

## Treatment of Osteoporosis in Australian Residential Aged Care Facilities: Update on Consensus Recommendations for Fracture Prevention

Gustavo Duque, MD, PhD, FRACP<sup>a,b,\*</sup>, Stephen R. Lord, PhD, DSC<sup>c</sup>, Jenson Mak, PhD, MBBS, FRACP, FAFRM(RACP), FACP<sup>d</sup>, Kirtan Ganda, BSc(Med), MBBS, FRACP, PhD<sup>e</sup>, Jacqueline J.T. Close, MD, FRCP, FRACP<sup>c</sup>, Peter Ebeling, MBBS, MD, FRACP<sup>f</sup>, Alexandra Papaioannou, MD, MSc, FRCP(C), FACP<sup>g</sup>, and Charles A. Inderjeeth, MBChB, FRACP, MPH<sup>h</sup>

<sup>a</sup>Australian Institute for Musculoskeletal Science (AIMSS), The University of Melbourne and Western Health, St. Albans, VIC, Australia

<sup>b</sup>Department of Medicine, Melbourne Medical School–Western Precinct, The University of Melbourne, St. Albans, VIC, Australia

<sup>c</sup>Neuroscience Research Australia, University of New South Wales, Randwick, NSW, Australia

<sup>d</sup>Faculty of Health and Medicine–The University of Newcastle, Callaghan, NSW, Australia

<sup>e</sup>Concord Clinical School–The University of Sydney, Concord, NSW, Australia

<sup>f</sup>Monash Medical Centre, Clayton Campus, Clayton, VIC, Australia

<sup>g</sup>GERAS Centre, McMaster University, St. Peter's Hospital, Hamilton, ON, Canada

<sup>h</sup>Area Rehabilitation and Aged Care NMHS and University of Western Australia, Nedlands, WA, Australia

### Abstract

**Background**—Older people living in residential aged care facilities (RACFs) are at a higher risk of suffering fractures than the community-dwelling older population. The first Consensus Conference on Treatment of Osteoporosis in RACFs in Australia, held in Sydney in July 2009, aimed to address some of the issues relating to the treatment of older residents with osteoporosis in RACFs. Considering that the field of osteoporosis diagnosis and management has significantly advanced in the last 5 years and that new evidence has been generated from studies performed within RACFs, a Second Consensus Conference was held in Sydney in November 2014.

**Methods**—An expert panel met in November 2014 in Penrith, NSW, Australia in an attempt to reach a consensus on diverse issues related to the treatment of osteoporosis at RACFs. Participants were selected by the scientific committee on the basis of their practice in an RACF and/or major published articles. The co-chairs distributed topics randomly to all participants, who then had to propose a statement on each topic for approval by the conference after a short, evidence-based presentation, when possible.

\*Address correspondence to Gustavo Duque, MD, PhD, FRACP, Australian Institute for Musculoskeletal Science, 176 Furlong Road, St. Albans, VIC, Australia 3021. gustavo.duque@unimelb.edu.au (G. Duque).

**Results**—This article provides an update on the most relevant evidence on osteoporosis in older people living in RACFs graded according to its level, quality, and relevance.

**Conclusion**—As with the first consensus, it is hoped that this statement will constitute an important guide to aid physicians in their decision making while practicing at RACFs.

### Keywords

Osteoporosis; fractures; nursing homes; falls; vitamin D

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In 2012, people aged 65 years and over made up 14% of Australia's population. This figure is projected to increase to 22% in 2061 and to 25% in 2101.<sup>1</sup> In Australia, the number of total admissions into residential aged care facilities (RACFs) has risen steadily in recent years. This is consistent with the increase in both the places available in the aged care system and the number of older people as a proportion of the population. During the 2013–2014 financial year, 254,929 separate individuals were residing in RACFs, with a total of 137,948 admissions. The average age of residents is 83 years, with an average length of stay of just under 3 years.<sup>2</sup> The typical profile of an institutionalized older person in Australia includes chronic diseases, multiple medications, cognitive disorders, vision and hearing impairment, poor muscle strength, a high prevalence of urinary and fecal incontinence, high risk of falls, and low bone mineral density (BMD).<sup>3–5</sup> General practitioners (GPs) are the primary care providers in RACFs in Australia. When possible, the same GP who has been treating the resident before admission would be responsible for his/her care while at the RACFs. In the majority of cases, however, a new GP becomes involved in the resident's care after institutionalization, which may affect continuity of care.

