



OSTEOPOROSIS NEW ZEALAND

Better bones, fewer fractures

Fracture Liaison Services Resource Pack

Provided as a
Service to Medicine
by Osteoporosis
New Zealand

Foreword

Each year almost 4,000 older New Zealanders break a hip. The burden imposed by these fractures is severe for those who suffer them, for their families and for the national economy. Half of all hip fracture sufferers will require long-term care, and a quarter will suffer early death. In terms of the financial cost to the national healthcare system, in excess of \$100 million per year is spent on hip fracture care alone. When all fractures caused by osteoporosis – sometimes called ‘fragility fractures’ – are taken into account, the total direct cost is \$330 million per year. Left unchecked as New Zealand’s one million baby boomers retire and age, this situation will only become worse.

In 2012, in response to this growing epidemic of fragility fractures, Osteoporosis New Zealand published *BoneCare 2020* which made the case for a systematic approach in New Zealand to hip fracture care and prevention. Four key objectives were identified:

- **Objective 1:** Improve outcomes and quality of care after hip fractures by delivering Australian and New Zealand professional standards of care monitored by a new NZ National Hip Fracture Registry.
- **Objective 2:** Respond to the first fracture to prevent the second through universal access to Fracture Liaison Services in every District Health Board in New Zealand.
- **Objective 3:** General Practitioners to stratify fracture risk within their practice population using fracture risk assessment tools supported by local access to axial bone densitometry.
- **Objective 4:** Consistent delivery of public health messages on preserving physical activity, healthy lifestyles and reducing environmental hazards.

Since publication of *BoneCare 2020* two years ago, a collaborative implementation strategy has been undertaken by Osteoporosis NZ, the Ministry of Health, the Health Quality & Safety Commission NZ, the Australian and New Zealand Hip Fracture Registry, the NZ Orthopaedic Association, Regional District Health Board (DHB) Alliances, and many clinicians and administrators within the DHBs.

As of November 2014, significant progress has been made towards establishment of the NZ Hip Fracture Registry. The Registry IT platform will soon undergo testing in the Northern Region DHBs to support roll-out of recently published trans-Tasman acute hip fracture care guidelines.

By August 2014, six DHBs had adopted Fracture Liaison Services (FLS). Because half of all hip fracture patients have broken a different bone before breaking a hip, it is essential to ensure that all fragility fracture patients aged 50 years and over receive ‘best practice’ secondary preventive care. FLS have been shown in Australia, Asia, Europe, North America and Latin America to dramatically improve secondary fracture prevention. This is achieved through routine osteoporosis assessment and management, plus practical interventions to reduce risks of repeat falls.

Osteoporosis NZ has published this FLS Resource Pack to support clinicians and administrators in the DHBs that are yet to implement FLS. The Pack provides a distillation of current global experience of FLS, and includes practical resources such as a comprehensive, fully-referenced, business plan template. A section on the International Osteoporosis Foundation’s (IOF) ‘Capture the Fracture Campaign’ summarises globally-relevant standards developed as a component of the IOF Best Practice Framework.

A common view is shared by Osteoporosis NZ, IOF and related organisations throughout the world that are focused on osteoporosis and fragility fracture prevention. Implementation of FLS is the most important thing that can be done to reduce the incidence of hip fractures, both in New Zealand and elsewhere. Currently, around half of New Zealand’s older people will receive care under FLS programmes if they present at hospital with what proves to be a fragility fracture. Effective collaboration between all stakeholders – locally and nationally – will ensure that all fragility fracture patients in our country benefit from ‘best practice’ secondary preventive care.



Executive summary

The burden of fragility fractures on patients and health services in New Zealand

In October 2014, the population of New Zealand was 4.5 million¹. During the 20th Century, life expectancy at birth increased by about 20 years², reaching 83 years for females and 79.3 years for males by 2010-12³. This trend is set to continue into the future; by the late 2050s, one in four New Zealanders will be aged 65 years and over⁴. During the next five decades, the proportion of the population aged 85 years and over is set to grow at least three-fold, from 72,500 people in March 2011⁵ to between 250,000 and 420,000 by 2061⁶. This ongoing shift in the demographic composition of the New Zealand population will fuel an increasing burden of chronic disease among the elderly.

