost all occur as a result of a simple fall. Hip protectors which are plastic shields or foam pads that fit into the pockets of specially designed underwear, have been advocated as a means to reduce the risk of sustaining a fracture in a fall on the hip. What is the effectiveness of hip protectors in reducing the incidence of hip fracture following a fall in elderly persons living in the community or in an aged care facility?

**FOCUSED CLINICAL QUESTION:** What is the evidence that wearing hip protectors compared to not wearing hip protectors reduces the incidence of hip fracture following a fall for older persons living in their own home or an aged care facility?

**SUMMARY of Search, 'Best' Evidence' appraised, and Key Findings:**

- ◆ 117 citations were located.
- ◆ 1 systematic review was located and appraised as the highest level of evidence (Parker, Gillespie & Gillespie). This systematic review found no evidence of the effectiveness of hip protectors from studies in which randomisation was by individual patient within an institution, or for those living in their own homes. Data from cluster randomised studies indicates that, for those living in institutional care who are considered to be at a high risk of sustaining a hip fracture, a program of providing hip protectors appears to reduce the incidence of hip fractures. However, these results must be considered in light of a number of biases apparent in these studies.

**CLINICAL BOTTOM LINE:**

Hip protectors may be effective in reducing the incidence of hip fracture following a fall for elderly people with a previous history of hip fracture living in aged-care facilities. However, biases and lack of compliance within the existing studies, limits the applicability of these results. There is no evidence that hip protectors are effective in reducing the incidence of hip fracture following a fall in elderly people living in the community.

**Limitation of this CAT:** This critically appraised paper has been individually prepared as part of a university subject, reviewed and marked by a lecturer, but has not been externally peer-reviewed.

## SEARCH STRATEGY:

### Terms used to guide Search Strategy:

- **Patient/Client:** elderly OR elderly people OR aged OR aged person OR older person OR older people AND community living OR aged care facility OR institutional care
- **Intervention:** hip protector\$ OR protective device\$ OR protective cloth\$
- **Comparison:** not wearing hip protectors
- **Outcome(s):** reduced incidence of hip fracture

I. Databases and sites searched	II. Search Terms	III. Limits used
<ul style="list-style-type: none"> <li>◆ National Health and Medical Research Council (NHMRC)</li> <li>◆ New Zealand Guidelines Group (NZGG)</li> <li>◆ National Guideline Clearinghouse</li> <li>◆ Scottish Intercollegiate Guidelines Network (SIGN)</li> <li>◆ The National electronic Library for Health (NLH)</li> <li>◆ Joanna Briggs Institute</li> <li>◆ NSW Health</li> <li>◆ Medical J of Australia (MJA)</li> <li>◆ Evidence On-Call</li> <li>◆ Cochrane Database of Systematic Reviews (CDSR)</li> <li>◆ Database of Abstracts of Reviews of Effectiveness (DARE)</li> <li>◆ PEDro – The Physiotherapy Evidence Database</li> <li>◆ McMaster Occupational Therapy</li> <li>◆ OTSeeker</li> <li>◆ PubMed, Medline, PreMedline</li> <li>◆ CINAHL, Embase</li> <li>◆ Proquest</li> <li>◆ Sciencedirect</li> <li>◆ Reference lists of relevant articles</li> </ul> <p><b>NB: Sites searched in order listed</b></p>	<p>“aged” [MeSH] OR “aged perso\$” OR “older perso\$” OR “elderly” OR “elderly people” OR “older people” AND  “community living” OR “aged care facility” OR “institutional care” AND  “hip protector\$” OR “protective device\$ OR “protective cloth\$” AND  “hip fracture\$” [MeSH]</p>	<ul style="list-style-type: none"> <li>• human studies</li> <li>• adults over 65 years of age</li> <li>• papers with primary outcome being incidence of hip fracture</li> <li>• Search for Clinical Guidelines, Systematic Reviews and Meta-analyses was limited to 2001 onwards</li> </ul>

