Australian and New Zealand Bone and Mineral Society

Secondary Fracture Prevention Program Resource Pack

Provided as a Service to Medicine by ANZBMS

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People who are concerned about osteoporosis, or their own longer-term bone health, should consult their normal qualified physician or healthcare provider

Foreword

For more than two decades, we have known that osteoporotic or 'fragility' fractures predispose to further fractures, significant morbidity and premature death. Despite all this hard-core evidence, amazingly little has changed for our patients with osteoporosis. Still, 75 to 80% of men and women who have suffered a minimal trauma fracture are neither investigated nor treated for their underlying condition, osteoporosis. As a result, up to 50% of patients admitted to hospital with a first fragility fracture are going to be re-admitted with a further fragility fracture – with enormous cost to the individual and the community alike. This failure is all the more shocking as we have available a whole range of subsidised pharmacotherapies with proven efficacy to reduce the risk of fracture. We are just not using them.

Let's face it: the current state of affairs in regards to osteoporosis management is a medical, social, political and financial nightmare of gigantic and ever growing dimensions. The reasons for this failure are complex. Certainly, inadequate awareness of the hazards related to osteoporosis amongst health professionals, health administrators and patients is a contributor. However, a perhaps more important factor is the almost complete lack of systematic and effective post-fracture care, a deficit unthinkable in other areas of medicine.

Fortunately, things are set to change. Worldwide, attempts are being made to improve secondary fracture prevention through the implementation of system-level models of care. Many of these have been shown to deliver beyond expectations: thus, re-fracture rates, morbidity and mortality, hospital bed days and other health system usage are all reduced as soon as patients are being managed by a well-organised Secondary Fracture Prevention (SFP) Program.

With this Resource Pack you are holding in your hands the key to implement an efficient post-fracture care program at your place of work – be it a hospital, a community health centre or other service locality, a metropolitan, regional or rural setting, a surgical or medical context, as a health professional, administrator or regulator. Paul Mitchell has done a formidable job in collating the evidence from all around the world, organising and presenting it in an easy to read and pragmatic fashion, and adapting the facts and recommendations to the specifics of the Australian Health System. In a competitive environment such as ours, it is often not a simple task to meet the financial and logistic requirements of a secondary fracture prevention program. Here too, this Resource Pack will provide you with specific evidence on the proven cost-effectiveness of SFP Programs.

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Executive summary

The burden of fragility fractures on patients and health services in Australia

In June 2015, the population of Australia reached almost 23.9 million people[1]. Over the last century, life expectancy at birth has increased by more than 40%, from 59 to 84 years for women and 55 to 80 years for men, respectively[2]. This trend is set to continue into the future; by 2056, one in four Australians will be aged ≥65 years[3]. During the next five decades, the proportion of the population aged ≥85 years is set to grow in excess of three-fold, from 344,000 people in 2007 to between 1.7 and 3.1 million by 2056. This ongoing shift in the demographic composition of the Australian population will fuel an increasing burden of chronic disease amongst the elderly.

Osteoporosis is the most common chronic bone disease affecting both women and men[4]. The clinical manifestation of this disease is osteoporotic or 'fragility' fractures, which can be defined as a fracture resulting from a fall from a standing height, or its equivalent. During 2012, Osteoporosis Australia estimated that almost 143,000 fractures occur in Australia every year amongst older people, including almost 23,000 hip fractures[5]. The risk of fracture increases significantly following a prior fracture[6, 7]. All too often, hip fracture represents the final destination of a thirty year journey fueled by decreasing bone strength and increasing falls risk[8].

Policy and clinical guidelines in Australia

Osteoporosis was a focus of the Australian National Health Priority Area on musculoskeletal conditions and arthritis designated in 2002[9]. A primary aim of the subsequent National Action Plan was to promote appropriate post-fracture assessment to minimise further fragility fractures[10]. The related National Service Improvement Framework (NSIF) highlighted a major post-fracture care gap[11] in Australia; nearly 70% of Australians are not investigated for osteoporosis after suffering a fragility fracture. This is all the more remarkable given that Medicare Benefits Schedule[12] and Pharmaceutical Benefits Scheme[13] both deem testing and treatment of people aged ≥50 years who have suffered a fragility fracture as cost-effective.

State strategies for New South Wales[14, 15], South Australia[16] and Western Australia[17, 18] all focus on the care gap identified in the NSIF and approaches that have been shown to close it. The need for establishment of healthcare systems that always ***respond to the first fracture to prevent the second*** is paramount[15]. The appointment of dedicated members of staff to ensure that the best post-fracture care is consistently delivered is a common theme throughout all strategy documents. Furthermore, national clinical guidelines from the Royal Australian College of General Practitioners prioritise the need for timely identification, diagnosis and management of women and men who have suffered fragility fractures[19, 20]. Similarly, national guidelines on falls prevention strategies highlight the need for both osteoporosis and falls risk to be addressed in patients with fragility fractures[21-23].

The rationale for secondary fracture prevention

Several studies have evaluated future fracture risk associated with fractures at various skeletal sites[6, 7]; a prior fracture at any site is associated with a doubling of future fracture risk. Secondary fractures appear to occur rapidly after the incident fracture[24]. The Glasgow Fracture Liaison Service established that 80% of re-fractures occur during the first year post-index fracture, with 50% of re-fractures having occurred during the first 6-8 months, dependent on whether the incident fracture was hip (6 months) or non-hip (8 months)[25]. Long-term follow-up from the Dubbo Study in Australia demonstrated that fragility fracture patients are at increased risk of subsequent fracture for up to 10 years after the incident fracture[26].

In 1980, US investigators reported that over 50% of patients presenting with hip fractures had experienced prior fractures[27]. More recent studies from Australia[28], Scotland[29] and the USA[30] consistently found similar results. The Australian group coined the term 'signal' fracture[28] to illustrate the opportunity presented by prior fragility fractures to trigger secondary preventative assessment and intervention, which has also been advocated by a UK consensus group[31]. Approximately 50% of all hip fracture cases come from the 16% of the post-menopausal female population with a history of fracture[32, 33]. Secondary prevention therefore presents an opportunity to intervene in about half of all future hip fracture sufferers by targeting one sixth of the population for assessment.

During the last two decades, a broad range of therapeutic interventions have been assessed in large-scale randomised clinical trials that have demonstrated consistent fracture reduction efficacy. The Principle agents licensed for the treatment of osteoporosis throughout the world have been shown to reduce the incidence of fractures by 30-50%[34-45]. Fracture reduction efficacy of 50% has been observed for patients with a history of multiple fractures[46]. An emerging body of evidence suggests that osteoporosis treatment is associated with reduced mortality[44, 47-50].

A prospective observational study from Southern California reported a 37% reduction in expected hip fracture rate over 3 years, compared to the rate expected from historical data following the implementation of a systematic approach to secondary and primary fracture prevention in 11 hospitals serving a population of 3.1 million people[51]. Reports from Secondary Fracture Prevention (SFP) Programs (aka Fracture Liaison Services) throughout the world[52-56], including Australia[54, 55], have shown similar encouraging impacts on secondary fracture incidence.

Current management gap and barriers to secondary fracture prevention in practice

Two major nationally representative audits which include measures of secondary fracture prevention have been undertaken in Australia, in both secondary and primary care settings. An audit of secondary preventive care of patients presenting to 16 Australian hospitals with probable fragility fractures was undertaken between 2003 and 2005[57]. Of the 1,829 patients with fractures that were evaluated, <13% had risk factors for fracture identified, 10% were appropriately investigated, 12% were commenced on calcium and 12% on vitamin D, and 8% started bisphosphonates and 1% selective oestrogens receptor modulators. Similar findings were reported in primary care from the Australian Bone Care Study[58]. Evaluation of >88,000 women aged over 60 years from 927 primary care physicians' lists found that 29% had suffered a prior fracture; 66% reported one fracture, 22% reported 2 fractures and 12% reported 3 - 14 fractures. Less than 28% of women with a fracture history received specific treatment for osteoporosis.

Given that the rationale for secondary preventive care appears to be so compelling, why is it not happening? Several surveys have been conducted amongst orthopaedic surgeons and GPs in the UK to explore the reasons for the lack of integrated care[59-61]. One survey asked orthopaedic surgeons and GPs about their routine clinical practice regarding investigation of osteoporosis following a low trauma Colles fracture[59]. Respondents recognised that fragility fracture patients should be investigated for osteoporosis (81% of orthopaedic surgeons, 96% of GPs). However, the majority of orthopaedic surgeons (56%) would discharge the patient without investigating for osteoporosis. The majority of GPs would take no action (45%) or would instigate investigations only if prompted to do so by the orthopaedic surgeon (19%). Only 7% of orthopaedic surgeons and 32% of GPs would assess and/or start treatment themselves. The findings of the national audits[57, 58] in Australia suggest a similar 'disconnect' is occurring in Australian medical practice.

Secondary Fracture Prevention Programs:
A systematic approach to secondary fracture prevention

A growing body of professional organisations[62-73], patient societies[69, 74-80] and policymakers[11, 15, 16, 18, 81-86] throughout the world have recognised the need for systematic approaches to secondary fracture prevention. A number of expressions have been adopted to describe exemplar service models, including 'Fracture Liaison Services' in Australia[54, 55, 87-95], Asia[96-98], Europe[53, 56, 99-117] and the United States[118-123], 'Coordinator Programs' in Canada[124-129] and 'Care Manager Programs' in the United States[130-132]. Regardless of the terminology, all of these service models deliver high quality secondary preventive care through ***identification, investigation and intervention*** for fragility fracture sufferers, with the aim of preventing future fractures. The common component of all successful Secondary Fracture Prevention (SFP) Programs, the term to be used in this document, is appointment of personnel dedicated to delivering secondary preventive care. SFP Programs have been shown to consistently outperform other service configurations[29]. However, the majority of Australian hospitals are yet to implement a SFP Program[15, 16, 18, 133, 134].

The ageing population is placing ever greater pressure on healthcare systems to deliver increased capacity and productivity within constrained resources. Crucially, against this back drop, SFP Programs have been shown to be highly cost-effective as well as clinically effective systems of care. Health economic evaluations from Australia[91] and elsewhere[51, 114, 121, 127] have consistently reported favourable findings.

The purpose of this Resource Pack is to improve the care of fragility fracture patients, by supporting healthcare professionals to establish and develop SFP Programs within their localities. As stated in a 2015 ANZBMS Position Paper[72] on this subject:

> '*The majority of older Australians and New Zealanders who suffer from osteoporosis, and as a consequence sustain fragility fractures, do not receive the care required to prevent such fractures. Recent collaborative initiatives in New Zealand should lead to universal access to secondary fracture prevention programs within the next year. A similar, government-supported approach is needed in Australia as most patients at high risk of suffering debilitating and costly fragility fractures do not receive appropriate management of their disease. This system-wide failure has led to an unacceptable care gap for some of the most vulnerable members of our society, the old and elderly.*
>
> *The Australian and New Zealand Bone and Mineral Society calls on the Australian Commonwealth and State governments to join the leading health professional and patient organisations to agree to a process which will make secondary fracture prevention available for all older Australians*.'

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1. National policy, state strategies and clinical guidelines in Australia

1.1 National policy

> *'Failure to prevent, detect and treat chronic disease at an optimal stage in its course impacts on affected individuals and their families and carers in terms of pain and suffering, and on the whole Australian community in productivity losses and high health care costs.*
>
> *Accordingly, effective prevention and management of chronic disease is a key policy objective of the Australian and all state and territory health systems.'*[135]
>
> Professor John Horvath AO
> Chief Medical Officer
> Department of Health and Ageing
> November 2005

Osteoporosis is a chronic disease which is manifested in the form of fragility fractures. Osteoporosis was a focus of the Australian National Health Priority Area on musculoskeletal conditions and arthritis designated in 2002[9]. A primary aim of the subsequent National Action Plan was to promote appropriate post-fracture assessment to minimise further fragility fractures[10]. The related National Service Improvement Framework (NSIF) highlighted a major post-fracture care gap[11] in Australia:

> *'... there is evidence that despite being eligible for bone density testing and osteoporosis medication under Medicare and the PBS, respectively, nearly 70% of Australians are not investigated for osteoporosis following a low trauma fracture, and more than 60% are not managed appropriately.*
>
> *Very few Australians (18% of women and 7% of men) with a history of previous osteoporotic fractures who suffer subsequent fractures are receiving appropriate osteoporosis care.'*

The Australian Medicare Benefits Schedule[12] and Pharmaceutical Benefits Scheme[13] both deem testing and treatment of people ≥50 years of age who have suffered a fragility fracture as cost-effective. The NSIF proposed that the following issues underpinned the observed failure to consistently deliver secondary preventive care:

- Lack of knowledge about the implications of fractures and opportunities to reduce the risk of further fractures.
- Lack of integration of hospital, medical and surgical services.
- Uncertainty over who is responsible for initiating investigation and who will follow up the results of diagnostic tests.

A multidisciplinary approach based upon clinical pathways in fracture clinics was advocated as a mechanism to close the care gap. The national policy documents are intended to provide a framework that will guide an implementation process which will be led within each of the jurisdictions.