Once an older person enters an RACF, several changes occur in his or her care including the opportunity to maximize adherence to medications.<sup>6,7</sup> Osteoporosis treatment is a particularly challenging area in RACFs. The majority of residents in this setting are at high risk of suffering a fracture,<sup>8</sup> but only a minority receives treatment according to their level of risk.<sup>9–11</sup>

### Methods

The first Consensus Conference on Treatment of Osteoporosis in RACFs in Australia, held in Sydney in July 2009,<sup>12</sup> aimed to address some of the issues relating to the treatment of older residents with osteoporosis in RACFs. Considering that the field of osteoporosis diagnosis and management has significantly advanced in the last 5 years and that new evidence has been generated from studies performed within RACFs, a Second Consensus Conference was held in Sydney in November 2014. This article provides an update on the most relevant evidence on osteoporosis in older people living in RACFs graded according to their level, quality, and relevance (Table 1).<sup>13</sup> As with our first consensus, it is hoped that this statement will constitute an important guide to aid Australian physicians in their decision making.

## Results

### Risk Factors for Fractures

Eighty-five percent of all nursing home residents are reported to have osteoporosis worldwide.<sup>14</sup> In fact, approximately 40% of all hip fractures occur in this population,<sup>15</sup> which is associated with a disability and high mortality.<sup>16</sup> Identification of patients at risk should therefore be actively pursued in this population.

Although the risk factors for fractures in noninstitutionalized populations are well known,<sup>15–18</sup> the risk factors for people in RACFs remain less studied. Chen and colleagues reported the results of the Fracture Risk Epidemiology in the Frail Elderly (FREE) study.<sup>19</sup> This prospective cohort study was designed to evaluate risk factors for falls and fractures in a population of 1894 older people (1433 women and 461 men) recruited from 52 nursing homes and 30 hostels in Northern Sydney. It was found that risk factors for individuals in RACFs differed from those for community-dwelling older people. Bringing together the results reported by Chen et al<sup>19</sup> and other related evidence on risk assessment for osteoporosis in RACFs,<sup>8,20–22</sup> we summarized a new risk profile for osteoporotic fractures in people in RACFs (Table 2).

### Assessing Fracture Risk

Two risk assessment tools are available to facilitate the identification of fracture risk in community-dwelling individuals. The FRAX and the Garvan fracture risk assessment tools have become pivotal in closing the gap in care for people with osteoporosis.<sup>23</sup> Although these tools have been validated in predominantly community-dwelling populations, their applicability to residents of RACFs (who have a different risk profile to community populations) remains unknown. One study<sup>26</sup> determined the prevalence of vertebral fracture among 151 nursing home residents using vertebral fracture assessment on dual-energy X-ray absorptiometry (DXA). While the prevalence of osteoporosis and vertebral fractures was high (52% and 36%, respectively) this did not significantly alter FRAX scores. Therefore, medical history, especially incorporating age and previous fractures may be the most practical way to determine fracture risk in this population.

### Fracture Prevention

Despite the high risk of fracture in institutionalized older people, osteoporosis treatment rates in RACFs remain markedly low.<sup>27–29</sup> Some of the potential causes for this treatment gap include limited access to diagnostic methods for fractures and BMD, lack of knowledge about evidence-based interventions for osteoporosis in RACFs, assumptions about length of stay and survival, and family and patients' concerns about polypharmacy and potential side effects.<sup>8</sup> Nevertheless, hip fractures in institutionalized older adults constitute an important cause of morbidity and mortality that could be prevented with an appropriate evidence-based approach to prevention.<sup>15</sup>

Several initiatives have been tested to improve physicians' awareness of the importance of identifying and treating osteoporosis. A randomized trial to improve fracture prevention in

nursing home residents demonstrated that audit feedback and education interventions are ineffective in improving fracture prevention.<sup>28</sup> In this study, nursing homes (n = 67) with >or = 10 residents with a diagnosis of osteoporosis or recent hip fracture (n = 606) were randomized to receive an early or delayed intervention consisting of audit and feedback, educational modules, teleconferences, and academic detailing. Medical record abstraction and the Minimum Data Set were used to measure the prescription of osteoporosis therapies before and after the intervention period, with no significant improvements being observed in any of the quality indicators.

In contrast, new approaches to diagnosing and treating osteoporosis in nursing homes have obtained very promising results, at least by increasing the number of vitamin D supplements among nursing home residents.<sup>30</sup> It is expected that the use of a similar structured and multidisciplinary approach, which includes pharmacological as well as nonpharmacological interventions, could be very useful in the Australian context where access to prescriptions for osteoporosis is highly regulated and based on evidence of cost effectiveness.