Osteoporosis is the most common chronic bone disease affecting both women and men⁷. The clinical manifestation of this disease is a fragility fracture, which occur primarily at the hip, spine, wrist, humerus or pelvis. The incidence of hip fracture in New Zealand was estimated to be 3,803 cases per year in 2007, at a cost of NZ\$105 million⁸. Given that hip fractures represent up to 20% of all fragility fractures that come to clinical attention⁹, approximately 19,000 fragility fracture presentations to urgent care services occur in New Zealand every year. The annual incidence of hip fractures in women aged 60 years and over in 1991 was 1,830¹⁰ which had risen to 2,639 by 2007⁸, an increase of 44%. All too often, hip fracture represents the final destination of a thirty year journey fuelled by decreasing bone strength and increasing falls risk¹¹.

The rationale for secondary fracture prevention

Several studies have evaluated future fracture risk associated with the occurrence of fractures at various skeletal sites^{12, 13}; a prior fracture at any site is associated with a doubling of future fracture risk. Secondary fractures appear to occur rapidly after incident fracture¹⁴. 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)¹⁵. 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 fracture¹⁶.

In 1980, US investigators reported that more than 50% of patients presenting with hip fractures had experienced prior fractures¹⁷. More recent studies from Australia¹⁸, Scotland¹⁹ and the USA²⁰ consistently found similar results. The Australian group coined the term 'signal' fracture¹⁸ 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 group²¹. Approximately 50% of all hip fracture cases come from the 16% of the post-menopausal female population with a history of fracture^{22, 23}. Secondary fracture 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 pharmacological agents licensed for the treatment of osteoporosis in New Zealand have been shown to reduce the incidence of fractures by 30-70%²⁴⁻³², dependent upon the particular agent and site of fracture. Fracture reduction efficacy of 50% has been observed for patients with a history of multiple fractures³³. An emerging body of evidence suggests that osteoporosis treatment is associated with reduced mortality^{29, 34-37}.

Current management gap and barriers to secondary fracture prevention in practice

Two audits have been conducted in New Zealand to assess post-fracture osteoporosis care delivered by orthopaedic surgeons. The first study, published in 2005, was part of a multi-national survey of osteoporotic fracture management^{38, 39}. The 70% response rate of New Zealand orthopaedic surgeons to the survey was the highest of any national group. Key findings included:

- The majority of New Zealand orthopaedic surgeons felt they lacked formal training in osteoporosis treatment.
- Less than 25% of fragility fracture patients would routinely be referred for a bone density test after fracture.
- More than 80% of surgeons would not prescribe osteoporosis medication.

The second subsequent multi-centre audit evaluated osteoporosis intervention by 8 New Zealand orthopaedic units for patients admitted to hospital with fragility fractures^{40, 41}. Notably, only 23% of fracture patients were taking some form of osteoporosis treatment on admission. Amongst the 77% of patients that were not taking osteoporosis medication on admission, less than 3% had a bone density scan organised in response to their new fracture. Twelve percent of patients were initiated on treatment, of which the majority was started by a visiting orthogeriatric service which was available at 2 of the hospitals. Practically all of the patients initiated on treatment were hip fracture sufferers. This study highlights a near universal secondary prevention care gap for patients with non-hip fragility fractures. In the absence of an orthogeriatric service, the care gap is extended to hip fracture patients. Establishment of orthogeriatrics services has resulted in dramatic improvements in post-hip fracture osteoporosis treatment at hospitals in Christchurch^{42, 43} and Auckland^{44, 45}.

A study of patients admitted to Waitemata District Health Board (WDHB) in 2006-7 described standards of osteoporosis care for patients aged 65 years and over with a primary or secondary diagnosis of vertebral fracture⁴⁶. Overall, 33% of patients received optimal treatment to reduce future fracture risk.

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 care⁴⁷⁻⁴⁹. One survey asked orthopaedic surgeons and GPs about their routine clinical practice regarding investigation of osteoporosis following a low trauma Colles fracture⁴⁷. 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 multi-centre audit in New Zealand suggest a similar 'disconnect' is occurring in our medical practice.

Fracture Liaison Services: a systematic approach to secondary fracture prevention

A growing number of professional organisations^{38, 50-53}, patient societies^{22, 54-58} and policymakers⁵⁹⁻⁶⁸ 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 Europe⁶⁹⁻⁷⁸ and Australia⁷⁹⁻⁸³, 'Co-ordinator Programs' in Canada⁸⁴⁻⁸⁷ and 'Care Manager Programs' in the United States⁸⁸⁻⁹⁰. 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 Fracture Liaison Services (FLS) is appointment of personnel dedicated to delivering secondary preventive care. FLS have been shown to consistently outperform other service configurations¹⁹.