## INCLUSION and EXCLUSION CRITERIA

- ◆ Inclusion:
  1. Studies including elderly people living in their own home or an aged care facility;
  2. Studies including incidence of hip fracture as the primary outcome
  3. Studies published in English
- ◆ Exclusion:
  1. Studies including elderly people who were an inpatient in a hospital at the time
  2. Studies that had cost-effectiveness of hip protectors as the primary outcome
  3. Studies that had compliance with hip protectors as the primary outcome
  4. Studies that examined the effectiveness of a multifaceted falls intervention program which included hip protectors as one component
  5. A second publication of the same study presenting the same results
  6. Evidence-based clinical guidelines or SRs or Meta-Analyses that were greater than 3 years old (as will be outdated by new research)

## RESULTS OF SEARCH

117 relevant publications located and categorised as shown in Table 1 (based on Levels of Evidence, Centre for Evidence Based Medicine, 1998)

**Table 1:** Summary of Study Designs of Articles retrieved

Level of Evidence	Study Design/ Methodology of Articles Retrieved	No. Located	Source(s) and reference numbers
N/A	Evidence Based Clinical Practice Guidelines	3	National Guideline Clearinghouse – reference number 8, 9. and 10 SIGN – 9; PEDro – 8, 9, 10.
1a	Systematic Reviews (SRs)	1	CDSR – 7 ; PEDro – 7; OTSeeker – 7; PubMed – 7 Medline – 7; CINAHL – 7
1b	<b>Randomised Controlled Trials (RCTs)</b>	<b>11</b>	CCTR – 11, 13, 14, 15, 16, 17, 18, 19, 20, 21. PubMed – 11, 12, 13, 15, 21.; Medline – 11, 13, 15, 17, 21. CINAHL – 11, 13, 15, 21.; EMBASE – 11, 15, 17, 18, 21. OTSeeker – 13, 17, 18.; PEDro – 18
2a		<b>0</b>	
2b	<b>Low quality RCTs or Individual Cohort studies</b>	7	CCTR – 24, 27. PubMed – 23, 25, 26, 27.; PreMedline – 23; Medline – 24, 27, 28. CINAHL – 24, 27.; EMBASE – 23, 24, 26, 27, 28. OTSeeker – 25, 26. ; PEDro – 25, 26, 27. ScienceDirect – 22, 26.; Proquest – 29
3a		0	
3b	Individual Case-Control Studies	4	PubMed – 32; Medline –30, 31, 32. CINAHL – 32; EMBASE – 32 ScienceDirect – 31; Proquest - 33
4	Case series or poor quality cohort and case-control studies	3	PubMed – 34; Medline –34, 35, 36. CINAHL – 35; Proquest - 36
5	Expert opinion	87	PubMed – 67, 80, 81, 88. PreMedline – 44, 68, 84, 86, 87, 106, 109. Medline – 38, 39, 42, 43, 47, 49, 50, 52, 53, 59, 61, 62, 63, 70, 72, 73, 74, 78, 79, 80, 81, 83, 85, 88, 91, 93, 97, 103, 104, 106, 108, 112, 113, 116, 118, 119. CINAHL – 37, 44, 46, 49, 51, 55, 68, 69, 71, 86, 90, 98, 99, 106, 107, 109, 110, 114, 117, 118. EMBASE – 43, 44, 48, 49, 53, 57, 58, 60, 62, 63, 66, 72, 74, 78, 81, 82, 85, 86, 88, 89, 93, 100, 101, 102, 103, 104, 105, 106, 108, 109, 111, 112, 113, 116, 118, 121. ScienceDirect – 85, 101, 113. Proquest – 40, 41, 45, 54, 56, 57, 65, 74, 77, 92, 94, 95, 96, 99, 115, 120, 121, 123. NSW Health – 64, 75, 76.

### BEST EVIDENCE

The following article was identified as the 'best' evidence and selected for critical appraisal. Reasons for selecting this paper were:

- **Best addresses the clinical question.**
- **A more recent RCT is available, however, it only looks at effectiveness of hip protectors for women in the community.**
- **SR selected was substantially updated in April 2003, and while it does not contain the latest RCT, it is still the best available evidence to answer the clinical question.**

***Hip protectors to reduce the incidence of hip fractures in older persons.***

Prepared by Kathryn Thorpe, OT student, University of Western Sydney, 2004.