## Fracture Prevention Interventions

### Nonpharmacological

**Fall prevention in nursing homes**—As fall risk is an important determinant factor for fractures in institutionalized older people, there is agreement that all residents of RACFs should be screened for fall risk (Table 3). Recently, Whitney et al<sup>31</sup> evaluated a fall risk screening in the nursing home setting. The authors concluded that the tool was useful for identifying older people living in RACFs who were at increased risk of falls and provided important information about risk factors amenable to intervention. The risk of falling over a 6-month prospective period increased from 0% in those with no risk factors to 100% in those with six or more risk factors. The screening tool, presented in Figure 1, is easy to administer and contains items that are routinely collected in RACFs in Australia.

Furthermore, a pharmacist (if available) in association with the GP should perform a regular medication review to identify potential or actual medication-related problems and support appropriate prescribing. This medication review should be particularly focused on benzodiazepines, other psychotropic medications, and medicines that contribute to a high drug burden index (ie, those with anticholinergic or sedative properties).<sup>6,32–34</sup>

Other interventions to prevent falls have been multifactorial in nature and have addressed risk factors pertaining to the individual (eg, strength and balance training) as well as his or her ability to safely interact with the environment. A meta-analysis by Cameron et al<sup>35</sup> reported that multifactorial interventions reduce falls and risk of falling in hospitals and may do so in nursing care facilities. They also reported that vitamin D supplementation significantly reduced the rate of falls (Relative attributable risk [RaR], 0.63; 95% confidence interval, 0.46 to 0.86; five trials, 4603 participants), thus confirming a recent report by Kennedy et al<sup>30</sup> supporting the correction of vitamin D deficiency as an effective intervention to prevent falls in this setting.

Regarding the effect of exercise on fall prevention in RACFs, a recent meta-analysis<sup>36</sup> concluded that combined frequent and long-term exercise programs (strength and balance exercises combined) are effective to prevent falls in long-term care facilities, possibly by addressing sarcopenia.<sup>37</sup> However, no effect of exercise on fracture prevention was observed in this population.

**Hip protectors**—Studies of the efficacy of hip protectors to prevent hip fractures in residents of RACFs have reported conflicting results, possibly due to potential bias from cluster randomization designs and modest adherence to intervention.<sup>38–42</sup> A multicenter, randomized controlled trial in 37 nursing homes by Kiel et al,<sup>41</sup> which included 1042 residents, was unable to detect a protective effect on the risk of hip fracture despite good adherence to the protocol. In contrast, a Bayesian meta-analysis of four trials on the effect of hip protectors on fracture risk reported that hip protectors decrease the risk of hip fracture in elderly nursing home residents.<sup>40</sup> More recently, Cameron et al<sup>42</sup> tested different adherence strategies aimed at improving hip protector use in RACFs. Providing free hip protectors to older people living in nursing care facilities was necessary to increase initial acceptance and adherence. After 6 months, the achieved level of adherence was not high enough to be associated with a reduction of hip fracture. In addition, the provision of educational sessions and demonstrations to nursing staff and participants had no added value in this trial.

The most recent Cochrane Collaboration review of 19 studies and 17,000 people<sup>43</sup> concluded that for older people living in nursing care facilities, providing a hip protector probably decreases the chance of a hip fracture marginally but may increase the small chance of a pelvic fracture slightly. When wearing hip protectors, very few people had side effects, such as skin irritation. Often, however, people did not wear them, and a better understanding is needed of the personal and design factors that may influence acceptance and adherence.

## Pharmacological

Pharmacological treatment of osteoporosis has been found to be cost effective in community populations and nursing home residents aged 85 years and older based on BMD (Table 4).<sup>44,45</sup> Nevertheless, considering the particular characteristics of this population, and the difficulties involved in performing BMD assessment in RACF residents, physicians make the ultimate decision after consultation with the patients and their families, after involving the members of the multidisciplinary team, and after assessing the harm/benefit ratio of medication interventions. The consensus conference concluded that, at the very least, residents with a history of prior low trauma fracture should be offered treatment with currently available agents (Table 4).