A prospective observational study from Southern California reported a 37% reduction in expected hip fracture rates over 3 years following the implementation of a systematic approach to primary and secondary fracture prevention in 11 hospitals serving a population of 3.1 million people⁹¹. Reports from FLS throughout the world^{74, 81, 92} have shown similar encouraging impacts on secondary fracture incidence. Critically, health economic evaluations from FLS based in Australia⁹³, Canada⁹⁴, the UK^{60, 95} and the United States⁹¹ have consistently reported favourable findings.

Implementation of Fracture Liaison Services in New Zealand

In December 2012, Osteoporosis New Zealand published *BoneCare 2020*⁵⁸, which made the case for implementation of a systematic approach to hip fracture care and prevention for New Zealand. Key components of the strategy included establishment of a NZ Hip Fracture Registry⁹⁶, to enable nationwide benchmarking of Australian and New Zealand professional standards of acute hip fracture care⁹⁷, and implementation of FLS in all District Health Boards (DHBs) to reliably deliver secondary fracture prevention.

BoneCare 2020 invited all relevant professional organisations, policy groups and private sector partners to join a National Fragility Fracture Alliance to implement this strategy. In this regard, many organisations have worked together in a spirit of collaboration to play a role in supporting implementation, including the Ministry of Health, the Health Quality and Safety Commission New Zealand, the Australian and New Zealand Hip Fracture Registry, the 4 regional DHB Alliances, and many clinical and administrative staff from the DHBs⁹⁸.

In Q4-2014, the NZ Hip Fracture Registry will be tested in an evaluation project within the 4 Northern Region DHBs. With regards to FLS implementation, as of August 2014⁹⁸:

- 6 DHBs had some form of FLS operating (albeit some at an early stage).
- The combined population of these DHBs is 2,271,708 people (over half New Zealand's population).
- The 6 DHBs that have an FLS account for approximately 282,500 people over the age of 65 (44% of the total population over 65).
- The 6 DHBs will continue to implement and monitor their FLS during 2014-15. The remaining 14 DHBs will also be implementing their FLS during 2014-15.

The purpose of this Resource Pack is to provide practical support to those DHBs that are in the process of developing FLS for their populations during 2014-15. Osteoporosis New Zealand is in complete accord with the International Osteoporosis Foundation (IOF) on this subject:

'IOF believes this is the single most important thing that can be done to directly improve patient care and reduce spiralling fracture related healthcare costs worldwide.'⁵⁷

Table of Contents

1.	The rationale for secondary fracture prevention	6
1.1	The ageing population	6
1.2	Fracture as a predictor of future fracture risk	6
1.3	A systematic approach to secondary fracture prevention	8
2.	The current management gap	9
2.1	The challenge of integrated care	9
2.2	Audit of secondary fracture prevention in New Zealand	9
2.3	Barriers to secondary fracture prevention in clinical practice	10
3.	Fracture Liaison Services	12
3.1	Development of effective healthcare delivery using Plan-Do-Study-Act Methodology	12
3.2	Fracture Liaison Service case studies	12
3.2.1	FLS in Australia	12
3.2.2	FLS in Canada	13
3.2.3	FLS in the United Kingdom	13
3.2.4	FLS in the United States of America	14
3.3	The role of Orthogeriatrics Services	14
3.4	Implementation of Fracture Liaison Services in New Zealand	15
3.5	International Osteoporosis Foundation Capture the Fracture Campaign: Best Practice Framework Standards	16
3.6	Setting up a Fracture Liaison Service	18
3.6.1	Preparatory work prior to FLS becoming operational	18
3.6.2	Issues to consider when FLS is operational	19
3.7	Optimisation of Fracture Liaison Services for patient identification	20
3.7.1	Identification of In-patient fracture cases by FLS	20
3.7.2	Identification of Out-patient fracture cases by FLS	20
3.7.3	Identification of vertebral fracture patients by FLS	21
3.7.4	The role of Vertebral Fracture Assessment in FLS assessment	21
3.8	Integrating secondary care and primary care	22
3.8.1	Case-finding in Primary Care: Australian experience	22
3.8.2	Case-finding in Primary Care: UK experience	23
3.9	Systematic approaches to primary fracture prevention	23
3.10	Delivering fracture risk reduction in the long-term	24
4.	A case for a Fracture Liaison Service at St. Anywhere's Hospital	25
Appendix 1: International Osteoporosis Foundation Capture the Fracture Campaign: Best Practice Framework Standards		26
Appendix 2: Fracture Liaison Service Status Summary		34
Appendix 3: Generic Fracture Liaison Service business plan template		35
Appendix 4: Step-by-step guide to Fracture Liaison Service development		40
Appendix 5: Generic Fracture Liaison Nurse Specialist job description		42
Acknowledgements		44
References		44-53