1.2 State strategies

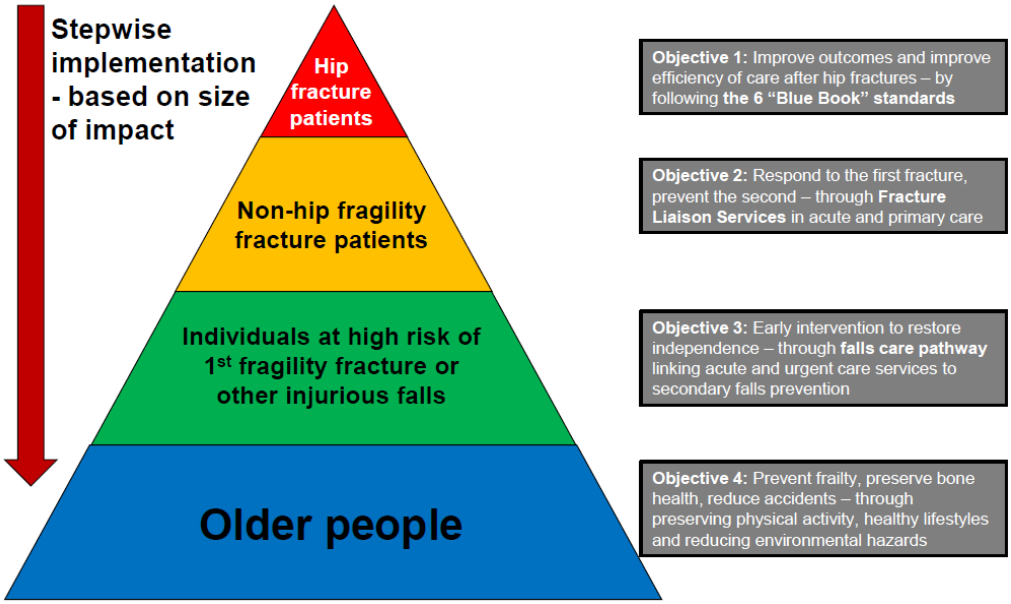
1.2.1 New South Wales

In January 2011, the New South Wales Agency for Clinical Innovation (NSW ACI) published the 'NSW Model of Care for Osteoporotic Refracture Prevention'[15]. During the period 2002-2008, 35% of fragility fracture admissions to hospitals in the state involved patients that had suffered a secondary fracture. This accounted for 16,225 bed days per year, with an average length of stay of 22 days. A survey of osteoporosis service provision for patients presenting with fragility fractures to the state's 40 healthcare localities revealed that 12% had post-fracture coordinators in place. The majority of these posts were funded by research or service-to-medicine grants by pharmaceutical companies. Accordingly, the

majority of patients presenting to hospitals across the most populous state of Australia usually fail to receive secondary preventive care.

The NSW ACI model has adopted the strategic approach originally developed by the Department of Health in England[84] illustrated in figure 1. This strategy advocates specific service models to deliver objectives derived from professional consensus guidance[63] for particular sub-populations that have suffered, or at high risk of suffering injurious falls and fragility fractures. The NSW ACI Orthogeriatric Model of Care[14] and ACI Minimum Standards for the management of hip fracture in the older person[136] are intended to deliver the first objective of improving outcomes and efficiency of care for hip fracture patients. Secondary Fracture Prevention (SFP) Programs, which will be described in more detail in section 4 of this document, are designed to ensure local healthcare systems consistently ***respond to the first fracture to prevent the second***, to deliver the second objective. The strategy interfaces with the NSW Government's mandatory policy directive on falls prevention[137]. Falls prevention care pathways should be configured to link urgent care services to systems that reliably deliver secondary falls prevention measures for individuals who are falling frequently, and so deliver the third objective.

Figure 1: Department of Health in England falls and fracture prevention strategy[84]



Adapted from *Falls and fractures: Effective interventions in health and social care*[84]

The NSW ACI model identifies appointment of 'Fracture Liaison Coordinators' as the key step to close the current care gap. The state-wide survey determined the precise number of coordinators required based upon case-load in each hospital. Implementation of the NSW ACI Model is subject to formal evaluation by the ACI in collaboration with the Centre for Clinical Governance Research in Health at the University of New South Wales.

1.2.2 Queensland

In 2008, Queensland Health published community good practice guidelines for the Queensland 'Stay On Your Feet®' initiative[138]. The purpose of the guidelines was to inform good practice in preventing falls, and minimising harm from falls, among community-dwelling people aged >65 years and for Aboriginal and Torres Strait Islander people in Queensland aged ≥50 years. The Good Practice Points include:

- Older people with a history of low trauma fracture should be investigated for osteoporosis and treated as appropriate.

In January 2015, investigators from the Health Statistics Branch of Queensland Health published an analysis of readmission rates for fall-related injuries[139]. The index episode was defined as the first acute care admission for a fall-related fracture occurring during the period 2008-2009 to 2009-2010. Readmissions were defined as a subsequent admission for a fall-related fracture to any hospital within two years of the index admission. Of the 19,286 eligible patients, 4,399 died during their index stay or had no readmission record but died within two years of their index stay. Accordingly, 14,887 patients were included in the analysis cohort, of which 14.3% (2,123) were readmitted for a fall-related fracture within two years of their index admission. Readmission rates varied considerably between facilities, from 7.6% to 21.8%. Ten percent of patients were readmitted within 16 months and 15% had been readmitted by 2 years and 8 months after the index admission. A diagnosis of osteoporosis at any stage during the study period increased the adjusted odds of readmission.

1.2.3 South Australia

In May 2011, the South Australia Statewide Orthopaedic Clinical Network and Rehabilitation Clinical Network published 'Models of Care for Orthopaedic Rehabilitation - Fragility Fractures, General Orthopaedic Trauma and Arthroplasty'[16]. This strategy identifies the need for osteoporosis management and falls prevention to be a standard component of post-fracture care:

> *'Appointment of hospital based fragility fracture coordinators to work within the multi-disciplinary teams in development of patient care plans ensuring appropriate supports, rehabilitation and follow up is organised on discharge and secondary prevention commenced.'*

The strategy recognises that current provision of these services is variable, with referral to rehabilitation services and long-term osteoporosis management being delivered on an ad hoc basis. Furthermore, variation of service delivery is also apparent between metropolitan and rural areas.

The hospital fracture coordinators would be responsible for ensuring that all fragility fracture patients receive appropriate assessment, including bone mineral density testing, screening tests for secondary causes of osteoporosis and screening and referral to multi-disciplinary falls prevention programmes. The need to establish reliable systems of communication with local general practitioners is highlighted, in accordance with recommendations published by Osteoporosis Australia[140], the British Orthopaedic Association[63] and the International Osteoporosis Foundation[32, 140] on the benefits of SFP Programs. The strategy also makes the case for community based fragility fracture coordinators. Their roles would include:

- Liaison with general practitioners to ensure that a long-term osteoporosis management plan is in place.
- Clinical pharmacy review to be undertaken if appropriate.
- Organising falls prevention strategies such as exercise classes and assessment of the home environment.
- Education on healthy living.
- Linkage to self-management programmes.

The need for post-fracture services to provide appropriate care to individuals living in residential aged care facilities is also highlighted. Services that are developed in response to the strategy should be subject to continuous evaluation with a focus on process, impact, outcomes and structure.

In 2015, the South Australian Government is implementing the 'Transforming Health' reforms[141]. Throughout the implementation of Transforming Health, a number of time-limited clinical working parties will be established, each focussing on a specific area of healthcare, including orthogeriatrics. Model of care development and an initial project workshop was held in June/July 2015.

1.2.4 Tasmania

In 2014, the Department of Health and Human Services of the Tasmanian Government published a Green Paper titled 'Delivering safe and sustainable clinical services'[142]. The stated purpose of the Green Paper was to facilitate feedback and discussion on the development of a clear vision for the future direction of health in Tasmania. A new Health Council of Tasmania would be established to advise the Minister of Health on strategic priorities to guide health service planning and delivery in Tasmania. The Health Council would be supported by discipline specific Clinical Advisory Groups (CAGs). In response to the Green Paper, the subsequently established Musculoskeletal Medicine CAG made several recommendations, including the following of relevance to fragility fracture care and prevention:

- **Recommendation 3:** Explore factors contributing to inefficiencies within the theatres and ways to ensure more efficient use of theatre time. To include:
    - Involvement of a medically-based ortho-geriatrician in the care for older patients post hip fracture surgery and hip replacement surgery would improve patient survival outcomes and help reduce their hospital length of stay.
    - The follow-up for patients who have had fractures (i.e. neck of femur etc.) is important to prevent and/or treat osteoporosis and decreasing potential for further fractures. This is recognised as a cost effective component of their management.
- **Recommendation 6:** Establish secondary fracture prevention pathways.

The final White Paper was published in June 2015[143].

1.2.5 Victoria

In 2013, a Musculoskeletal Clinical Leadership Group (MSCLG) was established to promote and support a coordinated state-wide approach to chronic musculoskeletal conditions in Victoria[144]. The MSCLG has identified SFP Programs as an opportunity to improve care. However, at the time of writing current projects are focused on osteoarthritis care and pain services. Furthermore, Arthritis and Osteoporosis Victoria identified SFP Programs as an evidence-based intervention which could be undertaken immediately in Victoria to address the burden of musculoskeletal disease in their 2014-15 State Budget Submission[145].

1.2.6 Western Australia

In August 2011, the Health Networks Branch of the Department of Health of the Government of Western Australia published an Osteoporosis Model of Care[18]. This comprehensive strategy complements the previously published Orthogeriatric Model of Care[17] and the Falls Prevention Model of Care for the Older Person in Western Australia[146]. The Model of Care focuses on five areas, which include the following specific aims and objectives:

- **Health promotion**
    - Evidence-based messages and methods of delivery.
    - Focus on early identification, particular amongst people who have sustained fractures.
    - Appoint coordinators akin to the approach of the Ontario Osteoporosis Strategy[82].
- **Lifetime fracture risk assessment**
    - Improve compliance with guidance on screening including the Royal Australian College of General Practitioners guideline (RACGP)[19, 20] and the 2007 Position Statement of the International Society for Clinical Densitometry[147].
    - Refer all patients presenting to Emergency Departments with fragility fractures to a fracture clinic and their GP to initiate appropriate assessment and treatment.
    - Refer patients with falls history or risk factors for falling to a falls clinic.
- **Treatment**
    - Treatment decisions should be informed by the RACGP guideline[19, 20] and the consensus recommendations for treatment of osteoporosis in Australian residential aged care facilities[148].
    - Consumers should be educated about the efficacy of pharmacologic treatments.

    - Introduce comprehensive electronic discharge summaries from hospitals to GPs that include an appropriate management plan.
- **Workforce development**
    - Identify training needs of front-line staff.
    - Link educational initiatives to established or planned services in the community setting.
    - Support dissemination of best practice resources.
- **Research and evaluation**
    - Evaluate the efficacy of initiatives intended to raise consumer awareness.
    - Develop a health economic model of the impact of fracture liaison positions.
    - Investigate barriers and enablers for integrated approaches to osteoporosis and falls prevention.

The extensive body of evidence from the Australian[57, 58, 149-153] literature on the current secondary prevention care gap is highlighted. In the context of delivering the *right care* at the *right time* by the *right team*, in the *right place*, SFP Programs are identified as an important solution:

> *'Establish fracture liaison positions to coordinate care between hospital and community settings. Hospital GP Liaison Officers can contribute to this role.'*

In June 2015, an analysis of hospitalisations, admission costs and re-fracture rates was published for WA residents aged ≥50 years who had been admitted to a WA hospital between 2002 and 2011[154]. A total of 5,326 patients were admitted to WA hospitals with an index fracture. More than 2,000 (38.2%) of these patients sustained a re-fracture which required readmission. Of these, 1,223 (23%) had one re-fracture episode, 453 (8.5%) had two, and 361 (6.8%) had three or more re-fracture episodes which required readmission. Furthermore, 44.4% of readmissions occurred within 6 months of the index fracture. The 3,646 readmissions resulted in 75,182 bed days. During the 10 year period, the total consumer price index-adjusted cost for the index admissions was AU$57 Million, and the total cost for the readmissions was almost AU$49 Million. The authors concluded that this study provided further justification for the implementation of SFP Programs across WA.

1.3 Clinical guidelines

1.3.1 Treatment of osteoporosis

In February 2010 the Royal Australian College of General Practitioners (RACGP) published a 'Clinical guideline for the prevention and treatment of osteoporosis in postmenopausal women and older men'[19] and, in collaboration with Osteoporosis Australia, a management algorithm[20]. The guideline was approved by the National Health and Medical Research Council (NHMRC). The guideline provides Australian GPs with a best practice approach to:

- Identify, diagnose, treat and manage, in a timely and accurate manner, men and women who have been diagnosed with at least one minimal trauma fracture.
- Reduce the progression of such individuals to a second fracture.
- Optimise patient and carer access to information, understanding of the condition and involvement in its management in order to help patients improve their health status.