With the exception of those residents with limited life expectancy (<1 year) or advanced disease stage (ie, dementia), and given the proven anti-fracture efficacy for most of the current medications for osteoporosis, their low risk of drug interactions with other medications and their relatively low incidence of adverse effects, osteoporosis medications should not be considered as “inappropriate prescriptions” in RACFs.<sup>46,47</sup> Despite strong

evidence supporting the use of osteoporosis medications in RACFs, however, their utilization remains extremely low.<sup>15</sup>

Selection of the most appropriate osteoporosis medication for the patient should include consideration of the likely potential benefit (bedridden individuals would have limited potential to benefit, given the low exposure to risk), optimal dose frequency and route of administration, potential side effects and tolerance, adherence and compliance issues, cost-effectiveness, and ability to prevent fractures early.<sup>9</sup> The present statement provides an update on the evidence on osteoporosis medications revised and discussed at the consensus conference. Although still very scarce in the current literature, relevant evidence obtained from the residential aged care setting or frail older people is provided. In addition, evidence obtained in similar populations (noninstitutionalized old-old and frail older persons) was discussed and summarized due to its relevance and potential benefit in the institutionalized population.

**Calcium and vitamin D supplementation**—There is evidence that vitamin D supplementation (Table 5) is beneficial for most residential aged care residents.<sup>48–50</sup> Benefits include prevention of falls and fractures.<sup>35</sup> Cholecalciferol (vitamin D<sub>3</sub>) should be administered at a dose of 800 IU/day or higher.<sup>49–53</sup> This is relatively inexpensive and achieves serum 25(OH) D concentrations >50 nmol/L in most subjects, so it can be implemented without baseline or follow-up measurement of serum 25(OH) D concentrations, which can be relatively expensive. Recent studies suggest that weekly doses of vitamin D may be more effective in correcting deficiency than small regular doses, have an effect on preventing both fractures and falls, and might achieve higher compliance, which is a major limitation of this therapy.<sup>54</sup> In addition, access to the sunshine for nursing home residents also improves vitamin D status,<sup>55,56</sup> although it is not enough to correct serum levels of vitamin D in severely deficient residents.

An Australian position statement on calcium and bone health<sup>57</sup> concluded that adequate vitamin D status was essential for active calcium absorption in the gut. A total daily intake of 1300 mg calcium—optimally from dietary—needs to be achieved (up to 500 mg/d of calcium supplementation), which may have a beneficial effect on BMD. Although there is no evidence of increased cardiovascular events in nursing home residents on calcium supplementation, recent evidence suggesting that it may increase the risk of cardiovascular diseases warrants caution.<sup>58</sup> As recommended by our previous Consensus Conference, resolution of this issue (risk vs benefit) will determine the appropriateness of supplemental nondietary calcium in fracture prevention. Currently, no high dosing of vitamin D, either oral or parenteral, has been approved for falls and fracture prevention in Australia. Based on the evidence suggesting that very high doses have an effect on increasing falls and fractures in older subjects,<sup>59,60</sup> however, use of very high doses (>500,000 IU/year or 24,000 IU/monthly) of vitamin D is not considered an alternative in the RACFs.

**Antiresorptives**—Bisphosphonates are the most commonly used medications for fracture prevention in the general population. However, the evidence supporting the use of bisphosphonates in institutionalized older persons is limited to just two randomized controlled studies. Greenspan et al demonstrated the utility of alendronate in improving



BMD in nursing home residents.<sup>61</sup> A more recent study by the same author tested the safety and efficacy of single-dose zoledronic acid for osteoporosis in a population of nursing home residents.<sup>62</sup> There was no difference in terms of the incidence of fractures between the treatment and placebo groups. However, the power of the study was limited by the small sample size and by the significant differences between both groups in terms of comorbidities.

A particular limitation of oral bisphosphonates in the RACF environment is the fact that adherence could be affected by the administrative burden on both nursing staff and patients due to complex directions, difficult administration to patients with cognitive impairment, and a high prevalence of swallowing problems among residents. If oral therapy is considered, the enteric coated preparation of risedronate may be the preferred option when fasting is difficult. In this setting, intravenous bisphosphonates could become a useful alternative to oral bisphosphonates due to the lack of gastrointestinal side effects, prolonged dose intervals (1 year), and 100% adherence over 12 months at least.<sup>63–65</sup>

Denosumab is another type of antiresorptive agent, which has demonstrated a strong anti-fracture effect in several populations.<sup>66,67</sup> Denosumab is a fully human monoclonal antibody, which is injected subcutaneously every 6 months. Although no studies have tested denosumab in RACFs, overall, the advantages of denosumab in this population include (1) convenient biannual subcutaneous administration that could improve adherence, (2) lack of gastrointestinal side effects, (3) reversibility, because it targets RANKL and is not incorporated into the bone mineral, and (4) useful for impaired renal function because of nonelimination by the kidneys. This last advantage is more evident in older persons in whom low glomerular filtration rate is a common finding. However, the risk of hypocalcemia increases in this population; therefore, appropriate serum levels of calcium and vitamin D should be ensured prior to the administration of denosumab.