1. The rationale for secondary fracture prevention

1.1 The ageing population

In October 2014, the population of New Zealand was 4.5 million¹. During the 20th Century, life expectancy at birth increased by about 20 years², reaching 83 years for females and 79.3 years for males by 2010-12³. In 2012, New Zealanders' life expectancy ranked 20th for females and 8th for males amongst 34 OECD countries⁹⁹. New Zealand's population is projected to increase to more than 5.7 million by 2061⁶. In 2009, 13% of the population was ≥ 65 years of age, a figure which is predicted to rise to 25% by 2061. During the next five decades, the proportion of the population aged ≥ 85 years is set to grow at least three-fold, from 72,500 people in March 2011⁵ to between 250,000 and 420,000 by 2061⁶.

1.2 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 1. 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.'¹¹

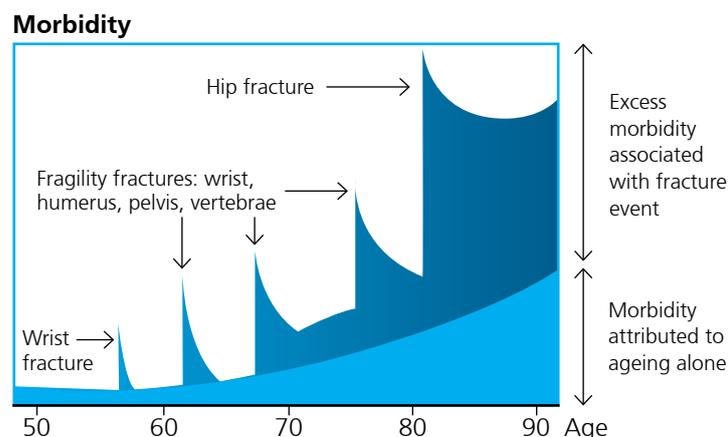


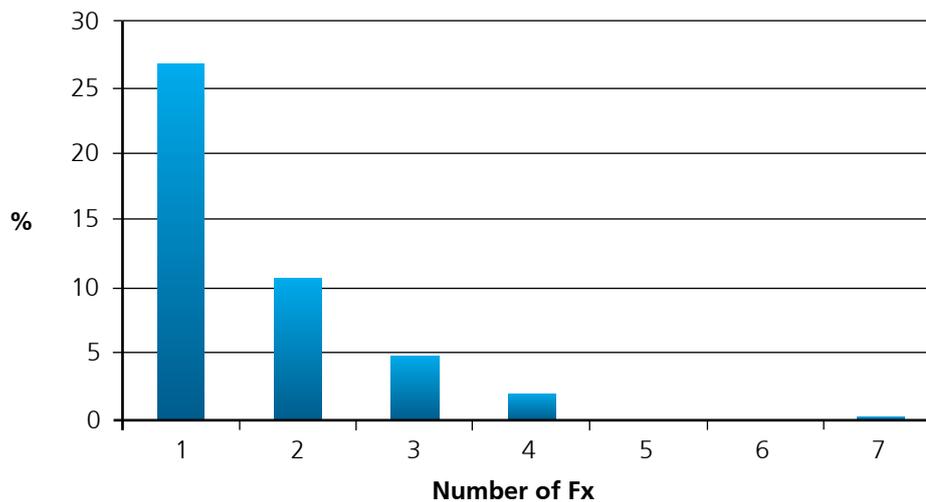
Figure 1. Fracture and quality of life during the life span of a patient with osteoporosis

The incidence of hip fracture in New Zealand was estimated to be 3,803 cases per year in 2007, at a cost of NZ\$105 million⁸. Given that hip fractures represent up to 20% of all fragility fractures that come to clinical attention⁹, approximately 19,000 fragility fracture presentations to urgent care services occur in New Zealand every year. The annual incidence of hip fractures in women aged 60 years and over in 1991 was 1,830¹⁰ which had risen to 2,639 by 2007⁸, an increase of 44%.