The guidance was informed by a systematic review of the literature. This has also enabled recommendations to be made on a best practice approach for identification, diagnosis, treatment and management of osteoporosis in the following target populations:

- Postmenopausal women and older men who may be at risk of developing osteoporosis.
- Postmenopausal women and men over 50 years of age who have been diagnosed with osteoporosis defined as a T-score of ≤-2.5 but without evidence of a minimal trauma fracture.

The guideline highlights the secondary prevention care gap identified in the 2005 National Institute of Clinical Studies 'Evidence-practice gaps report, volume two'[155]:

'Osteoporosis is both under diagnosed and under treated in Australia. It represents an example of a gap between evidence and clinical practice. Only 7–20% of patients who have sustained an osteoporotic fracture receive treatment for OP to prevent further fractures.'

The recommendations relating to secondary prevention of fracture that received a Grade A ranking on the NMHRC scale - indicating that the body of evidence can be trusted to guide practice - were:

- **Recommendation 2:** Diagnosis of osteoporosis - Low trauma fracture:
  - There is excellent evidence to support GPs investigating patients with a fracture following low trauma.
- **Recommendation 3:** BMD Measurement:
  - Bone mineral density should be measured by DXA scanning performed on two sites, preferably anteroposterior spine and hip.
- **Recommendation 6:** Dietary calcium:
  - General practitioners should recommend that postmenopausal women and older men maintain a diet high in calcium to meet the Australian recommended dietary intake.
- **Recommendation 19:** Bisphosphonates:
  - There is excellent evidence to support the effectiveness of bisphosphonates (alendronate, risedronate or zoledronic acid) in reducing the risk of vertebral and non-vertebral fractures and increasing BMD in postmenopausal women and older men with osteoporosis.
- **Recommendation 21:** Hormone Therapy (for postmenopausal women):
  - There is excellent evidence to support the effectiveness of hormone therapy (HT) in reducing the risk of fractures in postmenopausal women with OP. The significant increase in risk of adverse events associated with treatment should be weighed carefully against benefits, and long term use is not recommended.
- **Recommendation 23**: Parathyroid Hormone (for postmenopausal women):
  - There is excellent evidence to support the effectiveness of teriparatide in postmenopausal women with osteoporosis for reduction in fracture risk and improvement in BMD. Because of expense, teriparatide is generally recommended for patients at very high risk of fracture or in whom bisphosphonate therapy is contraindicated or has been ineffective.
- **Recommendation 25:** Selective Oestrogen Receptor Modulators (for postmenopausal women):
  - There is excellent evidence to support the effectiveness of selective oestrogen receptor modulators (SERMs) for postmenopausal women with OP where vertebral fractures, rather than non-vertebral fractures, are considered to be the major OP risk and where other agents are poorly tolerated.
- **Recommendation 26:** Strontium Ranelate (for postmenopausal women):
  - There is excellent evidence to support the effectiveness of strontium ranelate 2 g/day for reducing the risk of further osteoporotic fractures in postmenopausal women with prevalent fractures.

A practical tip is offered with respect to identification of patients to investigate for osteoporosis:

'Any adult woman or man should be considered to have osteoporosis if they suffer a fracture after minimal trauma, such as after a fall from standing height or less.'

In June 2010, after publication of the RACGP guidelines, the Therapeutic Goods Administration (TGA) registered denosumab for the treatment of osteoporosis in post-menopausal women and in men with osteoporosis[156]. Denosumab is also indicated for treatment to increase bone mass in men with osteopenia receiving androgen deprivation therapy for non-metastatic prostate cancer. Denosumab significantly reduces the risk of vertebral, nonvertebral and hip fractures, and is subsidised by the PBS.

In August 2010, consensus recommendations[148] for fracture prevention through treatment of osteoporosis in Australian residential aged care facilities (RACF) were published. The authors highlight the importance of identification of patients at high risk of suffering fragility fractures in this setting, given that 40% of all hip fractures emanate from the RACF population. Assessment of fracture risk on admission is recommended to ensure early implementation of fracture prevention measures.

1.3.2 Prevention of falls

In August 2009, the Australian Commission on Safety and Quality in Health Care (the Australian Commission) published a comprehensive suite of guidelines titled 'Preventing Falls and Harm From Falls in Older People' for the hospital[21], community[23] and residential aged care settings[22]. Several recommendations highlight the need for an integrated approach to osteoporosis management and prevention of falls:

- Patients with a history of recurrent falls should be considered for a bone health check. Also, patients who sustain a minimal-trauma fracture should be assessed for their risk of falls.
- People with diagnosed osteoporosis or a history of low-trauma fracture should be offered treatment.
- Hospitals and residential aged care facilities should establish protocols to increase the rate of osteoporosis treatment in patients who have sustained their first osteoporotic fracture.

1.3.3 Australian and New Zealand Guideline for Hip Fracture Care

In September 2014, the Australian and New Zealand Hip Fracture Registry (ANZHFR) Steering Group published the Australian and New Zealand Guideline for Hip Fracture Care[157], which was approved by the National Health and Medical Research Council (NHMRC). The purpose of the guideline was to support professionals to deliver consistent, effective and efficient care for individuals who suffer a hip fracture. On account of NHMRC approved guidance[19] on the treatment of osteoporosis having been published in 2010 (section 1.3.1) and falls guidance[21-23] in 2009 (see section 1.3.2), there was not a requirement to duplicate that work in the hip fracture care guideline.

In May to July 2015, the Australian Commission, working with the Health Quality and Safety Commission New Zealand (HQSC), undertook a public consultation on a draft Hip Fracture Care Clinical Care Standard[158]. A Clinical Care Standard is a small number of quality statements that describe the clinical care that a patient should be offered for a specific clinical condition. The seven quality statements in the draft Clinical Care Standard are:

1. A patient presenting to hospital with a suspected hip fracture receives care guided by timely assessment and management of medical conditions, including diagnostic imaging, pain assessment and cognitive assessment.
2. A patient with a hip fracture is assessed for pain at the time of presentation and regularly throughout their hospital stay, and receives pain management including the use of multimodal analgesia as clinically appropriate.
3. A patient with a hip fracture is offered treatment based on an orthogeriatric model of care as defined in the *Australian and New Zealand Guideline for Hip Fracture Care*[157].
4. A patient presenting to hospital with a hip fracture, or sustaining a hip fracture while in hospital, receives surgery on the day of or the day after, where clinically indicated and surgery is preferred by the patient.
5. A patient with a hip fracture is offered mobilisation without restrictions on weight-bearing the day after surgery and at least once a day thereafter, depending on the patient's clinical condition and agreed goals of care.
6. Before a patient with a hip fracture leaves hospital, they are offered a falls and bone health assessment, and a management plan based on this assessment to reduce the risk of another fracture.
7. Before a patient leaves hospital, the patient and their carer are involved in the development of an individualised care plan that describes the ongoing care that the patient will require after they leave hospital. The plan includes a summary of any changes in medicines, any new medicines, mobilisation, wound care and function post-injury, recommendations for future fracture prevention and referral to ongoing rehabilitation if clinically indicated. This plan is provided to the patient before discharge and to their general practitioner or ongoing clinical provider within 48 hours of discharge.

When the final version of Clinical Care Standard is published it will serve three purposes:

1. To ensure that people will know what care should be offered by their healthcare system, and to make informed treatment decisions in partnership with their clinician.
2. To support clinicians to make decisions about appropriate care.
3. To support health services to examine the performance of their organisation and make improvements in the care they provide.

1.4 National Health and Medical Research Council

The NHMRC Research Translation Faculty (the Faculty) was established as a key advisory forum in 2012. The primary work of the Faculty for the period 2013-15 was to help NHMRC accelerate the translation of research by identifying the most significant gaps between research evidence and health policy and practice in each of the major health areas in the NHMRC Strategic Plan, and to propose to NHMRC possible action it could consider taking to address that gap, which are called Cases for Action. In April and May 2013, fourteen Faculty steering groups were established as NHMRC working committees to each oversee the development of a Case for Action.

The Faculty's Arthritis and Musculoskeletal Conditions Steering Group and Injury Prevention and Control Steering Group are comprised of a range of experts and include primary and secondary representatives of NHMRC Health Care Committee (HCC) and Prevention and Community Health Committee (PCHC). In February 2015, these two Steering Groups submitted a Case for Action on falls and fracture prevention to NHMRC[159]. The Case for Action identified four care gaps:

- **Gap 1:** Older adults do not participate in activities likely to prevent falls.
- **Gap 2:** Health professionals are not recommending/referring older adults for appropriate falls prevention exercises.
- **Gap 3:** Exercise prescribers and providers are not prescribing the right type of exercise or correct dose.
- **Gap 4:** High-risk individuals with minimal trauma fracture remain untreated for their underlying osteoporosis and/or fail to adopt and adhere to treatment recommendations.

The proposed action to address care gap 4 was:

> *'Advise State, Territory and Commonwealth Ministers for Health on strategies to reduce second minimal trauma fractures in Australia and support the development of appropriate models of care to ensure coverage for all Australians, irrespective of geographic location or socioeconomic status, and recognising the additional challenges for regional, rural and remote areas, as well as specific population such as Aboriginal and Torres Strait Islanders and people from non-English speaking backgrounds. This would include examination of the feasibility and costs of different models of care such as fracture liaison clinics in public and private hospitals and primary care facilities, fracture liaison coordinators who would link the patient and different health professionals to ensure that appropriate assessment and treatment is being received, and quality improvement strategies aimed at improved primary care physicians and/or patients.*
>
> *Timeframe: 3-5 years.'*

National policies, state strategies and clinical guidelines all highlight the existence of a secondary prevention care gap for fragility fracture patients in Australia.

2. The rationale for secondary fracture prevention

2.1 The ageing population

In June 2015, the resident population of Australia reached almost 23.9 million people[1]. Over the last century, life expectancy at birth has increased by more than 40%, from 59 to 84 years for women and 55 to 80 years for men, respectively[2]. Australia enjoys one of the highest life expectancies of any country in the world. In 2012, among Organisation for Economic Co-operation and Development (OECD) countries, life expectancy was ranked third and seventh for women and men, respectively.

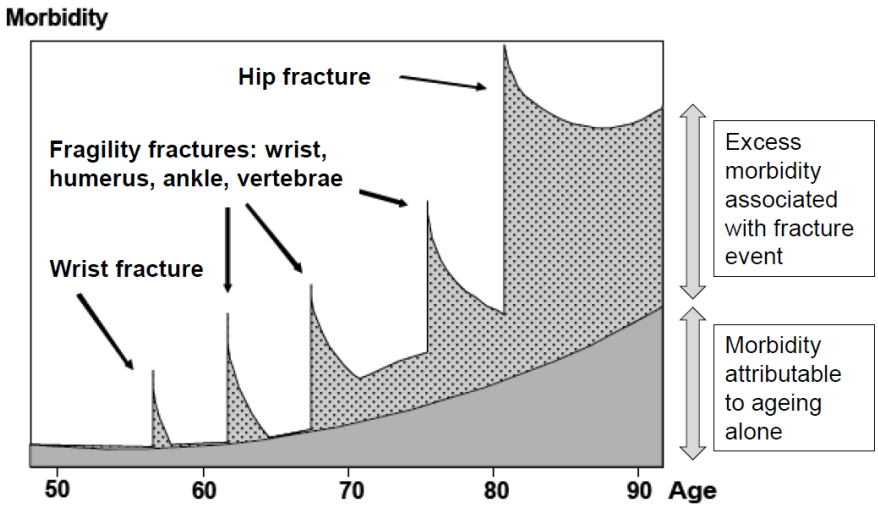
Australia's population is projected to increase to between 31 and 43 million people by 2056[3]. In 2007, 13% of the population was ≥65 years of age, a figure that is predicted to increase to 25% by 2056. Over the next five decades, the proportion of the population aged ≥85 years is projected to increase from 1.6% (344,000 people) to 5-7% (1.7-3.1 million people).

2.2 Fracture as a predictor of future fracture risk

Osteoporosis is a chronic disease which is manifested in the form of fragility fractures. An illustration of the consequences of unchecked osteoporosis amongst ageing patients is provided in figure 2. As with other chronic diseases such as hypertension or hyperlipidaemia, osteoporosis sufferers experience an asymptomatic disease phase prior to occurrence of end-organ damage. Fragility fractures usually result from a fall in older patients who have compromised bone strength.