Therefore, and considering the limited evidence available on the use of antiresorptives in RACFs, the consensus conference reviewed the current evidence on the effectiveness of this group of medications on fracture prevention in the closest type of populations, the old-old and the frail older population.<sup>63–67</sup> A summary of the evidence is provided in Table 6.

The number of potential side effects associated with the use of antiresorptives is a common concern of physicians when deciding on an osteoporosis treatment.<sup>67–71</sup> Osteonecrosis of the jaw (ONJ) and atypical fractures are the potential side effects of most concern.<sup>68</sup> Although there are no reports on the prevalence of ONJ or atypical fractures in nursing home patients treated with antiresorptives, a recent International Consensus Conference<sup>69</sup> concluded that the risk of ONJ associated with antiresorptive therapy for osteoporosis was low, and that routine pre-treatment dental assessment should only be performed in individuals at high risk, such as patients with cancer receiving oncology-dose parenteral antiresorptive therapy of bisphosphonates and denosumab, which is not yet a common occurrence in nursing home residents. In terms of atypical fractures, these events follow longer-term use of antiresorptives. As with ONJ, a recent consensus<sup>70</sup> has concluded that the absolute risk of atypical fractures in patients on bisphosphonates is low, ranging from 3.2 to 50 cases per 100,000 person-years. Nevertheless, this side effect could be observed in

nursing home residents who have been on antiresorptives for long periods of time; therefore, prodromal symptoms (ie, thigh pain) should be actively explored in these patients.

### Other treatments

**Strontium ranelate (Table 7):** A systematic review by Inderjeeth et al<sup>63</sup> on the safety and efficacy of pharmacological agents in managing osteoporosis in people 85 years and older concluded that there is good evidence for the benefit of current treatments in reducing vertebral fractures, but that data are limited for nonvertebral and hip fracture reduction. However, the use of strontium ranelate in clinical practice has been affected by recent evidence reporting a higher incidence of cardiovascular events in post-menopausal women receiving treatment for osteoporosis with this compound<sup>71</sup>; therefore, its use in RACFs is not recommended.

*Teriparatide* is an anabolic medication that is administered subcutaneously on a daily basis. No studies have assessed the effect of teriparatide in RACFs. Although compliance with this medication should not be an issue in RACFs, major limitations to using this medication in RACFs include the Australian Pharmaceutical Benefits Scheme requirements and the high cost of the medication. Indications to use teriparatide in RACFs include several possible scenarios: (1) patients with severe osteoporosis with use of bisphosphonates for a number of years with recurrent fracture and (2) in cases where an osteoporotic fracture has failed to unite after surgical treatment. In general, although highly effective in hip fracture prevention, <sup>72</sup> teriparatide should not be considered as a first-line treatment for fracture prevention, and even less so in the RACF population.<sup>73</sup>

## Conclusion

Prevention of falls and fractures in older persons living in RACFs should include risk identification, fracture/BMD documentation, nonpharmacological and pharmacological interventions, staff education, and involve residents and their families, where appropriate. In addition, research in the field of fall and fracture prevention in RACFs, including major clinical trials, should be encouraged. Our recommendations closely correspond with those recently published in Canada.<sup>74</sup> Although there are substantial differences between the Canadian and the Australian RACFs, we all agree that only by increasing awareness on the consequences of osteoporotic fractures in this population, we will generate an important change in practice with a major impact on quality of life in this high-risk population.