Available at [www.otcats.com](http://www.otcats.com).

## SUMMARY OF BEST EVIDENCE

**Table 2:** Description and appraisal of SR by Parker, Gillespie and Gillespie (2004)

### ***Aim of the Study***

To determine if external hip protectors reduce the incidence of hip fractures in elderly persons following a fall.

### ***Intervention Investigated***

Allocation to wearing hip protectors which are plastic shields or foam pads worn around the hip area. They are kept in place by pockets within specially designed underwear.

### ***Outcome Measures***

#### ***Primary***

Incidence of hip fractures over the study period.

#### ***Secondary***

Incidence of pubic rami, or other pelvic fractures.

Incidence of other fractures.

Incidence of reported falls.

Mortality.

Compliance with protectors.

Reported complications of the use of the protectors (including skin damage/breakdown).

Cost effectiveness of the protectors.

### ***Results***

- ◆ 13 RCT's were included in the third update of this SR
- ◆ 5 studies involving 4316 participants were cluster randomised (see "Definition of terms" below) by care unit, nursing home, or nursing home ward. Individually each study reported a decrease in hip fracture for those units that received hip protectors. However, results could not be pooled because of the randomisation technique used.
- ◆ 7 studies were randomised by individual patient. Data was pooled from 5 RCT's (1426 participants) conducted in aged care settings. No significant reduction in hip fracture incidence was found - hip protectors 37/822, controls 40/ 604, RR 0.83, 95% CI 0.54 to 1.29. 2 RCT's (966 participants) conducted with those living in the community, reported no reduction in hip fracture incidence - RR 1.11, 95% CI 0.65 to 1.9. Results from these studies were pooled using the fixed effects model (see "Definition of terms" below).
- ◆ Adverse effects reported were skin irritation, abrasion, and local discomfort.
- ◆ Compliance with the hip protectors was poor, especially in the long term.

<b>INCIDENCE OF HIP FRACTURES: SUBGROUP ANALYSIS BY METHOD OF RANDOMISATION</b>				
<b>STUDY</b>	<b>HIP PROTECTORS n/N</b>	<b>CONTROL n/N</b>	<b>WEIGHT (%)</b>	<b>RELATIVE RISK (FIXED) 95% CI</b>
<b>RANDOMISATION BY UNIT, WARD, OR NURSING HOME</b>				
Ekman et al, 1997	4/302	17/442	10.2	0.34 (0.12, 1.0)
Harada et al, 2001	1/88	8/76	6.4	0.11 (0.01, 0.84)
Kannus et al, 2000	13/653	67/1148	36.0	0.34 (0.19, 0.61)
<b>Lauritzen et al, 1993</b>	8/247	31/418	17.1	0.44 (0.20, 0.93)
Meyer et al, 2003	21/459	42/483	30.3	0.53 (0.32, 0.87)
Subtotal (95% CI) Test for heterogeneity chi-square=3.09 df=4 p=0.5426 Test for overall effect=5.61 p<0.00001 NB: See definition of terms listed below the tables of results.	47/1749	165/2567	100.0	0.40 (0.29, 0.55)
<b>RANDOMISATION BY INDIVIDUAL PATIENT</b>				
Birks et al, 2003	6/182	2/184	3.0	3.03 (0.62, 14.83)
Cameron et al, 2001	8/86	7/88	10.6	1.17 (0.44, 3.08)
Cameron et al, 2003	21/302	22/298	33.9	0.94 (0.53, 1.68)
Chan et al, 2000	3/40	6/31	10.4	0.39 (0.11, 1.43)
Hubacher et al, 2001	7/384	2/164	4.3	1.49 (0.31, 7.12)
Jantti et al, 1996	1/36	5/36	7.7	0.20 (0.02, 1.63)
van Schoor et al, 2003	18/276	20/285	30.1	0.93 (0.5, 1.72)
Subtotal (95% CI) Test for heterogeneity chi square=6.49 df=6 p=0.3701 Test for overall effect=0.39 p=0.7	64/1306	64/1086	100.0	0.94 (0.67, 1.31)