> *'Hip fracture is all too often the final destination of a thirty year journey fuelled by decreasing bone strength and increasing falls risk.'*[8]

Figure 2. Fracture and quality of life during the life span of a patient with osteoporosis



Adapted from *The care of patients with fragility fracture*[63]

In 2013, Osteoporosis Australia published a new burden of disease analysis for the period 2012-2022[5]. Key findings included:

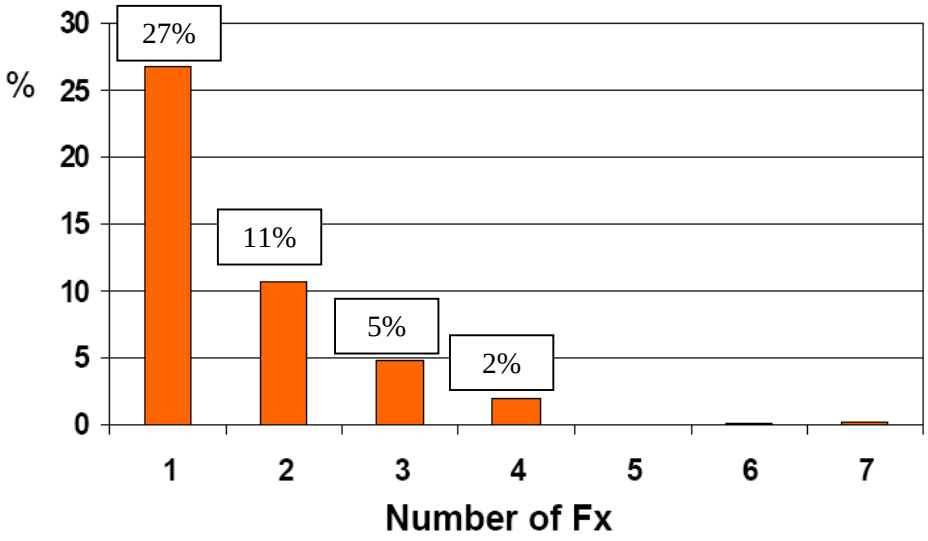
- In 2012, 140,822 fragility fractures occurred in Australia, including almost 23,000 hip fractures.
- In 2012, the total direct cost for fracture repair was AU$1.6 Billion.
- By 2022, a 30% increase in fracture incidence will result in 183,105 fractures per year.

Several recent studies from Australia[160-162] have reported that the age adjusted incidence of hip fracture is levelling-off or declining. Studies from other comparably developed countries have identified similar

trends in Europe[163-168], North America[169, 170] and New Zealand[171]. The proposed reasons for this change include increased osteoporosis screening and pharmacotherapy, healthy birth cohort effect, healthy migrant effect and the protective effect of greater body weight. Whilst the observed reduction in age-adjusted incidence of hip fracture is very welcome, as stated in a study from Victoria on this subject[162], there is no room for complacency. As Australia's 5.4 million baby boomers began to retire in 2011[172], hip fractures will continue to exert a tremendous burden on older Australians and the Australian healthcare system.

The central challenge facing policymakers and healthcare professionals is how to maximise the impact of interventions that reduce rates of fragility fracture. In this regard, the nature of the progression of the osteoporosis disease state provides a significant opportunity to optimally target resources. Almost three decades ago US investigators found that more than half of patients presenting with hip fractures had experienced prior fractures[27]. More recent studies from Australia[28], Scotland[29] and the USA[30] consistently found similar results. A prior history of fracture events occurred amongst 40% to 52% of hip fracture patients that presented to the 6 centres involved in the Scottish study. As is evident from figure 3, 45% of hip fracture patients had experienced ≥1 fracture after the age of 50 years, 18% had suffered ≥2 prior fractures and 7% had suffered ≥3 prior fractures.

Figure 3. Prior non-vertebral and clinical vertebral fractures after age 50 amongst hip fracture patients[29]



Adapted from McLellan et al. *Effectiveness of Strategies for the Secondary Prevention of Osteoporotic Fractures in Scotland. CEPS: 99/03*

Several studies have evaluated future fracture risk associated with fractures at various skeletal sites. Two meta-analyses[6, 7] found that a prior fracture at any site is associated with a doubling of future fracture risk; subsequent fracture risk amongst males may be higher[24, 26, 173]. Secondary fractures appear to occur rapidly after incident fracture[24]. The Glasgow Fracture Liaison Service established that 80% of re-fractures occur during the first year post-index fracture with 50% of re-fractures having occurred during the first 6-8 months; dependent on whether the incident fracture was hip (6 months) or non-hip (8 months)[25]. Long-term follow-up from the Dubbo Study in Australia demonstrated that fragility fracture patients are at increased risk of subsequent fracture for up to 10 years after the incident fracture[26].

The Australian group coined the term "signal" fracture[28] to illustrate the opportunity presented by the prior fragility fracture to implement secondary preventive care immediately, with the aim of reducing subsequent hip fracture risk. Clearly, each of these prior signal fractures could and should have served as a trigger for secondary preventive assessment and intervention where appropriate[31]. The Scottish

audit[29] also found that 34% of patients with a wrist fracture and 50% of patients with vertebral fracture had a history of prior non-vertebral and/or clinical vertebral fracture.

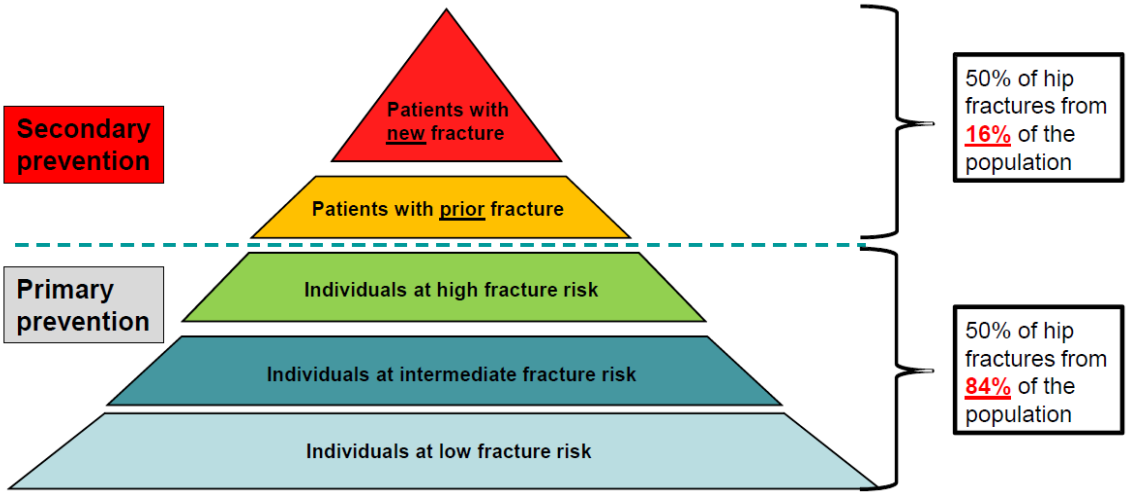
The majority of non-vertebral fragility fractures are the result of a fall. Falls are highly prevalent amongst older people; 34% aged 65 years or over who live in the community fall each year, increasing to 45% in those aged 80 or above[174]. A 2005 review summarised the literature on falls epidemiology, risk factors, clinical assessment and interventions to prevent falls[175]. Up to 10% of falls result in serious injury of which 5% are fractures. Accordingly, the majority of fracture patients have fallen, whilst the minority of fallers suffer a fracture. This relationship underpins the recommendations in Australian clinical guidelines[19, 20, 176] and consensus guidance from the UK[63] and United States[177] that patients presenting with fragility fractures require an integrated assessment of osteoporosis and falls risk.

2.3 A systematic approach to secondary fracture prevention

A major study of the epidemiology of fragility fracture from Australia provides valuable insights on the proportion of patients in the general population that have suffered fractures during later life[58]. The Australian BoneCare Study evaluated more than 88,000 women aged over 60 years from 927 primary care physicians' lists. Of 69,358 patient surveys returned, 57,088 reported the presence of a postmenopausal fracture or risk factors. Twenty nine percent of these women reported a fracture history; 66% reported one fracture, 22% reported 2 fractures and 12% reported 3 - 14 fractures. Notably, this study suggests that approximately 1 in 10 Australian women over 60 years of age have suffered at least two fractures.

The population at risk of suffering fragility fractures can be stratified in terms of future fracture risk and relative ease of case-finding as illustrated in figure 4. Triangulation of data from the Australian BoneCare Study[58], the UK[178] and France[179] suggests that the prevalence of fragility fracture amongst women aged over 50 years is approximately 16%. Given that 50% of hip fracture sufferers have fractured before, 50% of future hip fracture cases will emanate from 16% of the postmenopausal population[32, 33]. Patients experiencing new fragility fractures will present to medical services, be it hospital emergency departments or community-based fracture units, thus providing an obvious opportunity for an intervention to be made.

Figure 4. Fracture risk and ease of case-finding: Effective targeting of healthcare resources[33]



In respect of patients that have fractured in the past but not been assessed for future fracture risk, studies have demonstrated that self-report of prior fracture events provides a means to identify this population with reasonable accuracy. Specificity of fracture self-report has been shown to exceed 80%[180-182] and under-reporting is rare[182].

During the last two decades, a broad range of therapeutic interventions have been assessed in large-scale randomised clinical trials that have demonstrated consistent fracture reduction efficacy. The principle agents licensed for the treatment of osteoporosis throughout the world have been shown to reduce the incidence of fractures by 30-70%, dependent upon the skeletal site and the particular agent used[34-45]. Fracture reduction efficacy of 50% has been observed for patients with a history of multiple fractures[46]. An emerging body of evidence suggests that osteoporosis treatment is associated with reduced mortality[44, 47-50].

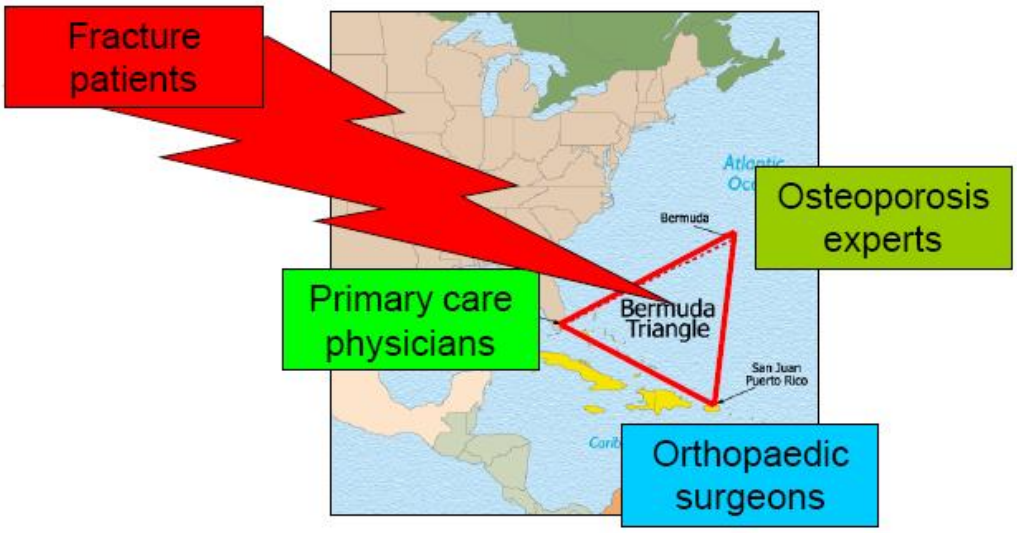
As half of hip fracture patients have suffered prior fragility fractures, nationwide implementation of a secondary prevention strategy would enable intervention in up to half of all future cases of hip fracture.

3. The current management gap

3.1 The challenge of integrated care

Osteoporosis care of fragility fracture patients has been characterised as a Bermuda Triangle comprised of orthopaedic surgeons, primary care physicians and osteoporosis experts into which the fracture patient disappears[183]. This phenomenon presents a similar challenge to management of all chronic conditions whereby end-organ damage is precipitated by worsening of an asymptomatic risk factor. In this regard, strategies for secondary prevention of fragility fractures, strokes and myocardial infarctions - as consequences of diminished bone density, uncontrolled hypertension and hyper-cholesterolaemia, respectively - require analogous and comparably reliable healthcare delivery solutions.

Figure 5. Osteoporosis care of the fragility fracture patient and healthcare professional 'silos'[183]



3.2 National, state-wide and local audits of secondary fracture prevention

3.2.1 National audits

Two major nationally representative audits, which include measures of secondary fracture prevention, have been undertaken in Australia, in both primary and secondary care settings:

- **Secondary care:** An audit of secondary preventive care of patients presenting to 16 Australian hospitals with probable fragility fractures was undertaken between 2003 and 2005[57]. Participating sites included hospitals from New South Wales, Queensland, South Australia, Victoria and Western Australia. The study evaluated care of 1,829 patients with fracture, of which 75% were women and 49 patients had suffered multiple fractures. Seventy percent of fractures occurred amongst people aged >70 years and 1,172 (70%) of the cohort required hospitalisation, the majority of whom underwent surgical interventions.

  Less than 13% of patients had risk factors for fracture identified, 10% were appropriately investigated, 12% were commenced on calcium and 12% on vitamin D, and 8% started bisphosphonates and 1% selective oestrogens receptor modulators in the acute setting.

- **Primary care:** The Australian BoneCare Study[58] evaluated more than 88,000 women aged over 60 years from 927 primary care physicians' lists. Of 69,358 patient surveys returned, 57,088 reported the presence of a postmenopausal fracture or risk factors. Twenty nine percent of these women reported a fracture history; 66% reported one fracture, 22% reported 2 fractures and 12% reported 3 - 14 fractures. The bulk of the fractures (42%) occurred amongst women aged 70-79 years.