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<b>CaHFRIS - CARE HOME FALLS SCREEN (Residential Aged Care Facilities)</b>		<b>Room Number:</b>													
		<b>Surname:</b>													
		<b>Date of Birth:</b>													
		(Score – Please Circle)				(Tick if applicable)									
MMSE <small>(refer to MMSE performed by healthcare professional e.g. ACAT assessment)</small>						SCORE 16 or LESS <input type="checkbox"/>									
<b>IMPULSIVITY</b>						SCORE 2 OR MORE <input type="checkbox"/>									
1. Does the resident tend to be impulsive when moving around? Impulsive means "rushing to carry out an activity without thinking about it first"?		Yes = 1 No = 0													
2. How often does the resident do the following? Try to sit down before getting right up to the chair / toilet / bed		Very frequently = 4, Frequently = 3, Often = 2, Occasionally = 1, Never = 0													
Attempt to stand before wheelchair brakes have been applied / footplates moved or walking frame placed in front of them		Very frequently = 4, Frequently = 3, Often = 2, Occasionally = 1, Never = 0													
Tries to walk without help when asked not to		Very frequently = 4, Frequently = 3, Often = 2, Occasionally = 1, Never = 0													
3. a. Wandering frequency in last week: b. Wandering alterability <small>(Wandering is defined as moving with no rational purpose, seemingly oblivious to needs or safety)</small>		Every day = 3, 4-6 days = 2, 1-3 days = 1, not at all = 0 Easily altered/not present = 0, not easily altered = 1													
<b>STANDING BALANCE</b>						SCORE 5 OR LESS <input type="checkbox"/>									
Please rate the resident's standing balance using the scale		Unable to stand = 1, Requires assistance of 2 to remain standing = 2, Requires assistance of 1 to remain standing = 3, Requires use of walking aid to remain standing = 4, Stands without aid / assistance but unsteady = 5, Stands without aid / assistance steady = 6.													
<b>WALKING FRAME</b>		Does the resident require a walking frame to mobilise?				YES <input type="checkbox"/>									
<b>FALL IN THE PREVIOUS YEAR</b>		Has the resident had a fall in the last year?				YES <input type="checkbox"/>									
<b>USE OF ANTIDEPRESSANT MEDICATION?</b>		Commonly prescribed antidepressants = Amitriptyline, Dosulepin, Doxepin, Citalopram, Fluoxetine, Paroxetine, Sertraline, Mirtazapine. If not sure ask GP for confirmation of any anti depressant prescription				1 OR MORE <input type="checkbox"/>									
<b>USE OF HYPNOTIC/ANXIOLYTIC MEDICATION</b>		Commonly prescribed hypnotics/anxiolytics = benzodiazepines such as diazepam, nitrazepam, temazepam as well as Zaleplon, Zopiclone, Zolpidem. If not sure ask GP for confirmation of any hypnotic/anxiolytic prescription				1 OR MORE <input type="checkbox"/>									
<b>TOTAL NUMBER OF RISK FACTORS (circle below)</b>															
<b>ABSOLUTE RISK OF FALLS IN NEXT 6 MONTHS</b>		<b>0</b>		<b>1</b>		<b>2</b>		<b>3</b>		<b>4</b>		<b>5</b>		<b>6+</b>	
		<b>0%</b>		<b>10%</b>		<b>23%</b>		<b>45%</b>		<b>62%</b>		<b>82%</b>		<b>100%</b>	

**Reference:** Whitney et al (2012). Identification of high risk fallers among older people living in residential aged care facilities: A simple screen based on easily collectible measures, *Archives of Gerontology and Geriatrics*, 55: 690-695.

**Fig. 1.**  
Care Home Falls Screen (CaHFRIS).

**Table 1****Consensus Process and Methods**


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**Aim:** To update previous recommendations for the clinical management of osteoporosis in residential aged care facilities.<sup>12</sup>

**Source:** The participants included experts in the field of osteoporosis, geriatric medicine, and rehabilitation (n = 5) who acted as moderators of the small groups and as speakers at the plenary sessions. In addition, geriatricians and general practitioners practicing at the residential aged care level (n = 45) from all over Australia acted as participants at the workshops and plenary sessions.

**Methods:** A search of peer-reviewed journals was conducted using MEDLINE (1966–15 November 2014). Relevant articles were identified using combinations of the subject headings “osteoporosis,” “nursing homes,” “residential care,” “long-term care,” “fractures,” “fracture prevention,” “calcium,” “vitamin D,” “bisphosphonates,” “antiresorptives,” “denosumab,” “strontium ranelate,” “teriparatide,” “hip protectors,” “falls,” and “falls prevention.”

**Levels of evidence:** Articles retrieved were graded according to their level of evidence based on the NHMRC levels of evidence:

**Level I:** A systematic review of level II studies

**Level II:** A randomized controlled trial

**Level III-1:** A pseudorandomized controlled trial (ie, alternate allocation or some other method)

**Level III-2:** A comparative study with concurrent controls:

- Nonrandomized, experimental trial
- Cohort study
- Case-control study
- Interrupted time series with a control group

**Level III-3:** A comparative study without concurrent controls:

- Historical control study
- Two or more single-arm study
- Interrupted time series without a parallel control group

**Level IV:** Case series with either posttest of pretest/posttest outcomes

When an NHMRC level of evidence for a clinically relevant aspect of fracture and fall prevention in the aged cared residential setting was lacking, consensus expert opinion (designated evidence V) was applied.

