Prevention of Fractures in Older People: What Does the Evidence Say?

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Fall-related fractures in older people are an important public-health problem around the world.¹ The economic and social impact of fractures in older people will increase substantially in the future as the number of older people increases in both developed and developing countries.² This editorial discusses the use of evidence to guide practice, provides examples of a rapid search strategy, and outlines the current evidence to guide fracture-prevention activities in the general older population.

Increasingly, physiotherapists and other health professionals are taking an evidence-based approach to interventions. This approach involves integrating the results of high-quality clinical research with clinical expertise and patient preferences.³ It is widely accepted that well-designed randomized controlled trials (RCTs) and systematic reviews of RCTs are needed to give unbiased estimates of the effects of health care interventions and preventive strategies. In other words, when a well-designed RCT is used to test the impact of an intervention, we can be confident that any benefits seen are a result of the intervention rather than of other factors.³ In addition to providing interventions to people who already have health problems, physiotherapists are well placed to contribute to a range of preventive health activities, including the prevention of fall-related fractures in older people. Potential funders of such interventions need evidence from RCTs to justify the allocation of valuable resources to such interventions.

The Physiotherapy Evidence Database (PEDro, www.pedro.org.au) aims to help physiotherapists use evidence to guide their practice by providing a free, searchable online database of evidence-based clinical practice guidelines, systematic reviews, and RCTs of relevance to physiotherapists. PEDro has now been available for more than 10 years.⁴ The global interest in the use of evidence to guide physiotherapy practice is indicated by the increasing number of PEDro searches (now more than 5,000 per day), as well as by the fact that PEDro is now used in 80 countries and has been partially translated into Portuguese, French, Chinese, and German by local volunteers. The availability of evidence to guide physiotherapy practice is rapidly increasing (there are now

more than 17,500 records indexed in PEDro), and there has also been an improvement in the methodological quality of trials indexed by PEDro.⁵

In order to obtain an overview of the current evidence to guide physiotherapists in fracture prevention in older people, I conducted a search of PEDro using the advanced search function, using the sub-discipline “gerontology” and the search terms *fracture* and *prevention* in the Abstract box. To gain a brief overview of non-exercise approaches, I also used the freely available PubMed Clinical Queries feature (www.ncbi.nlm.nih.gov), with the search terms *fracture* and *prevention*.

These searches identified several useful summary sources of evidence. A highlight was the 2010 update for the US Preventive Services Task Force on screening for osteoporosis, which covered both screening and intervention.⁶ This document concluded that

1. Risk-assessment instruments are modest predictors of low bone density (area under the curve [AUC] = 0.13–0.87, 14 instruments) and fractures (AUC 0.48–0.89, 11 instruments), and simple and complex instruments perform similarly.
2. Dual-energy x-ray absorptiometry (DXA) predicts fractures for men and women, and calcaneal quantitative ultrasonography also predicts fractures, but correlation between the two methods is low.
3. For postmenopausal women, bisphosphonates, parathyroid hormone, raloxifene, and estrogen reduce primary vertebral fractures. Trials are lacking for men.
4. Bisphosphonates are not consistently associated with serious adverse events; both raloxifene and estrogen increase thromboembolic events; and estrogen is associated with additional adverse events.

Exercise as a fracture-prevention strategy was not included in the review outlined above. My searches of PEDro and PubMed did not identify any trials of exercise interventions that would have been large enough to detect effects on fractures (a sample size of at least 5,000 people would be needed). It is important to note that evidence of no effect differs from a lack of evidence

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of effect. If there were evidence from trials that exercise does not prevent fractures, it would be difficult to argue that this intervention is worthy of preventive health care resources; what we currently have, however, is a lack of evidence of effect (i.e., no such trials have been conducted). Trials of exercise interventions are more difficult to conduct than trials of medication; in addition, while pharmaceutical companies with an interest in particular medications are likely to fund trials of those medications, funders for exercise trials are likely to be more difficult to find, as few companies have a financial interest in exercise.

Observational studies have shown us that people who do more exercise have fewer fractures. For example, the Australian Longitudinal Study on Women's Health⁷ found that people who participated in a very high level of physical activity were significantly less likely to suffer a broken bone within a 1-year period 5 years later (OR = 0.53, 95% CI: 0.34–0.83). This relationship persisted after adjustment for confounding variables (i.e., other variables likely to be associated with both physical activity and fracture). However, in an observational study it is very hard to adequately adjust for the confounding effects of other variables; in particular, is difficult to be sure that these results do not simply indicate that people who are more physically able and healthier are able to exercise more and also have fewer fractures. Potential funders of preventive interventions are still likely to require evidence from trials of exercise with fracture outcomes.

However, there are some other pieces of evidence that we can use to guide our practice. As the vast majority of fractures are associated with falls, it has been argued that fracture prevention should focus more strongly on fall prevention;⁸ and because falls are more common than fractures, a smaller trial is able to detect effects on falls. A PEDro search using the search terms *fall* and *exercise* in the Abstract box located a Cochrane Collaboration systematic review⁹ that states clearly that there is now evidence that exercise as a single-intervention strategy can prevent falls in older people in the general community as well as in those at increased risk of falls. In fact, more than 50 RCTs of exercise interventions have now been conducted. Successful programmes include the home-based Otago exercise programme,¹⁰ group-based tai chi,¹¹ and other well-designed group-based programmes.^{12,13} A systematic review I conducted with colleagues found that the common feature of successful programmes is a focus on training of balance.¹⁴ We adopted a broad view of balance as the ability to control the body's position in space (also used in the Cochrane review on balance training in older people),¹⁵ and defined as exercises that challenge balance those that aimed to (a) decrease the base of support, (b) decrease reliance on the arms for support, and (c) involve controlled movement of the body. A higher dose of exercise was also associated with greater reductions in falls.

Several trials of exercise interventions that have falls as the primary outcome also report the effect of the interventions on fractures. The Cochrane reviews of interventions aiming to prevent falls also included some meta-analyses of fracture outcomes from these trials. There is an indication of an effect of exercise on fractures in both community⁹ and residential care¹⁶ settings. These results need to be interpreted with some caution, as they may have been influenced by publication bias. As discussed above, studies that are designed to detect effects on falls are likely to lack statistical power to detect effects on fractures. If there are only a few fractures in each group, the sizes and direction of effects on fractures are likely to be inconsistent, and it appears to me that studies that did not find an effect on fractures may not have reported their results.

So where does this leave us as clinicians and researchers? I suggest that we can be confident that falls can be prevented by exercise and that this is an important component of fracture prevention. As researchers, we should cooperate in providing data from trials for meta-analysis and work collaboratively to gain funding for trials large enough to detect an effect on fractures, thus providing firmer evidence to guide significant investment of preventive health resources in exercise programmes designed to prevent fractures.

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DOI:10.3138/physio.63.2.146