Less than 28% of women with a fracture history received specific treatment for osteoporosis.

An aptly titled editorial, *Osteoporosis: it's time to 'mind the gap'*[184], commented upon the implications of both of these studies:

> *'Armed with this information and evidence of treatments that reduce fractures by approximately 50%, why are Australian doctors not implementing therapy to prevent these fractures and their attendant increased morbidity and mortality?*
>
> *Osteoporosis is a good example of an evidence–practice gap. This gap is present in both public hospitals and in general practice.'*

An analysis of government-dispensed prescription data on secondary fracture prevention in Australia adds further support to the findings of the national audits[185]. Whilst the volume of prescribing of PBS approved medications had increased substantially between 2000 and 2006, the authors highlighted:

> *'... fracture prevalence in this population is considerably higher than prescribing of effective anti-osteoporosis medications, representing a missed opportunity for the quality use of medicines.'*

3.2.2 State-wide audits

New South Wales

As a component of the development of the New South Wales Agency for Clinical Innovation 'NSW Model of Care for Osteoporotic Refracture Prevention'[15], a survey of services across the state was conducted in 2009. The key findings were:

- All Area Health Services participated in the survey.
- 3 out of 40 public health care settings have a budget to support people with osteoporosis.
- The total number of publicly funded staff across NSW are 5 nurses, 5 doctors and 1 Allied Healthcare Professional.
- 5 out of 40 localities have a post-fracture coordinator, most of whom are funded by research or service to medicine grants from the pharmaceutical industry.

The NSW ACI Model calculated the total number of post-fracture coordinators that would be required to deliver a comprehensive service across the state; 32.5 Full Time Equivalent (FTE) posts are needed, indicating an 85% shortfall at baseline, assuming all current services operate full time.

3.2.3 Local audits

A number of local audits of secondary fracture prevention have been published in Australia:

- **The Canberra Hospital:** Amongst patients presenting to the fracture clinic, 21% had appropriate anti-osteoporotic therapy initiated[186].
- **St. Vincent's Hospital, Sydney:** Amongst minimal trauma patients managed in an outpatient fracture clinic, during the 3 months after fracture, 11% received a bone density scan and 7% were initiated on anti-fracture treatment[187].
- **Westmead Hospital, Sydney:** Amongst patients admitted to hospital, 13% received osteoporosis management within the first year after the fracture occurred and <10% had any mention of osteoporosis in their medical notes during the fracture admission[188].
- **2 Regional hospitals in New South Wales:** Twenty two percent of patients admitted to hospital with fragility fractures were discharged on preventive medication[189].
- **3 Metropolitan hospitals in Melbourne:** Amongst wrist fracture patients, none were referred by the Emergency Department or Fracture Clinic for bone density testing and 6% received treatment after the fracture[149].
- **Flinders Medical Centre, Adelaide, SA:** Amongst wrist fracture patients, <30% recognition of fragility fracture and <10% treated appropriately[190].

- **Sir Charles Gairdner Hospital, Perth, WA:** Thirty seven percent of patients admitted to hospital with a fracture reported being on osteoporosis treatment on discharge, the majority of which was calcium (34%) rather than more potent licensed anti-fracture treatments[191]

3.3 Barriers to secondary fracture prevention in clinical practice

3.3.1 International Experience

Systematic review of the literature concerned with secondary fracture prevention has identified a number of barriers to consistent healthcare delivery. The 2004 publication 'Practice patterns in the diagnosis and treatment of osteoporosis after a fragility fracture: a systematic review' by Elliot-Gibson and colleagues identified the following issues in the provision of secondary fracture prevention[192]:

- Cost concerns relating to diagnosis and treatment
- Time required for diagnosis and case-finding
- Concerns relating to poly-pharmacy
- Lack of clarity regarding where clinical responsibility resides

The subsequent review titled 'Fragility Fractures and the Osteoporosis Care Gap: An International Phenomenon' by Giangregorio and colleagues evaluated publications from many countries including the Australia[193]. The key issues identified in this study were:

- Treatment was offered more frequently for patients with vertebral fractures in comparison to patients with non-vertebral fractures
- Older patients were more likely to be diagnosed with osteoporosis yet younger patients were more likely to receive treatment
- Males were less likely to be treated than women
- Post-fracture falls assessment are not often conducted and rarely reported as an outcome of the studies

The findings of the international systematic reviews suggest that regardless of the specific structure of the particular healthcare system, fracture patients routinely fail to receive secondary preventative care. The difference between treatment rates for patients with vertebral fractures relative to those with non-vertebral fractures is notable given that the majority of vertebral fractures do not come to clinical attention[194]. The observation that younger patients are more likely to be treated would appear at odds with targeting resources to patients at highest fracture risk.

Several national surveys have been conducted amongst orthopaedic surgeons and GPs in the UK to explore the reasons for the lack of integrated care[59-61]. Given that post-fracture osteoporosis treatment rates were similar in the UK and Australia, these findings may illustrate an issue that is relevant to both countries. One of the UK surveys asked orthopaedic surgeons and GPs about their routine clinical practice regarding investigation of osteoporosis in 3 clinical scenarios[59]:

- A 55 year old lady with a low trauma Colles fracture
- A 60 year old lady with a vertebral wedge fracture
- A 70 year old lady with a low trauma neck of femur fracture

Respondents recognised that fragility fracture patients should in principle be investigated for osteoporosis (81% of orthopaedic surgeons, 96% of GPs). However, in the case of the Colles fracture the majority of orthopaedic surgeons (56%) would discharge the patient without requesting investigation for osteoporosis. When faced with this scenario the majority of GPs would take no action having assumed that the orthopedic surgeons would have conducted investigations if appropriate (45%) or would instigate investigations only if prompted by the orthopaedic surgeon to do so (19%). Only 7% of orthopaedic surgeons and 32% of GPs would assess and/or start treatment themselves. The hip fracture scenario generated similar responses; 66% of orthopaedic surgeons would discharge the patient without osteoporosis assessment whilst 40% of GPs would file the letter and a further 19% of GPs would initiate assessment only if recommended by the orthopaedic surgeon. Notably, in the case of

vertebral wedge fracture a minority of orthopaedic surgeons (29%) would discharge the patient without any action to trigger assessment whilst the majority of GPs (58%) would routinely assess and/or start treatment themselves.

3.3.2 Australian Experience

The National Service Improvement Framework for Osteoarthritis, Rheumatoid Arthritis and Osteoporosis[11] concurs that the reasons discussed in this section are significantly responsible for the sub-optimal provision of secondary fracture prevention in Australia:

> *'In Australia, medical personnel are generally not involved in the management of surgical patients either during hospitalization or at surgical fracture clinics, and there is no standard approach to identifying people hospitalized with low trauma fractures who require investigation and management of osteoporosis'*[152]

The strategies developed to improve matters in New South Wales[14, 15], South Australia[16] and Western Australia[17, 18] all address this shortcoming of current service provision by making the case for dedicated post-fracture personnel to coordinate secondary preventive care. The next section will consider the role of SFP Programs to close the current care gap.

The secondary fracture prevention care gap is ubiquitous in Australia and across the world.

A common theme is apparent from many studies that explore barriers and solutions to delivery of secondary fracture prevention; the lack of clarity regarding where clinical ownership resides may be the primary problem.

4. Secondary Fracture Prevention Programs

A growing body of professional organisations[62-73], patient societies[69, 74-80] and policymakers[11, 15, 16, 18, 81-86] throughout the world have recognised the need for systematic approaches to secondary fracture prevention. A number of expressions have been adopted to describe exemplar service models, including 'Fracture Liaison Services' in Australia[54, 55, 87-95], Asia[96-98], Europe[53, 56, 99-117] and the United States[118-123], 'Coordinator Programs' in Canada[124-129] and 'Care Manager Programs' in the United States[130-132]. Regardless of the terminology, all of these service models deliver high quality secondary preventive care through ***identification, investigation and intervention*** for fragility fracture sufferers, with the aim of preventing future fractures. These programs are referred to as Secondary Fracture Prevention (SFP) Programs in this document. This section will consider in detail the operational characteristics of SFP Programs which have been established in Australia and elsewhere, and provide practical guidance for those engaged in establishing new services for their localities.

4.1 Development of effective healthcare delivery using Plan-Do-Study-Act Methodology

Rapid cycle process improvement methods have been central to the development of successful new approaches to delivery of secondary fracture prevention throughout the world.

Rapid cycle process improvement methods are widely applied in the industrial sector. The method involves execution of sequential Plan-Do-Study-Act (PDSA) cycles. This approach has been applied specifically to the redesign of osteoporosis care of fragility fracture patients[131]. The steps of the PDSA cycle in the context of secondary fracture prevention are illustrated below:

- **Plan**
  - Conduct baseline audit to establish care gap
  - Design prototype service to close the management gap
  - Engage healthcare commissioners to fund pilot phase
- **Do**
  - Implement prototype service model
  - Collect audit data throughout pilot phase
- **Study**
  - Analyse improvement in provision of care from audit
  - Refine prototype service model to improve performance
- **Act**
  - Implement changes and monitor performance improvement
  - Repeat PDSA cycle through continuous ongoing audit and review

4.2 Case studies

4.2.1 Secondary Fracture Prevention Programs: Australian experience

Concord Repatriation General Hospital, Sydney

Service structure: The Minimal Trauma Fracture Liaison (MTFL) service[54] was established in 2005 at this large tertiary referral centre in Sydney. The MTFL service provides a good illustration of effective collaboration between a physician-led SFP Program and the hospital's Orthogeriatrics Service; the MTFL provides care for non-frail patients with fragility fractures whilst the Orthogeriatrics Service[14] focuses on frail patients, including the majority of hip fractures. The MTFL is delivered by an advanced trainee (i.e. a physician in his/her 4th-6th year of post-graduate training) which required a 0.4-0.5 FTE appointment.

Service outcomes: The impact of the MTFL service was evaluated after 4 years. Fracture patients who chose to decline the consultation freely offered by the service, in favour of follow-up with their primary care physician, were considered as a control group for statistical comparison. Refracture incidence for those patients managed by the MTFL service was 80% lower than the control group.

A recently published cost-effectiveness analysis[91] of the MTFL service reported:

- A mean improvement in discounted quality-adjusted life expectancy per patient of 0.089 QALY gained
- Partial offset of the higher costs of the MTFL service by a decrease in subsequent fractures, which lead to an overall discounted cost increase of AU$1,486 per patient over the 10-year simulation period
- The incremental costs per QALY gained (incremental cost-effectiveness ratio - ICER) were AU$17,291, which is well below the Australian accepted maximum willingness to pay for one QALY gained of AU$50,000

The Concord team evaluated compliance and persistence with oral bisphosphonate treatment in a randomised controlled trial[93]. Fracture patients initiated on therapy by the SFP Program were randomised to either 6-montly follow-up by the SFP Program or referral to their primary care physician (PCP) with a single SFP Program visit at 24 months. Both median medication possession ratios and persistence at 24 months were very similar for both groups, with almost two-thirds of patients persistent with treatment. The authors concluded that the main function of an SFP Program is initiation of therapy post-fracture. Continuous patient monitoring offered no benefit as compared to monitoring by the PCP. This group also evaluated predictors of re-fracture amongst patients managed by the SFP Program[94]. Poor compliance with therapy, the presence of multiple co-morbidities, treatment with corticosteroids, low hip BMD and low body weight were all associated with increased risk of re-fracture.

Royal Prince Alfred Hospital, Sydney

Service structure: The First Fracture Project (FFP)[88] sought to close the secondary fracture prevention care gap which persisted after initial educational and awareness raising programmes failed to change outcomes. A dedicated Osteoporosis Nurse (ON) was appointed to coordinate and facilitate management. The FFP process is as follows:

1. The ON case-finds patients through daily attendance at fracture clinic and enters the results of patient interviews into a database
2. Patient receive lifestyle advice and information on risk factor reduction and falls prevention
3. Bone density testing, lateral spine X-ray and blood biochemistry are assessed
4. Patients with low bone mass (osteopenia or osteoporosis) are reviewed by a medical practitioner and treatment recommended to the GP where appropriate
5. A follow-up telephone call to the patient is made 1 month later to encourage compliance with treatment and to identify any issues
6. Bone density and vitamin D measurements are offered at the 12 month stage and communicated to the GP
7. A summary recommendation letter is provided to the GP of patients that decline or are unable to attend the review with the medical practitioner

Service outcomes: During the first 2½ years of the FFP, 655 fragility fracture patients with low bone mass, who were previously untreated for osteoporosis, received appropriate intervention. Whilst a formal cost-effectiveness evaluation was not conducted, the following information relating to cost implications of the FFP were reported:

- The cost to Medicare Australia for the FFP work-up was $423 per patient
- The FFP component of the Osteoporosis Nurse salary costs $40,000 per year
- The cost savings achieved by prevention of 1 hip fracture equates to 6 months salary of the Osteoporosis Nurse

Compliance with recommendations from the FFP appears to be high. Of the 90% of individuals that returned for the 12 month follow-up assessments, 95% of those recommended bisphosphonate therapy continued to take the medication. In 2013, this group published an analysis of logistical problems encountered and outcomes achieved for a cohort of fracture patients managed during one year of operations from July 2008 to June 2009[92].