A recent study from New Zealand¹⁰⁰ 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 Australia¹⁰¹⁻¹⁰³, Europe¹⁰⁴⁻¹⁰⁹ and North America^{110, 111}. 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, there is no room for complacency. In 2007, the total direct cost of osteoporosis in New Zealand was estimated to be NZ\$330 million per year^{8, 112}. As New Zealand's 1 million baby boomers began to retire in 2011¹¹³, hip fractures will continue to exert a tremendous burden on older New Zealanders and the New Zealand healthcare system.

The central challenge facing policymakers and healthcare professionals is how to maximise the impact of interventions that reduce the incidence of fragility fractures. 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 fractures¹⁷. More recent studies from Australia¹⁸, Scotland¹⁹ and the USA²⁰ 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 2, 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 2. Prior non-vertebral and clinical vertebral fractures after age 50 amongst hip fracture patients¹⁹



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^{12,13} 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^{14,16,114}. Secondary fractures appear to occur rapidly after incident fracture¹⁴. 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)¹⁵. 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 fracture¹⁶.

The Australian group coined the term 'signal' fracture¹⁸ to illustrate the opportunity presented by the prior fragility fracture to have implemented secondary preventive care immediately after the prior fracture occurred, 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 appropriate²¹. The Scottish audit¹⁹ 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; 30% aged 65 years or over who live in the community fall each year, increasing to 45% in those aged 80 or above¹¹⁵. A 2005 review summarised the literature on falls epidemiology, risk factors, clinical assessment and interventions to prevent falls¹¹⁶. 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 the Australian and New Zealand Society for Geriatric Medicine guidance on orthogeriatric care¹¹⁷, and consensus guidance from the UK⁵⁰ and United States¹¹⁸, that patients presenting with fragility fractures require an integrated assessment of osteoporosis and falls risk.

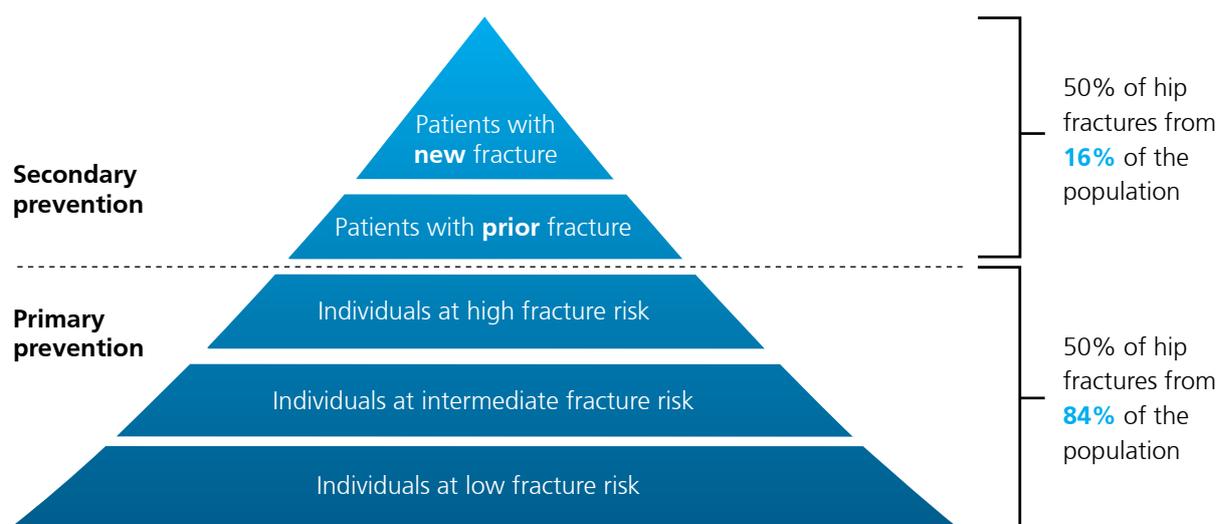
1.3 A systematic approach to secondary fracture prevention

A major study of the epidemiology of fragility fracture from Australia provides valuable insights on the proportion of people that have suffered fractures during later life¹¹⁹. 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. This study suggests that approximately 1 in 10 Australian women over 60 years of age have suffered at least two fractures. These data provide an indication of the likely prevalence of fragility fracture to be found in the New Zealand population.