**Final recommendations:** Comments from all participants (experts and participants) on the draft position statement were received and considered. Final clinical recommendations were prepared by the small groups and approved at the final plenary.

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NHMRC, National Health and Medical Research Council.

**Table 2****Risk Factors for Osteoporotic Fractures (Level II)**


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Low bone mass (by Dual-energy X-ray absorptiometry or ultrasound)
Female gender *
Older age *
Maternal history of fracture
History of previous fractures *
History of falls in the last 12 months
Low body weight *
Oral glucocorticoids at a dose of 5 mg prednisolone (or equivalent) for more than 3 months
Alcohol intake of 30 g/day
Current smoking
Previous hyperthyroidism
Diabetes mellitus
Vision loss
Psychotropic medication use
Postural instability *
Male residents *
Low serum vitamin D *
Bowel or bladder incontinence *
Cognitive impairment *
Poorer balance *
Ambulatory *

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\* Higher hazard ratio in institutionalized older persons versus community dwelling individuals.

Adapted from Chen et al.<sup>19</sup>



**Table 3****Recommendations for Fall and Fall Injury Preventions**


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<ul style="list-style-type: none"> <li>• On admission to RACFs, new residents should be assessed for fall risk using an evidence-based tool with clear links to interventions (level III-2).<sup>24</sup></li> <li>• Risk assessment should be repeated every 6 months or in the event of a fall (level III-2).</li> <li>• Evidence of assessment and delivery of evidence-based fall prevention strategies should be included in RACFs accreditation processes (level V).</li> <li>• Medication should be reviewed annually by a pharmacist in association with the general practitioner, carers, residents, and family to identify medication-related problems and ensure appropriate prescribing (level II).</li> <li>• Psychotropic medications and medications aggravating the Drug Burden Index<sup>25</sup> should specifically be reviewed in relation to fall risk. Use of benzodiazepines should be actively avoided in older people (level II).</li> <li>• Education is required around alternate methods to enhance sleep quality (daytime activity, avoiding naps, nonpharmacological aids to sleep) (level II).</li> <li>• Cholecalciferol should be considered for all residents (level II).</li> <li>• Multifactorial comprehensive assessment linked to tailored intervention should be routine practice in RACFs (level II).</li> <li>• Exercise as part of a multifactorial intervention is recommended. Exercise must challenge balance and be undertaken at least twice weekly (carers should be encouraged to assist) (level I).</li> <li>• Environmental assessment, which assesses the safe interaction of a resident with his or her environment should be part of a multifactorial intervention (level I).</li> <li>• Hip protectors should be recommended as part of a multifactorial intervention and targeted at people where adherence is likely to be good (level I).</li> <li>• Use of physical, mechanical, and chemical restraint is not recommended as a fall prevention strategy (level II).</li> </ul>	
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RACFs, residential aged care facilities.

**Table 4**

## Pharmacological Prevention of Fractures in RACF Residents Versus Community-Dwelling Older Persons

Agent	Dose	Evidence in Institutionalized Older Persons	Hip Fracture (RRR) General Population
Cholecalciferol	800–1000 IU/day	Yes (Fx prevention) (level I)	0.12–0.29
Alendronate	70 mg/weekly	Yes (only BMD) (level II)	0.45–0.51
Risedronate	35 mg/weekly	No	0.30–0.40
Zoledronate	5 mg/annually	No	0.41
Denosumab	60 mg/6 mo	No	0.40 (0.60 in older)
Teriparatide	40 µg/day	No	0.25

BMD, bone mineral density; Fx, fracture; RACF, residential aged care facility; RRR, relative risk reduction.