Royal Melbourne Hospital

Service structure: From November 2008 to January 2009, an audit of secondary fracture prevention was undertaken for patients aged 50 years and over who had presented to orthopaedic fracture clinics[95]. A repeat audit was undertaken a year later after introduction of a simple orthopaedic osteoporosis policy. The policy advised orthopaedic doctors to order a DXA scan and blood tests, and send a letter to the patient's GP recommending consideration of osteoporosis-specific therapy. The proportion of patients undergoing DXA scans increased significantly in the second audit as compared to the first (from 2% to 28%, P<0.001). However, no significant increase in osteoporosis-specific treatment was observed (from 6% to 10%, P=0.504).

In April 2010, a hospital-based Fracture Liaison Service (FLS) was established for patients aged 50 years and over who did not require hospitalisation for their fracture care. A part-time nurse coordinator (0.3 FTE appointment) was responsible for the following tasks:

- Identification of eligible patients at orthopaedic fracture clinics
- Provision of a letter to the patient to explain the FLS
- Order tests including DXA scan and blood tests (renal function tests [RFTs], liver function, calcium, thyroid function, serum protein electrophoresis, 25-hydroxyvitamin D [25(OH)D], complete blood examination

Patients were then referred to an endocrinologist (0.1 FTE appointment) for an osteoporosis assessment. A follow-up appointment was organised at 3 months after the initial assessment to assess medication tolerance and adherence whereupon the patients was discharged to the care of their GP.

Service outcomes: After 2 years, the FLS was subject to a quality assurance project. Patients were invited to complete a 13-point questionnaire which focused on their comprehension, satisfaction and compliance with FLS management. DXA scans, RFTs, calcium and 25(OH)D were assessed in all fracture patients, which represented a highly significant improvement as compared to the osteoporosis policy audit (P<0.001 for all investigations). Forty four percent and 40% of patients met the DXA criteria for osteoporosis and osteopenia, respectively. Among patients referred to the endocrinologist, 61% of patients were treated with osteoporosis-specific therapies.

Royal Newcastle Centre and John Hunter Hospital

Service structure: A multidisciplinary team was established in August 2007 with the primary intention of improve the identification, referral and ongoing management of patients over 50 years presenting to the Emergency Department with a fragility fracture and to decrease re-fracture incidence[90]. Key elements of the model included:

- Identification of the extent of current lost opportunities and consequences
- A collaborative consultative approach to identifying and engaging potential capture sites of patients with fragility fracture
- Central coordination by a fracture prevention nurse (FPN)
- Development and implementation of a flagging system and specific clinical data acquisition tool
- Establishment of a capture and referral pathway for detection and prevention of osteoporosis-related fractures

Appointment of the Fracture Prevention Nurse (FPN) enabled liaison with the Emergency Department, orthopaedics wards and the fracture clinic to establish mechanisms for reliably case-finding fragility fracture patients. A crucial step in this process was development of a report to extract data from the ED patient management system. A referral process was subsequently established to facilitate seamless referral from ED, fracture clinic, hospital wards, the rehabilitation unit and local general practitioners.

Service outcomes: A significant increase in the rate of referral to the Fracture Prevention Clinic (FPC) was observed between 2007 and 2008 (from 9% to 34%, P<0.001). All fracture patients that were not

directly referred to the FPC were contacted by the service, as was their GP. In the case of nursing home residents, nursing home staff were contacted.

In 2014, this group evaluated the impact of their SFP Program on initiation of treatment, continuing treatment and new fracture rates[55]. Outcomes for a cohort of patients who attended the SFP Program clinics were compared to those for patients who did not attend the SFP Program clinics. New fracture rates were significantly lower for the attenders (5.1%) as compared to the non-attenders (16.4%, P<0.001). The rate of treatment with osteoporosis specific medications at least 12 months after the index fracture were almost twice as high in the attender group as compared to the non-attenders (66.8% vs. 34.1%, P<0.001).

Sir Charles Gairdner Hospital, Perth:

Service structure: A multimodal strategy was developed with the primary aims to[89]:

- Improve osteoporosis awareness amongst patients presenting to the Emergency Department or that were admitted to hospital with a fragility fracture
- Empower patients to seek help to reduce their future fracture risk
- Improve awareness amongst hospital doctors and GPs on the need for secondary fracture prevention
- Develop and implement a simple, user-friendly guideline for secondary fracture prevention based on Australian national guidance
- Encourage referral of fracture patients to a geriatrician-led, SFP Program nurse-supported Fragile Bone Clinic for appropriate management

Service outcomes: Most GPs reported that they reviewed their patients after a fracture presentation to the ED (78%), informed them about osteoporosis risk (84%) and considered it their responsibility to initiate assessment and management (85%). However, during the pre-intervention phase only 3% of fracture patients were referred by the GP for bone densitometry and 6% received specific osteoporosis treatment. After the intervention, these figures increased to 45% and 30%, respectively. Of patients eligible for referral to the Fragile Bone Clinic (FBC), 26% were referred, which represented a significant improvement on the 4% referral rate observed in the previous 2 calendar years. Crucially, when patients were contacted by the SFP Program nurse, 84% accepted their appointment to the FBC.

St. Vincent's Hospital, Sydney

Service structure: Patients attending the orthopaedic out-patients fracture clinic received face-to-face medical education from a medical registrar and were offered bone mineral density (BMD) testing and blood biochemistry testing[87]. Those found to have low BMD or other risk factors were initiated on treatment and their primary carer informed. They were also invited to attend the Bone and Calcium Clinic to discuss osteoporosis treatment. Overall, 80% of patients agreed to participate in the direct intervention.

Service outcomes: Approximately three-quarters of these patients had not undergone a bone density test prior to the index fracture. Of the 83% that took up the offer of the BMD test, 68% had low bone mass. Of the 66% of patients that had not previously received osteoporosis treatment, 43% were advised to take anti-resorptive therapy based on their fracture risk and bone density results. Compared to previously implemented, information-based interventions, the direct intervention resulted in 83% uptake of BMD testing versus 42%; 43% being initiated on anti-resorptive treatment versus 16%; and a five-fold improvement in long-term management of osteoporosis at 80% of those requiring treatment.

4.2.2 Secondary Fracture Prevention Programs: International experience

Canada: St. Michael's Hospital Toronto, Osteoporosis Exemplary Care Program

Service structure: In 2002, the orthopaedic unit at a university teaching hospital in Toronto hired an osteoporosis coordinator to identify patients with a fragility fracture and to coordinate their education, assessment, referral, and treatment of underlying osteoporosis[124]. The Osteoporosis Exemplary Care

Program (OECP) provided secondary preventive care to fracture patients managed in both the in- and out-patient settings.

Service outcomes: Four hundred and thirty fracture patients were evaluated during the first year of operations (276 out-patients and 154 in-patients). Almost all (96%) of these patients received appropriate osteoporosis care:

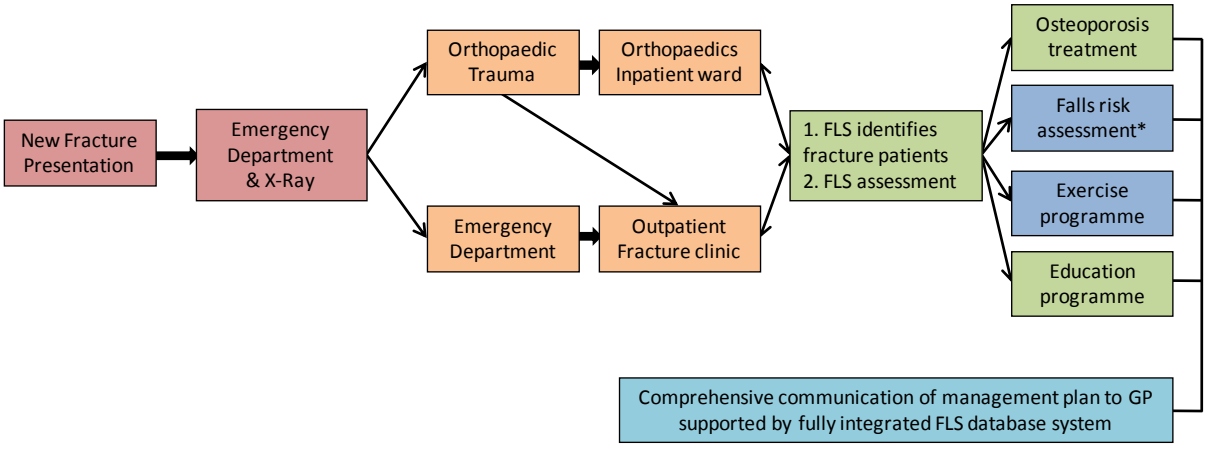
- 80 out-patients (36%) were treated for osteoporosis prior to assessment by the OECP
- 124 out-patients (56%) were referred to the Metabolic Bone Disease Clinic or to their GP for osteoporosis treatment
- 31% of the 128 in-patients were treated for osteoporosis prior to assessment by the OECP
- Treatment was initiated for a further 24% of in-patients and another 34% were referred to the Metabolic Bone Disease Clinic or their GP for post-discharge consultation on osteoporosis treatment

A cost-effectiveness analysis[127] of the OECP concluded that a hospital that hired an osteoporosis coordinator who manages 500 patients with fragility fractures annually could reduce the number of subsequent hip fractures from 34 to 31 in the first year, with a net hospital cost savings of CN$48,950 (Canadian dollars in year 2004 values), with use of conservative assumptions. Sensitivity analysis indicated a 90% probability that hiring a coordinator costs less than CN$25,000 per hip fracture avoided. Hiring a coordinator is a cost-saving measure even when the coordinator manages as few as 350 patients annually. Greater savings were anticipated after the first year and when additional costs such as rehabilitation and dependency costs are considered.

United Kingdom: The Glasgow Fracture Liaison Service

Service structure: First developed in 1999, the Glasgow FLS is a system to ensure fracture risk assessment, and treatment where appropriate, is delivered to all patients with fragility fractures[99]. The FLS is a 'doctor light' service and is primarily delivered by clinical nurse specialists, who work to pre-agreed protocols to case-find and assess fracture patients. Consultant Endocrinologists provide medical leadership for the Glasgow FLS. A critical success factor in development of the Glasgow FLS was establishment of a multi-disciplinary stakeholder group from project outset, with representation from all relevant hospital specialities, local primary care and regional health authority and administrative groups.

Figure 6. The structure of the Glasgow Fracture Liaison Service adapted from *The care of patients with fragility fracture*[63]



* Older patients, where appropriate, are identified and referred for falls assessment

Service outcomes: During the first 18 months of operations[99]:

- More than 4,600 patients with fractures of the hip, wrist, upper arm, ankle, foot, hand and other sites were seen by Fracture Liaison Nurse Specialists

- Nearly three-quarters were considered for BMD testing and treatment was recommended for approximately 20% of patients without the need for BMD testing
- 82% of patients tested were found to be osteopenic or osteoporotic at the hip or spine

During the first decade of this century in excess of 50,000 consecutive fracture patients have been assessed by the Glasgow FLS[195]. During this period, hip fracture rates in Glasgow have reduced by 7.3% versus almost a 17% increase in England[52], where only 37% of localities operated an FLS[196] by late 2010. A Scottish national audit compared case ascertainment for hip and wrist fractures in Glasgow versus 5 other centres operating less systematic models of care[29]. Ninety-seven percent of hip fracture and 95% of wrist fracture patients were assessed by the Glasgow FLS versus less than 30% for any other service configuration. In May 2011, a formal cost-effectiveness analysis of the Glasgow FLS was published[114]. This study concluded that 18 fractures were prevented, including 11 hip fractures, and £21,000 was saved per 1,000 patients managed by the Glasgow FLS versus 'usual care' in the UK.

United States of America: The Kaiser Permanente Healthy Bones Program

Service structure: In the late 1990s, Kaiser Permanente in Southern California resolved to close the secondary fracture prevention gap for patients presenting to hospital with hip fractures. Subsequently, the program was expanded to include all older patients presenting with fragility fractures at any site. As time and resources permitted, the Kaiser team undertook a systematic approach to delivering primary fracture prevention to patients at a high risk of suffering their first fragility fracture. The Healthy Bones Program is underpinned by effective case-finding made possible by the state-of-the-art HealthConnect® electronic medical record[197]. The program is primarily delivered by Care Managers and Nurse Practitioners, who serve as coordinators and disease managers.

Service outcomes: In 2008, a 37% reduction in the expected hip fracture rate was reported for the population served by the Kaiser Permanente Southern California system[51]. This corresponds to the prevention of 935 hip fractures in the year 2006 (2,510 hip fractures were predicted by actuarial analysis, and 1,575 fractures were actually observed). The cost of treating a hip fracture was approximately US$33,000. On that basis, it was estimated that the program saved more than US$30.8 million for Kaiser Permanente Southern California in the 2006.