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 3. Triangulation of data from the Australian BoneCare Study¹¹⁹, the UK¹²⁰ and France¹²¹ 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, 16% of the postmenopausal population will provide us with 50% of future hip fracture cases^{22, 23}. 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.

It should be noted that men aged 50 years and over who suffer fragility fractures should also receive secondary preventive care. Often - erroneously - considered a disease of older women, the fact that one third of hip fractures worldwide occur in men demonstrates that osteoporosis is an 'equal opportunity disease'¹²². The International Osteoporosis Foundation devoted the 2014 World Osteoporosis Day Report¹²³ to the subject of osteoporosis in men, with the aim of debunking this myth and raising awareness of osteoporosis in men among members of the public, healthcare professionals and policymakers throughout the world.

Figure 3. Fracture risk and ease of case-finding: Effective targeting of healthcare resources²³



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%¹²⁴⁻¹²⁶ and under-reporting is rare¹²⁶.

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 pharmacological agents licensed for the treatment of osteoporosis in New Zealand have been shown to reduce the incidence of fractures by 30-70%²⁴⁻³², dependent upon the particular agent and site of fracture. Fracture reduction efficacy of 50% has been observed for patients with a history of multiple fractures³³. An emerging body of evidence suggests that osteoporosis treatment is associated with reduced mortality^{29, 34-37}.

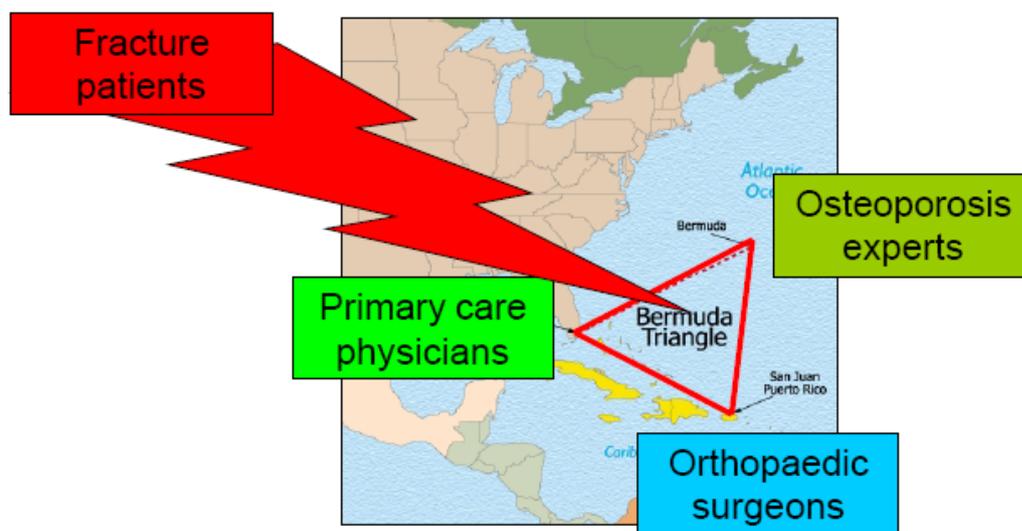
As half of hip fracture patients have suffered prior fragility fractures, nationwide implementation of a secondary prevention strategy would enable intervention in up to half of all future cases of hip fracture.

2. The current management gap

2.1 The challenge of integrated care

Osteoporosis care of fracture patients has been characterised as a Bermuda Triangle comprised of orthopaedic surgeons, primary care physicians and osteoporosis experts into which the fracture patient disappears¹²⁷. 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 hyperlipidaemia, respectively - require analogous and comparably reliable healthcare delivery solutions.