**INCIDENCE OF HIP FRACTURES BY RESIDENTIAL STATUS (INDIVIDUALLY RANDOMISED TRIALS)**

STUDY	HIP PROTECTORS n/N	CONTROL n/N	WEIGHT (%)	RELATIVE RISK (FIXED) 95% CI
<b>IN NURSING HOME OR RESIDENTIAL CARE</b>				
Cameron et al, 2001	8/86	7/88	10.6	1.17 (0.44, 3.08)
Chan et al, 2000	3/40	6/31	10.4	0.39 (0.11, 1.43)
Hubacher et al, 2001	7/384	2/164	4.3	1.49 (0.31, 7.12)
Jantti et al, 1996	1/36	5/36	7.7	0.20 (0.02, 1.63)
van Schoor et al, 2003	18/276	20/285	30.1	0.93 (0.50, 1.72)
Subtotal (95% CI) Test for heterogeneity Chi-square=4.24 df=4 p=0.3751 Test for overall effect =-0.83 p=0.4	37/822	40/604	63.0	0.83 (0.54, 1.29)
<b>COMMUNITY DWELLING</b>				
Birks et al, 2003	6/182	2/184	3.0	3.03 (0.62, 14.83)
Cameron et al, 2003	21/302	22/298	33.9	0.94 (0.53, 1.68)
Subtotal (95% CI) Test for heterogeneity chi-square=1.86 df=1 p=0.1731 Test for overall effect =0.40 p=0.7	27/484	24/482	37.0	1.11 (0.65, 1.9)
Total (95% CI) Test for heterogeneity chi-square=6.49 df=6 p=0.3701 Test for overall effect =-0.39 p=0.7	64/1306	64/1086	100.0	0.94 (0.67, 1.31)

**Original Authors' Conclusions:** There is no evidence of the effectiveness of hip protectors from studies in which randomisation was by individual patient within an institution, or for those living in their own homes. Data from cluster randomised studies indicates that, for those living in institutional care who are considered to be at a high risk of sustaining a hip fracture, a program of providing hip protectors appears to reduce the incidence of hip fractures. Acceptability by users of the hip protectors remains a problem, due to discomfort and practicality. Reported adverse effects of wearing the hip protectors were skin irritation, abrasion, and local discomfort.

## **Critical Appraisal:**

### **Validity (*Methodology, rigour, selection, bias*)**

- ◆ The review had a clearly focused, defined question.
- ◆ A thorough search was conducted and other potentially important sources were explored. Databases searched were the Cochrane Musculoskeletal Injuries Group trials register, the Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE, CINAHL, and reference lists of relevant articles. In addition trialists were contacted, and ongoing trials were identified in both The National Research Register and the Current Controlled Trials.
- ◆ Specific criteria for the selection of studies was identified and included types of studies, types of participants, types of interventions, and types of outcome measures.
- ◆ A specific search strategy was outlined for MEDLINE, EMBASE and CINAHL databases.
- ◆ Data extraction was carried out for each study by two independent reviewers.
- ◆ The methodology of each study was assessed by two independent reviewers and was predominantly determined by the randomisation methods used in each study. In addition, a list of a further nine aspects related to methodology were used to judge the quality of each study and give each study a score out of 12. No information is given as to how this list or scoring system was developed, or if it was piloted to ensure it could be consistently applied. In addition, the review states that differences were resolved by discussion. However, an explicit procedure or decision rule for resolving disagreement between the reviewers should have been given (Alderson, Green, & Higgins, 2003).
- ◆ A test for heterogeneity was carried out for different groups of studies using a chi-square test which is a relevant test to use as it determines if there is greater variation between the results of the trials than would be found by chance (Greenhalgh, 1997).
- ◆ Follow-up for individual studies varied from 12 weeks to 41 months. All 13 studies used intention-to-treat analysis. Only of the 9 studies reported loss to follow-up, and all of these 9 studies reported less than 5% of participants were lost to follow-up.