4.2.3 The role of Orthogeriatrics Services

The subspecialty of orthogeriatric medicine is a rapidly growing professional group throughout the world. The need for effective orthopaedic – orthogeriatric co-care of patients admitted to hospital with fragility fractures in general, and hip fractures in particular, is well recognised in professional guidance[63, 176, 177], including that of the Australian and New Zealand Society for Geriatric Medicine[176], and state level strategy documents in Australia[14, 16, 17]. In 2014, the Australian and New Zealand Guideline for Hip Fracture Care was published, with approval from NHMRC[157]. At the time of writing, the Australian Commission, in collaboration with HQSC in New Zealand, is developing a Hip Fracture Care Clinical Care Standard[158]. Details of the trans-Tasman guidelines and Clinical Care Standard are presented in section 1.3.3 of this Resource Pack.

A full discussion on the role and remit of Orthogeriatrics Service is beyond the scope of this Resource Pack. However, it is clear that SFP Programs and Orthogeriatrics Services play complementary roles in the implementation of systematic approaches to fragility fracture care and prevention. As illustrated by the configuration of services at Concord Repatriation General Hospital in Sydney, SFP Programs[54] and Orthogeriatrics Services[14] are both required if optimal care is to be provided for the spectrum of patients presenting with fragility fractures, from those in their fifties through to those in their 8th-11th decades.

4.3 Access to Secondary Fracture Prevention Programs in Australia

In September 2013, the Australian and New Zealand Hip Fracture Registry Steering Group published findings of a facilities level audit conducted across both countries during 2012[133], in the course of work to establish trans-Tasman guidelines for acute hip fracture care[157] and national hip fracture registries.

This audit evaluated various elements of service provision pertaining to hip fracture patients, including the presence of a Fracture Liaison Service (see table 1). Accordingly, as of December 2012, less than 20% of Australian hospitals - and no hospitals in New Zealand - had an SFP program established. A second facilities level audit published in 2014 reported that 6 new SFP programs had come into operation across both countries by December 2013[134]. At the time of writing, a third facilities level audit is underway, with results expected to be published by December 2015. This document will be updated when those results are available.

Table 1. Australian and New Zealand facilities level audit published in September 2013[133] (Reproduced with kind permission of the Australian and New Zealand Hip Fracture Registry Steering Group)

	NSW	VIC	NT	Qld	ACT	WA	TAS	SA	NZ	Overall Total
Number of hospitals performing hip fracture surgery.	37	24	2	13	1	6	3	8	22	116
Hospitals with dedicated orthopaedic bed available	68% (range 14-45)	75% (range 5-44)	50% (32 beds)	85% (range 18-48)	100% (34beds)	83% (range 16-45)	33% (18beds)	50% (range 15-60)	82% (range 10-90)	83/116 (72%)
Hospitals with Geriatric service available	62%	46%	50%	54%	100%	67%	33%	38%	55%	63/116 (54%)
Hospitals which have a fracture liaison service	22%	17%	0%	15%	0%	17%	0%	25%	0%	17/116 (15%)
Collect local hip fracture data.	38%	67%	50%	69%	100%	83%	0%	38%	64%	63/116 (54%)
Barriers to proposed hip fracture service redesign	59%	58%	50%	62%	100%	50%	67%	75%	64%	72/116 (62%)

4.4 Setting up a Secondary Fracture Prevention Program

A summary of key activities likely to be required prior to a SFP Program becoming operational and issues to be faced when operational are provided below.

4.4.1 Preparatory work prior to SFP Program becoming operational

A) Establish multi-disciplinary stakeholder group likely to include:

- The Hospital's "Lead Clinician in Osteoporosis"
- (usually a rheumatologist, endocrinologist, geriatrician or orthopaedic surgeon)
- Consultant Orthopaedic Surgeon with an interest hip/fragility fracture surgery
- Consultant Geriatrician or Ortho-geriatrician
- Relevant specialist nurses, physiotherapists and other Allied Healthcare Professionals
- Personnel responsible for development/installation of the SFP Program database
- Representatives from hospital and primary care medicines management
- Representative from local primary care-based service commissioning groups
- Representative from local general practice
- Representative from local Public Health
- Individual to serve as liaison with state musculoskeletal/fragility fracture strategy group

B) Utilise Plan-Do-Study-Act methodology to plan initial SFP Program development and cycle of continuous improvement:

- **Plan**
    - Conduct baseline audit to establish care gap
        - Number of patients over 50 years attending with fragility fracture
        - Proportion of patients over 50 years receiving secondary prevention post fracture
        - Review any data from previous local audits of fragility fracture care
    - Design prototype service to close the management gap
        - Write aims and objectives
        - Identify how you will capture fracture patients
        - Write protocols for wards and fracture clinics
    - Ensure algorithms and protocols are agreed before SFP Program clinics are in place
    - Agree all documentation and communication mechanisms
    - Develop business case
    - Engage hospital management and/or healthcare commissioners to fund pilot phase
- **Do**
    - Implement prototype service model
    - Collect audit data throughout pilot phase
- **Study**
    - Analyse improvement in provision of care from audit
    - Refine prototype service model to improve performance
- **Act**
    - Implement changes and monitor performance improvement
    - Repeat PDSA cycle through continuous ongoing audit and review

4.4.2 Issues to consider when SFP Program is operational

Patient identification:

- Emergency Department:
    - The ED is the first point of contact for fracture patients with the healthcare system and, as such, provides an opportunity to capture data on all new fracture patients
- Inpatients: Ensure SFP Program staff are notified of all patients admitted by
    - Attending wards to see patients admitted with fragility fracture
    - Attending orthopaedic/trauma team meetings to discuss patients admitted to wards overnight
    - Attending designated new fracture clinics if operated
- Outpatients:
    - A significant proportion of fragility fracture patients will not be admitted to hospital so establishing systems that reliably case-find those managed as outpatients is crucial if universal coverage is to be provided

Referral pathways:

- Ongoing evaluation of optimal terms to communicate the role of fracture risk assessment and falls assessment to patients
- Streamlining the process of referral from orthopaedic services to the SFP Program is paramount to minimise the duration between fracture and assessment

Communication with patients

- Evaluate effectiveness of delivery of information regarding lifestyle advice and modifications
- Evaluate delivery of treatment recommendations to patients – verbal and written

Communication with other specialities

- Discuss with ward staff and orthopaedic surgeons' management plans, and discuss and inform input with the multidisciplinary team.
- Regular review of appropriate referral pathways to:
    - Metabolic bone clinic
    - Bone densitometry
    - Local falls services, where available
- Ongoing evaluation of response to letters sent to colleagues:
    - Metabolic Bone Clinic
    - Local falls services, where available
    - Orthopaedic surgeons

Communication with Primary care

- Ongoing evaluation of response to letters sent to GPs including information on:
    - Assessment,
    - Fracture type
    - Risk factors
    - Blood results
    - Suitable treatment recommendations
- Suggest follow-up assessment at 3 months following initiation of treatment to assess compliance with therapy, administration technique and occurrence of side effects
- Subsequent follow-up would be conducted on a 1-2 yearly basis depending on resources available locally to assess progress and encourage compliance

4.5 Optimisation of Secondary Fracture Prevention Programs for patient identification

The primary challenge facing healthcare professionals during establishment of a SFP Program is how to achieve comprehensive capture of all fragility fracture patients presenting to their hospital. Accordingly, at outset, the total fracture population must be ascertained to establish the denominator for subsequent calculation of the success of the SFP Program in this regard.

An approximation to the likely number of patients presenting to 'the average' Australian hospital with fragility fractures can be determined from national epidemiology. During 2012, Osteoporosis Australia estimated that almost 143,000 fractures occur in Australia every year amongst older people, including almost 23,000 hip fractures[5]. Based upon an Australian population of 23.9 million individuals[1], this would correspond to 1,794 fracture presentations per year to a hospital serving a population of 300,000, including 288 hip fractures. Of course, a proportion of the overall case load of fracture patients will be seen in community-based fracture clinics.

The optimal mechanism to ensure comprehensive capture of all fragility fracture patients will differ between localities on account of specifics of local orthopaedic service configuration. This underscores the need to establish a multi-disciplinary strategy group at the outset of SFP Program development and to maintain this group in a permanent fashion. Ongoing audit of SFP Program case volume will reveal fluctuations that may be attributable to seasonal variation of fracture incidence and alert the team to systems-based issues leading to fracture patients being missed by the SFP Program.

4.5.1 Identification of In-patient fracture cases by Secondary Fracture Prevention Programs

Case-finding systems for patients admitted to hospital that have been employed by SFP Programs include:

- Regular visits by the SFP Program coordinator to the orthopaedic wards with orthopaedic ward staff maintaining a list of fracture admissions in between SFP Program coordinator visits[99]
- Attendance by the SFP Program coordinator at daily Trauma team meetings[198]
- Care pathway/protocol for direct referral from Orthogeriatric Services

- IT systems such as the Emergency Department weekly fracture report at the Royal Newcastle Centre and John Hunter Hospital in New South Wales[90] or Kaiser Permanente's HealthConnect®[197]

4.5.2 Identification of Out-patient fracture cases by Secondary Fracture Prevention Programs

Case-finding systems for fracture patients managed as outpatients by SFP Programs include:

- Routine attendance by the SFP Program coordinator to fracture clinics[88, 99]
- Face-to-face interaction with a medical registrar[87]
- "Link-nurses" - Creation by fracture clinic nurses of a daily register of new fracture patients[99]
- IT systems such as the Emergency Department weekly fracture report at the Royal Newcastle Centre and John Hunter Hospital in New South Wales[90] or Kaiser Permanente's HealthConnect®[197]

All patients presenting with fractures will be sent for X-Ray to confirm the fracture diagnosis. Accordingly, establishing a system with the radiology department which enables creation of a register of all patients over 50 years that have been sent for X-Ray provides a quality control metric for the SFP Program.

4.5.3 Identification of vertebral fracture patients by Secondary Fracture Prevention Programs

The majority of non-vertebral fractures are symptomatic and result in the patient attending urgent care services, be it a hospital Emergency Department with subsequent admission to hospital, or assessment as an out-patient in the hospital or primary care-based fracture clinic setting. SFP Programs tailored to interface with local orthopaedic services provide a reliable mechanism to deliver secondary fracture prevention for patients with clinically apparent, symptomatic fragility fractures. However, as shown in table 2, publications of audit data from several SFP Programs demonstrate that relatively few patients come to the attention of the SFP Program staff as a result of a vertebral fracture[90, 99, 101, 103, 106, 124, 131, 199, 200].

Whilst vertebral fractures are often cited as the most prevalent fracture type attributable to osteoporosis, a significant proportion does not come to clinical attention on account of several factors[201]:

- The nature of the clinical presentation of vertebral fracture
- Vertebral fractures are often overlooked on X-Rays
- Vertebral fracture can be overruled by a diagnosis with a poor prognosis
- The clinical relevance of vertebral fracture may be overlooked

Table 2. Vertebral fractures are a small proportion of FLS case loads

Country	FLS	Vertebral fractures (%)	Reference
Australia	Royal Newcastle	1.6%	Giles 2011[90]
Canada	St. Michael's, Toronto	1.7%	Bogoch 2006[124]
Netherlands	Eindhoven	5.4%	Blonk 2007[101]
Switzerland	University Hospitals of Geneva	5.5%	Chevalley 2002[200]
UK	Cambridge	0.1%	Premaor 2010[106]
UK	Glasgow	2.0%	McLellan 2003[99]
UK	Ipswich	1.8%	Clunie 2008[103]
USA	University of Wisconsin	6.1%	Harrington 2005[131]

(Reproduced with kind permission of Optasia Medical Ltd, UK)

Only one third of vertebral fractures are symptomatic and frequently occur in the course of routine daily activities rather than as a consequence of a fall[202]. The IMPACT Study[203] established that underdiagnosis of vertebral fractures is a worldwide problem attributable in part to a failure of detection on X-Ray and/or the use of ambiguous terminology on the radiology report. The 'Vertebral Fracture

Initiative', a joint venture between the International Osteoporosis Foundation and the European Society for Musculoskeletal Radiology, was developed to address the key issues underpinning sub-optimal identification of patients with vertebral fractures. The Vertebral Fracture Teaching Program – available for down-load from http://www.iofbonehealth.org/what-we-do/training-and-education/educational-slide-kits/vertebral-fracture-teaching-program - provides a range of educational resources that will support hospital clinicians and radiologists to close this component of the secondary fracture prevention management gap.