Figure 4. Osteoporosis care of the fragility fracture patient and healthcare professional 'silos'¹²⁷



2.2 Audit of secondary fracture prevention in New Zealand

Two audits have been conducted in New Zealand to assess post-fracture osteoporosis care delivered by orthopaedic surgeons. The first study, published in 2005, was part of a multi-national survey of osteoporotic fracture management undertaken by the Bone and Joint Decade and the International Osteoporosis Foundation^{38, 39}. The 70% response rate of New Zealand orthopaedic surgeons to the survey was the highest of any national group. Key findings included:

- The majority of New Zealand orthopaedic surgeons felt they lacked formal training in osteoporosis treatment.
- Less than 25% of fragility fracture patients would routinely be referred for a bone density test after fracture.
- More than 80% of surgeons would not prescribe osteoporosis medication.

The second subsequent multi-centre audit evaluated osteoporosis intervention by 8 New Zealand orthopaedic units for patients admitted to hospital with fragility fractures^{40, 41}. Notably, only 23% of fracture patients were taking some form of osteoporosis treatment on admission. More than half of these patients were not taking a bisphosphonate. Amongst the 77% of patients that were not taking osteoporosis medication on admission, less than 3% had a bone density scan organised in response to their new fracture. Twelve percent of patients were initiated on treatment, of which the majority was started by a visiting orthogeriatric service which was available at two of the hospitals. Practically all of the patients initiated on treatment were hip fracture sufferers. The authors also noted that osteoporosis was mentioned in the discharge summaries for only 30% of the patients that were already taking osteoporosis treatment, and just 11% of the patients started on medication during their admission. This study highlights a near universal secondary prevention care gap for patients with non-hip fragility fractures. In the absence of an orthogeriatric service, the care gap is extended to hip fracture patients. Establishment of orthogeriatrics services has resulted in dramatic improvements in post-hip fracture osteoporosis treatment at hospitals in Christchurch^{42, 43} and Auckland^{44, 45}.

A study of patients admitted to Waitemata District Health Board in 2006-7 described standards of osteoporosis care for patients aged 65 years and over with a primary or secondary diagnosis of vertebral fracture⁴⁶. Overall, 33% of patients were treated with a combination of calcium, vitamin D and a bisphosphonate (Ca+Vit-D+BP) and 47% with a bisphosphonate. Treatment rates were analysed by various sub-groups:

- Patients with prior non-vertebral fractures: These fractures were predominantly of the neck of femur, pelvis and chest wall. 9 patients had ≥ 2 prior non-vertebral fractures. Forty-six percent of these patients were receiving Ca+Vit-D+BP, 57% were receiving a bisphosphonate and 20% were not receiving osteoporosis treatment.
- Newly diagnosed vertebral fractures: Eighteen percent of patients were admitted with a new vertebral fracture. On discharge, 32% were receiving Ca+Vit-D+BP, 54% were receiving a bisphosphonate and 21% were not on osteoporosis treatment.
- Corticosteroid treated patients: Twenty percent of patients were being treated with corticosteroids. On discharge, 52% were receiving Ca+Vit-D+BP, 62% were receiving a bisphosphonate and 16% were not on osteoporosis treatment.

The authors concluded that treatment for secondary prevention of vertebral fractures was sub-optimal with only a third of patients receiving Ca+Vit-D+BP and 53% not being prescribed a bisphosphonate at all.

Prior to the introduction of a systematic approach, the provision of secondary preventive care for patients presenting to New Zealand hospitals with fragility fractures could be summarised as follows:

- Hip fracture patients: Where orthogeriatrics services are available, high quality osteoporosis care will be delivered.
- Vertebral fracture patients: Around a third of patients are being managed optimally according to professional guidance.
- Non-hip, non-vertebral fracture patients: Usual care is no care.

2.3 Barriers to secondary fracture prevention in clinical practice

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 prevention¹²⁸:

- 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 New Zealand¹²⁹. 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 preventive 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 attention¹³⁰. 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 care⁴⁷⁻⁴⁹. Given that post-fracture osteoporosis treatment rates were similar in the UK and New Zealand, 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 scenarios⁴⁷:

- 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 orthopaedic 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.

Prior to the introduction of a systematic approach, the secondary fracture prevention care gap was evident in New Zealand.

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.

3. Fracture Liaison Services

A growing number of professional organisations^{38, 50-53}, patient societies^{22, 54-58} and policymakers⁵⁹⁻⁶⁸ 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 Europe⁶⁹⁻⁷⁸, Australia⁷⁹⁻⁸³ and Asia^{131, 132}, 'Co-ordinator Programs' in Canada⁸⁴⁻⁸⁷ and 'Care Manager Programs' in the United States⁸⁸⁻⁹⁰. 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. This section will consider in detail the operational characteristics of successful Fracture Liaison Services (FLS), and provide practical guidance for those engaged in establishing new services for their localities.