**Table 5****Recommendations for Vitamin D and Calcium Supplementation**

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Vitamin D
<ul style="list-style-type: none"><li>• Vitamin D supplementation should be universal (level V).</li><li>• Vitamin D supplementation is an effective intervention in fall prevention (level I).</li><li>• Routine baseline and follow-up monitoring are not supported because of cost effectiveness except in selected populations (ie, declining BMD, new fractures, initiating new osteoporosis medications) (level V).</li><li>• Adequate 25(OH)D concentration is &gt;50 nmol/L (level I), with optimal levels &gt;75 nmol/L (level II).</li><li>• Dose equivalent to 1000 IU/day (25 mcg/d) necessary to achieve this target (level I).</li><li>• High daily doses (&gt;4,000 IU/d) or high load doses are not recommended (level II).</li><li>• Safe sunlight exposure should be encouraged (level I). However, it is not sufficient to correct serum levels of vitamin D in deficient residents (level II).</li></ul>
Calcium
<ul style="list-style-type: none"><li>• It is recommended that combination of calcium and vitamin D be optimized in all residents (level I).</li><li>• Increased dietary calcium should be encouraged in place of calcium supplements (level III-2) with dietician assessment as part of care.</li><li>• A total daily intake of 1300 mg calcium optimal from dietary means to be achieved (up to 500 mg/d of calcium supplementation) (level I).</li><li>• High-dose calcium supplementation alone may increase the risk of cardiovascular events (level II).</li><li>• Long-term compliance with calcium is very poor (level I).</li><li>• Anti-fracture efficacy of calcium supplements is marginal (level I).</li></ul>

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**Table 6****Antiresorptives Recommendations****General Considerations**

- It may be reasonable to reserve pharmacological therapy for nursing home residents at highest risk of hip fracture, such as those with prior fragility fracture or multiple risk factors (especially if any vitamin D insufficiency or deficiency has first been treated).
- Life expectancy should be taken into consideration.
- Careful consideration must be given to any contraindications to bisphosphonates or denosumab therapy.

**Primary Prevention**

- Assess fall risk (CaHFRiS tool) (level V).
- Assess risk (FREE tool, FRAX, or Garvan) (level V).
- Recommend BMD in patients at risk of osteoporosis prior to entry to residential aged-care facility (level III-2).
- Make sure that vitamin D, eGFR, and calcium levels are appropriate.
- Prescribe calcium/vitamin D, and multifactorial fall prevention (level I).
- Strongly consider subcutaneous denosumab or intravenous bisphosphonates in those at high risk of fracture (previous history of minimal trauma fracture and/or BMD criteria) (level I).

**Secondary Prevention**

- Treatment should be initiated in all residents with previous history of osteoporotic fractures (level II).
- Fractures should be actively documented (level V).
- Put on calcium/vitamin D, and implement multifactorial fall prevention (level I).
- Use of subcutaneous denosumab or intravenous bisphosphonate therapy is equally effective (level I).
- Recognize practical issues preventing successful uptake of oral bisphosphonates (level III-2).
- If oral bisphosphonates are still used, recommend education of nursing staff by pharmacists on oral bisphosphonate administration and dosing (level V).
- Subcutaneous denosumab and intravenous bisphosphonates are effective ways of overcoming dosing and compliance problems associated with oral bisphosphonates in this population (level V).
- Check 25(OH)D, Ca, and eGFR before using antiresorptives (level II).
- In patients with eGFR  $\geq$  35 mL/min, antiresorptive therapy with denosumab is a safer option (level II).

**Fractures Occurring on Antiresorptive Therapy**

- Consider using teriparatide if fracture occurs after 12 months of bisphosphonate therapy with T-score  $<$  -3 SD in patients with two or more fractures (level II).
- Consider denosumab as an alternative to oral bisphosphonate (level V).
- Strontium ranelate could be an alternative, taking into consideration recent warnings (level V).

**Side Effects of Antiresorptive Therapy**

- Oral bisphosphonates should not be used in patients with dysphagia or disordered swallowing (level I).
- Acute reaction post-IV bisphosphonate can be managed with prophylactic paracetamol therapy (level II).
- Osteonecrosis of the jaw is rare (between 1 in 10,000 and  $<$  1 in 100,000 in patients on antiresorptive therapy for osteoporosis).
- In patients already on long-term bisphosphonates, close monitoring of predictive symptoms of atypical fractures is recommended with low threshold of x-ray if the resident complains of groin pain (level III).

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BMD, bone mineral density; eGFR, estimated glomerular filtration rate; FREE, Fracture Risk Epidemiology in the Frail Elderly.

**Table 7****Other Treatments**

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<ul style="list-style-type: none"><li>• Strontium ranelate can be considered as a second-line treatment option (level I).</li><li>• Strontium ranelate should not be coprescribed with other osteoporosis treatments except calcium and vitamin D (level V).</li><li>• Strontium ranelate should not be used in those with established cardiovascular disease or thromboembolic disease risk or those who are immobile (level III).</li><li>• Teriparatide should be considered as a treatment for those with severe osteoporosis (T score <math>-3.0</math> SD, with a recurrent fracture despite 12 months of antiresorptive therapy), and (level II).</li></ul>
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