4.5.4 The role of Vertebral Fracture Assessment in SFP Program assessment

Assessment of patients by the combination of bone density measurement with ascertainment of vertebral fracture status has been shown to improve fracture risk prediction[204]:

> *"For any given BMD T-score, the risk of an incident vertebral, non-vertebral fragility, and any fracture differs by up to twelve times, 2 times, and 7 times, respectively, when information regarding spine fracture burden is considered. In the absence of knowledge about the prevalent vertebral fracture status, assessments based solely on BMD may under- or over-estimate the true risk of a patient experiencing an incident fracture."*

Several barriers have been identified in relation to routine imaging of the spine by plain radiographs including cost, radiation exposure, accessibility and patient inconvenience. Accordingly, use of vertebral fracture assessment (VFA) equipment, which is commonly available on modern axial bone densitometers, provides a low radiation exposure alternative to standard X-Ray that could be conducted when patients attend for DXA scan. This approach has been explored in the SFP Program setting[205, 206]. Amongst patients presenting with non-vertebral fractures that were assessed by a SFP Program, the overall prevalence of vertebral deformity was of the order of a quarter to a fifth (25%[205] and 20%[206]). VFA identified a substantial burden of prevalent vertebral fractures that had not been previously documented. The proportion of non-vertebral fracture patients that would be managed differently as a result of conducting VFA was relatively small (9%[205] and 3%[206]). This is perhaps not surprising given that the patients investigated had a non-vertebral fracture which triggered SFP Program assessment. However, incorporation of VFA into SFP Program protocols has the potential to reveal two sub-groups of non-vertebral fracture patients that may be managed differently as a result of ascertainment of vertebral fracture status:

- Patients with ≥ 1 vertebral fracture and an osteopenic BMD
- Patients with multiple vertebral fractures and profoundly osteoporotic BMD

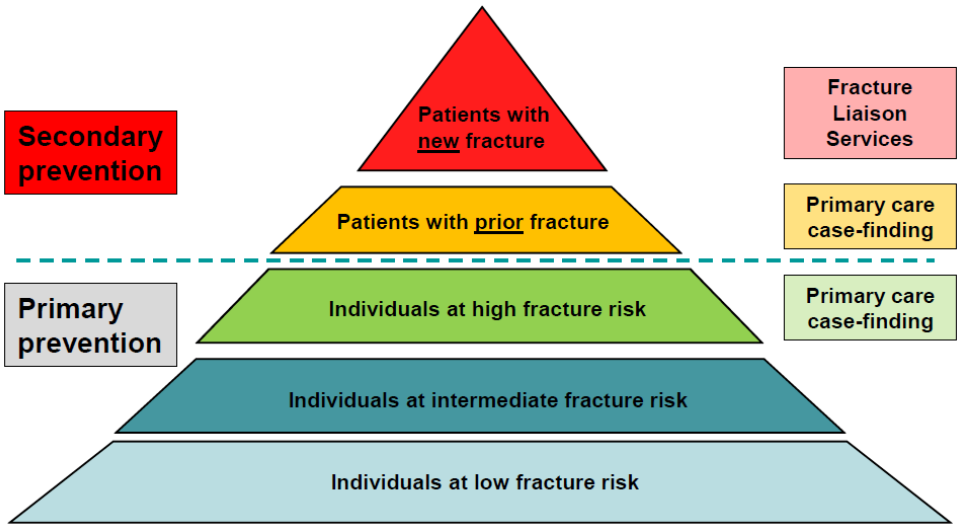
In both cases, knowledge of the presence of vertebral fractures has the potential to impact upon clinical decision making to optimise care for the individual patient's circumstances.

Another conclusion of the SFP Program VFA work was that VFA should ideally be conducted on all patients that are referred for DXA who do not have a clinical fracture history[205]. This concept will be explored further in the next section concerned with integration with primary care services.

4.6 Integrating secondary care and primary care

Osteoporosis is a chronic disease that may afflict sufferers for multiple decades during which 'acute exacerbations' will come to clinical attention in the form of fragility fractures[63]. As such, the development and implementation of hospital-based SFP Program must be cognisant of the need for seamless integrated care between providers of both secondary and primary care. SFP Programs provide a mechanism to instigate secondary fracture prevention measures for the most readily identifiable population at high risk of future fracture at the top of the 'pyramid' illustrated in figure 7.

Figure 7. Prioritisation of osteoporosis assessment in the older population



The majority of Australian hospitals are yet to implement a SFP Program[15, 16, 18, 133, 134] and the majority of Australian fragility fracture patients do not receive secondary preventive care[57, 58]. Accordingly, if fracture risk is to be reduced within the second stratum of the pyramid i.e. the population that has suffered fragility fractures in the past, pro-active case-finding by primary care doctors is required, supported by local access to bone densitometry services. Such strategies have been implemented in Australia and the UK.

4.6.1 Case-finding in Primary Care: Australian experience

The management of osteoporosis in Australian primary care was the subject of a large scale study published in 2009[151]. Almost 40,000 patients (55% female, 45% male) were recruited during the 12 month period February 2006 to January 2007, with the majority (90%) of GP practices being located in capital cities or large regional urban centres. A chronic disease management program enabled the identification of patients in this study. More than 3,600 female and 1,100 male participants had a prior history of a fragility fracture. Only 29.7% of these fracture patients were receiving any specific therapy for osteoporosis. These findings are particularly concerning given that the Australian BoneCare Study[58] published in 2004 reported practically identical findings; 27.9% received specific treatment for osteoporosis. The Australian Bone Care Study recruited patients during calendar year 1999, suggesting no change in secondary preventive care had occurred in the 7 year period in between the recruitment phases of these two studies.

4.6.2 Case-finding in Primary Care: UK experience

A study from Lanarkshire, Scotland titled 'Closing the osteoporosis management gap in primary care: a secondary prevention of fracture programme' provides an illustration of best practice in primary care case-finding in the UK[178]. All women aged ≥65 years (4,045) served by the Coatbridge Local Health Care Co-operative (CLHCC), a primary care organisation, were mailed an osteoporosis questionnaire with a particular focus on prior fracture history. Of the 2,286 respondents to the survey, 852 reported a history of at least one fracture since age 50 years. Five percent (43) had previously undergone a DXA scan and 9.4% (80) were receiving specific treatment for osteoporosis. The new service model was delivered by a team comprised primarily of an osteoporosis nurse specialist reporting to a general practitioner with a specialist interest in osteoporosis. Prior to implementation of the programme, 9% of fragility fracture patients were managed according to Scottish national guidelines, which increased to 64% afterwards.

It should be noted that the Coatbridge Programme is not representative of the usual standard of care for fragility fracture patients in UK primary care. A major national evaluation of the standard of care published in 2007[207] reported only 25% of females aged ≥75 years with a prior fracture had evidence

of treatment for osteoporosis, only 10% of females aged 65-74 with a fracture had undergone bone densitometry and the situation for men was even worse. Less than 2% of males aged >65 years with a recorded prior fragility fracture had been DXA scanned. In response to this and other national audit data[208], the UK National Osteoporosis Society in collaboration with national professional groups lobbied the government to have secondary fracture prevention included in the GP contract incentive scheme, the Quality and Outcomes Framework. From 1st April 2012, all UK GPs were eligible for a component of their annual incentive payment to be made if they delivered the following quality metrics[209]:

- **OST1:** The practice can produce a register of patients:
    1. Aged 50-74 years with a record of a fragility fracture after 1 April 2012 and a diagnosis of osteoporosis confirmed on DXA scan, and
    2. Aged 75 years and over with a record of a fragility fracture after 1 April 2012
- **OST2:** The percentage of patients aged between 50 and 74 years, with a fragility fracture, in whom osteoporosis is confirmed on DXA scan, who are currently treated with an appropriate bone-sparing agent
- **OST3:** The percentage of patients aged 75 years and over with a fragility fracture, who are currently treated with an appropriate bone-sparing agent

To support UK GPs to deliver these standards of care, the UK National Osteoporosis Society and the Royal College of General Practitioners developed a web resource - https://www.nos.org.uk/health-professionals/osteoporosis-resources-for-primary-care. It has been suggested that similar ventures could be collaboratively developed by Osteoporosis Australia and the Royal Australian College of General Practitioners[210].

4.7 Systematic approaches to primary fracture prevention

The focus of this document is upon systematic approaches to delivery of secondary fracture prevention and, as such, strategies for primary prevention are out with the current scope. In light of the current under-diagnosis and under-treatment of patients whom have already suffered fragility fractures, developing systematic approaches to close the secondary fracture prevention management gap is a priority. However, significant advances have occurred in relation to fracture risk assessment including:

- The Fracture Risk Calculator from the Garvan Institute of Medical Research in Sydney (available online at http://www.garvan.org.au/bone-fracture-risk/)[211]
- The FRAX® tool from the World Health Organisation Collaborating Centre for Metabolic Bone Diseases at the University of Sheffield, UK (available online at http://www.shef.ac.uk/FRAX/)[212]

Notably, there is commentary on the FRAX® website in relation to radiographically (or morphometrically) identified vertebral fractures:

> *"**Previous fracture***
> *A special situation pertains to a prior history of vertebral fracture. A fracture detected as a radiographic observation alone (a morphometric vertebral fracture) counts as a previous fracture. A prior clinical vertebral fracture from which the patient suffers consequences, is an especially strong risk factor. The probability of fracture computed may therefore be underestimated. Fracture probability is also underestimated with multiple fractures."*

This is significant in relation to the use of vertebral fracture assessment as a means of imaging the spine when patients attend for bone density measurement. Clearly, the 10 year fracture risk estimates will be significantly influenced by awareness of the presence of otherwise undiagnosed morphometric vertebral fractures. If the FRAX® tool is to be used for patients that have not suffered clinically apparent fragility fractures, vertebral fracture assessment provides a means to more accurately inform the FRAX® calculation.

A central component of the rationale for secondary fracture prevention is that half of hip fracture patients have experienced prior clinically apparent fragility fractures[27-30]. Conversely, this would suggest that half of hip fracture patients suffer a hip fracture as their first fragility fracture. Accordingly, a stratified sequential top-down approach to fracture risk assessment of the older population, as illustrated in figure 7, could be undertaken as time and resources permit.

4.8 Delivering fracture risk reduction in the long-term

Healthcare providers responsible for the management of asymptomatic chronic conditions need to consider how to maximise adherence and persistence with intervention strategies in the long term in order to optimise health gains. As is the case in management of hypertension and hyper-cholesterolaemia, adherence and persistence with osteoporosis treatments routinely diminishes to 50% within one year of initiation[213]. Several approaches have been associated with improvements in adherence and persistence to osteoporosis treatments including:

- Interaction and follow-up by an osteoporosis nurse specialist[214]
- Correct patient understanding of bone density results[215]
- Offering patients a choice of dosing interval[216]

A substantial literature has developed during the last decade on the impact of sub-optimal adherence and persistence with osteoporosis drug treatments on anti-fracture efficacy[217-219]. Many osteoporosis sufferers will experience non-hip 'signal' fragility fractures a decade or more prior to the average age for occurrence of hip fracture[63]. A primary objective of systematic approaches to secondary fracture prevention is to maximise the benefit of long-term treatment, through optimal adherence and persistence with medication, to minimise the likelihood of hip fracture being the final destination of the patient's multi-decade osteoporotic journey[8].

5. A case for a Secondary Fracture Prevention Program at St. Anywhere's Hospital

Establishing a SFP Program provides a mechanism to deliver a systematic approach to secondary fracture prevention through the identification of patients who have sustained a fragility fracture

Because half of hip fracture patients have suffered prior clinically apparent fragility fractures, SFP Programs provide an opportunity to intervene in half of all potential cases of hip fracture in the future[32, 33]

SFP Programs have been shown to deliver high quality care in a cost-effective manner in Australia[91] and throughout the world[51, 114, 127]

In the event that your hospital is yet to establish a SFP Program, resources are provided to support you and your colleagues to construct a SFP Program business case.

A factor common to centres that have successfully developed a SFP Program is to establish a multi-disciplinary stakeholder group from the outset. This group will likely include:

- The Hospital's "Lead Clinician in Osteoporosis"
- (usually a rheumatologist, endocrinologist, geriatrician or orthopaedic surgeon)
- Consultant Orthopaedic Surgeon with an interest hip/fragility fracture surgery
- Consultant Geriatrician or Ortho-geriatrician
- Relevant specialist nurses, physiotherapists and other Allied Healthcare Professionals
- Personnel responsible for development/installation of SFP Program database
- Representatives from hospital and primary care medicines management
- Representative from local primary care-based service commissioning groups
- Representative from local general practice
- Representative from local Public Health
- Individual to serve as liaison with state musculoskeletal/fragility fracture strategy group

This SFP Program Resource Pack (Resource 1) and Resource 2 to 11 are provided as free-standing documents to support clinicians to establish SFP Programs in their institutions:

- Resource 1: SFP Program Resource Pack (i.e. this document)
- Resource 2: Analysis of Australian SFP Programs using Ganda's classification system
- Resource 3: Generic SFP business plan template
- Resource 4: Fracture incidence by state
- Resource 5: Potential cost savings
- Resource 6: How to start and expand SFP Programs
- Resource 7: Step by step guide to setting up SFP Programs
- Resource 8: Orthogeriatric Services and SFP Programs
- Resource 9: Algorithms for SFP Programs by fracture type
- Resource 10: Other practical tools for SFP Programs
- Resource 11: SFP Program online resources

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