### **Results (*Favourable or unfavourable, specific outcomes of interest, size of treatment effect, statistical and clinical significance; minimal clinically important difference*)**

- ◆ Statistical analysis provided relative risk (fixed) and confidence intervals for individual studies as well as groupings of studies (studies grouped by method of allocation and by residential status). Results from the 5 studies that used cluster randomisation could not be pooled with the results from the individually randomised studies. Pictorial representations known as a forest plot (Greenhalgh, 1997) were also provided of the relative risk and CI of the studies.
- ◆ In all five of the studies where cluster randomisation was used, the confidence intervals do not contain the value of no effect (RR of 1), therefore the results are statistically significant at the 5% level. In addition, three of these studies have narrow confidence intervals indicating any effects outside this range have been ruled out by the studies. Furthermore, effect sizes (NNT) calculated by the author of this CAT ranged from 11 to 40 (small NNT indicates a large treatment effect, see definition of terms above). The NNT calculated for the total was 27. However, a number of biases are apparent with these studies and must be considered. The first of these is a measurement bias as no study used blinded assessors. Secondly, selection bias may have occurred as patients are not generally admitted to a particular ward or aged-care facility by a random process. In addition, although the studies randomised by institution, analysis was done by individual participant which may result in a Type I error. Finally, differences in the way participants were treated in individual facilities and by different staff members may have introduced an intervention bias.
- ◆ In the seven studies where patients were randomised by individual patient, CIs contains the value of no effect (RR of 1), thus indicating the results were not statistically significant. Furthermore, five of the CIs are wide suggesting the studies were underpowered. NNT for combined results calculated by author of this CAT = 100 which is high indicating the treatment is not effective.
- ◆ Compliance with wearing the hip protectors was reported to be low in all the studies ranging from 24% to 70%. This makes interpreting the results difficult as it would be difficult to determine the true treatment effect.
- ◆ Cost effectiveness of hip protectors was not assessed in this review as this information was not addressed in the individual studies.

## IMPLICATIONS FOR PRACTICE/ APPLICABILITY

- ◆ No effectiveness for the intervention was found in studies which randomised the participants individually to treatment or control groups.
- ◆ The studies where a treatment effect was found had a number of biases, which may have resulted in a false-positive result.
- ◆ Poor compliance with the intervention in the studies further limits the applicability of this evidence, and future studies are needed that address this issue.
- ◆ No cost effectiveness of the intervention is provided.
- ◆ The population where the hip protectors were found to be effective was those living in aged-care facilities. This may have been because the staff encouraged the participants to wear the hip protectors thus addressing the issue of compliance.

## REFERENCES

1. Alderson P, Green S, Higgins JPT, editors. Assessment of study quality. *Cochrane Reviewers' Handbook* [updated December 2003]; Section 4. Retrieved March 28, 2004, from Cochrane Collaboration Web site: <http://www.cochrane.org/resources/handbook/hbook.htm>
2. Bandolier: Evidence based thinking about health care. (2004). *Glossary index*. Retrieved April 26, 2004 from <http://www.jr2.ox.ac.uk/bandolier/glossary.html>
3. Greenhalgh, T. (1997). Papers that summarise other papers. *The British Medical Journal*, 315(7109), 672-676.
4. Helewa, A., & Walker, J. M. (2000). Critical evaluation of research in physical rehabilitation: Towards evidence-based practice. Philadelphia: W. B. Saunders.
5. Huck, S. W. (2000). *Reading statistics and research* (3<sup>rd</sup> ed.). New York: Longman.
6. Phillips B, Ball C, Sackett D, Badenoch D, Straus S, Haynes B, Dawes M. (1998). *Levels of evidence and grades of recommendations*. Retrieved December 20, 2003, from CEBM Web site: <http://cebm.jr2.ox.ac.uk/docs/levels.html>

### Article critically appraised: Level 1a evidence

7. Parker MJ, Gillespie LD, Gillespie WJ. Hip protectors for preventing hip fractures in the elderly (Cochrane Review). In: *The Cochrane Library*, Issue 2, 2004. Chichester, UK: John Wiley & Sons, Ltd.

### Related Articles (not individually appraised)

#### Evidence-Based Guidelines

8. Registered Nurses Association of Ontario (RNAO). (2002). *Prevention of falls and fall injuries in the older adult*. Retrieved April 26, 2004, from the RNAO Web site: [http://www.rnao.org/bestpractices/completed\\_guidelines/BPG\\_Guide\\_C1\\_Prevent\\_Falls.asp](http://www.rnao.org/bestpractices/completed_guidelines/BPG_Guide_C1_Prevent_Falls.asp)
9. Scottish Intercollegiate Guidelines Network (SIGN). (2002). *Prevention and management of hip fracture in older people. A national clinical guideline*. Retrieved April 26, 2004, from the SIGN Web site: <http://www.sign.ac.uk/pdf/sign56.pdf>
10. American Geriatric Society, British Geriatrics Society, American Academy of Orthopaedic Surgeons. (2001). *Guideline for the prevention of falls in older persons*. Retrieved April 26, 2004, from <http://www.americangeriatrics.org/products/positionpapers/Falls.pdf>

#### Level 1A Evidence

NIL other than article appraised

#### Level 1b evidence

11. Birks, Y. F., Hildreth, R., Campbell, P., Sharpe, C., Torgerson, D. J., & Watt, I. (2003). Randomised controlled trial of hip protectors for the prevention of second hip fractures. *Age & Ageing*, 32(4), 442-444.
12. [Birks, Y. F., Porthouse, J., Addie, C., Loughney, K., Saxon, L., Baverstock, M., Francis, R. M., Reid, D. M., Watt, I., & Torgerson, D. J.](#) (2004). Randomized controlled trial of hip protectors among women living in the community. *Osteoporosis International (Online)*, March. Retrieved April 20, 2004 from PubMed database.
13. Cameron, I. D., Cumming, R. G., Kurrle, S. E., Quine, S., Lockwood, K., Salkeld, G., & Finnegan, T. (2003). A randomised trial of hip protector use by frail older women living in their own homes. *Injury Prevention*, 9 (2), 138-141.
14. Cameron, I. E., Kurrle, S. E., Chang, Y. C., Cumming, R., & Quine, S. (2000). Falls and non-hip fractures in users of hip protectors: One-year follow-up. *Australian and New Zealand Journal of Medicine*, 30(2), 293.
15. Cameron, I. D., Venman, J., Kurrle, S. E., Lockwood, K., Birks, C., Cumming, R. G., Quine, S., & Bashford, G. (2001). Hip protectors in aged-care facilities: A randomized trial of use by individual higher-risk residents. *Age & Ageing*, 30(6), 477-481.
16. Ekman, A., Mallmin, H., Michaelsson, N., & Ljunghall, S. (1997). External hip protectors to prevent osteoporotic hip fractures. *Lancet*, 350(9077), 563-564.
17. Harada, A., Mizuno, M., Takemura, M., Tokuda, H., Okuizumi, H., & Niino, N. (2001). Hip fracture prevention trial using hip protectors in Japanese nursing homes. *Osteoporosis International*, 12(3), 215-221.

---

### **Hip protectors to reduce the incidence of hip fractures in older persons.**

Prepared by Kathryn Thorpe, OT student, University of Western Sydney, 2004.

Available at [www.otcats.com](http://www.otcats.com).



18. Jensen, J., Lundin-Olsson, L., Nyberg, L., & Gustafson, Y. (2002). Fall and injury prevention in older people living in residential care facilities: A cluster randomized trial. *Annals of Internal Medicine*, 136(10), 733–741.
19. Lauritzen, J. B., Petersen, M. M., & Lund, B. (1992). Hip fractures prevented by external hip protectors. A randomized nursing home study. *Acta Orthopaedica Scandinavica. Supplementum*, 248, 84.
20. Torgerson, D. J., Watt, I., & Hildreth, R. (2000). Prevention of second hip fractures using hip protectors. *Osteoporosis International*, 11( Suppl 1), 53.
21. van Schoor, N. M., Smit, J. H., Twisk, J. W., Bouter, L. M., & Lips, P. (2003). Prevention of hip fractures by external hip protectors: A randomized controlled trial. *Journal of the American Medical Association*, 289(15), 1957-1962.

#### **Level 2a**

NIL

#### **Level 2b**

22. Chan, D. K., Hillier, G., Coore, M., Cooke, R., Monk, R., Mills, J., & Hung, W. T. (2000). Effectiveness and acceptability of a newly designed hip protector: A pilot study. *Archives of Gerontology and Geriatrics*, 30(1), 25-34.
23. Heikinheimo, R., Jalonen-Mannikko, A., Asumaniemi, H., & Lehtomaki, E. (2004). External hip protectors in home-dwelling older persons. *Aging; Clinical and Experimental Research*, 16(1), 41-3.
24. Jensen, J., Nyberg, L., Gustafson, Y., & Lundin-Olsson, L. (2003). Fall and injury prevention in residential care - Effects in residents with higher and lower levels of cognition. *Journal of the American Geriatrics Society*, 51(5), 627-35.
25. Kannus, P., Parkkari, J., Niemi, S., Pasanen, M., Palvanen, M., Jarvinen, M., & Vuori, I. (2000). Prevention of hip fracture in elderly people with use of a hip protector. *New England Journal of Medicine*, 343(21), 1506-1513.
26. Lauritzen, J., Petersen, M., & Lund, B. (1993) **Effect of external hip protectors on hip fractures.** *The Lancet*, 341(8836), 11-13.
27. Meyer, G., Warnke, A., Bender, R., & Muhlhauser, I. (2003). Effect of on fractures of increased use of hip protectors in nursing homes: Cluster randomised controlled trial. *British Medical Journal*, 326(7380), 76-78.
28. Segui-Gomez, M., Keuffel, E., & Frick, K. D. (2002). Cost and effectiveness of **hip protectors** among the elderly. *International Journal of Technology Assessment in Health Care*, 18(1), 55-66.
29. Villar, M. T. A., Hill, P., Inskip, H., Thompson, P., & Cooper, C. (1998). Will elderly rest home residents wear hip protectors? *Age and Ageing*, 27, 195–198.

#### **Level 3a Evidence**

NIL

#### **Level 3b evidence**

30. Forsen, L., Sogaard, A. J., Sandvig, S., Schuller, A., Roed, U., & Arstad, C. (2004). Risk of **hip** fracture in protected and unprotected falls in nursing homes in Norway. *Injury Prevention*, 10(1), 16-20.
31. Merilainen, S., Nevalainen, T., Luukinen, H., & Jalovaara, P. (2002). Risk factors for cervical and trochanteric **hip** fracture during a fall on the **hip**. *Scandinavian Journal of Primary Health Care*, 20(3), 188-192.
32. Willig, R., Luukinen, H., & Jalovaara, P. (2003). Factors related to occurrence of **hip** fracture during a fall on the **hip**. *Public Health*, 117(1), 25-30.
33. Woo, J., Sum, C., Yiu, H. H., Ip, K., Chung, L., & Ho, L. (2003). Efficacy of a specially designed hip protector for hip fracture prevention and compliance with use in elderly Hong Kong Chinese. *Clinical Rehabilitation*. 17(2), 203-205.

#### **Level 4 Evidence**

34. Cameron, I. D., Kurrle, S. E., Cumming, R. G., & Quine, S. (2000). Proximal femoral fracture while wearing correctly applied **hip protectors**. *Age & Ageing*, 29(1), 85-86.
35. Forsen, L., Arstad, C., Sandvig, S., Schuller, A., Roed, U., & Sogaard, A. J. (2003). Prevention of hip fracture by external hip protectors: An intervention in 17 nursing homes in two municipalities in Norway. *Scandinavian Journal of Public Health*, 31(4), 261-266.
36. Johnson, T., & Binney, S. (2003). Reducing the incidence of falls and **hip** fractures in care homes. *Nursing Times*, 99(24), 38-40.

#### **Level 5 Evidence**

For the purposes of brevity level 5 evidence (refs. 37-123) will not be included on website. For a full reference list, please email the author of the CAP on [ktandca@tpg.com.au](mailto:ktandca@tpg.com.au)