3.1 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 patients⁹⁰. 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

3.2 Fracture Liaison Service case studies

As of August 2014, 6 District Health Boards (DHBs) in New Zealand had established an FLS (see section 3.4)⁹⁸, with Waitemata DHB being the first in December 2013¹³³. In the absence of peer-reviewed publications from FLS in New Zealand, summaries of well-established FLS from Australia, Canada, the United Kingdom and the United States follow.

3.2.1 FLS in Australia

Concord Repatriation General Hospital, Sydney

Service structure: The Minimal Trauma Fracture Liaison (MTFL) service⁸¹ 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 FLS and the hospital's Orthogeriatrics Service; the MTFL provides care for non-frail patients with fragility fractures whilst the Orthogeriatrics Service¹³⁴ 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 MFL 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 MFL service was 80% lower than the control group. A recently published cost-effectiveness analysis⁹³ of the MFL 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 MFL service by a decrease in subsequent fractures, which led 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

3.2.2 FLS in 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 osteoporosis⁸⁴. The Osteoporosis Exemplary Care Program (OEC) 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 OEC
- 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 OEC
- 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

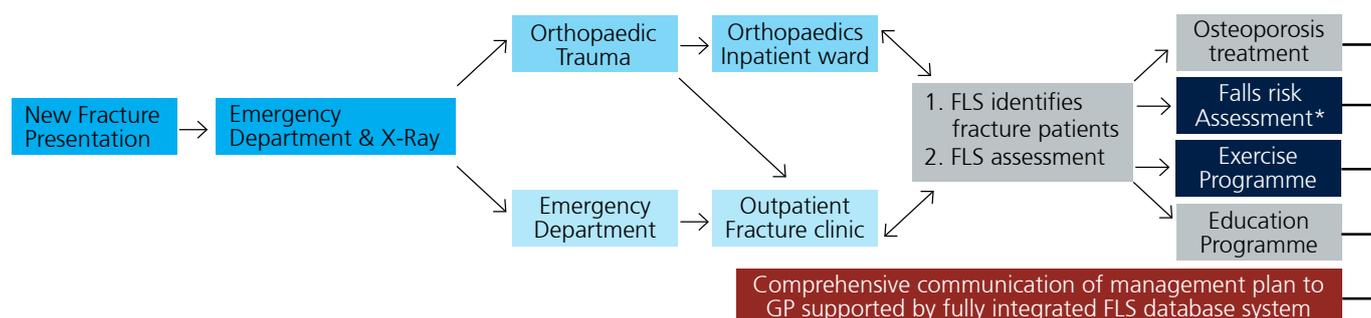
A cost-effectiveness analysis⁹⁴ of the OEC concluded that a hospital that hired an osteoporosis coordinator who manages 500 patients with fragility fractures annually could reduce the number of subsequent hip fractures from 34 to 31 in the first year, with a net hospital cost savings of CN\$48,950 (Canadian 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.

3.2.3 FLS in the 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 fractures⁷⁰. 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 5. The structure of the Glasgow Fracture Liaison Service adapted from *The care of patients with fragility fracture*⁵⁰



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

Service outcomes: During the first 18 months of operations⁷⁰:

- 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 FLS¹³⁵. During this period, hip fracture rates in Glasgow have reduced by 7.3% versus almost a 17% increase in England⁹², where only 37% of localities operated an FLS¹³⁶ 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 care¹⁹. 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 published⁹⁵. 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.

3.2.4 FLS in the 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 record¹³⁷. The program is primarily delivered by Care Managers and Nurse Practitioners, who serve as co-ordinators 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 system⁹¹. 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.

3.3 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^{50, 117, 118}, including that of the Australian and New Zealand Society for Geriatric Medicine¹¹⁷. A full discussion on the role and remit of Orthogeriatrics Service is beyond the scope of this Resource Pack. However, it is clear that FLS 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, Australia, FLS⁸¹ and Orthogeriatrics Services¹³⁴ 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. As stated previously, establishment of orthogeriatrics services has resulted in dramatic improvements in post-hip fracture osteoporosis treatment at hospitals in Christchurch^{42, 43} and Auckland^{44, 45}.

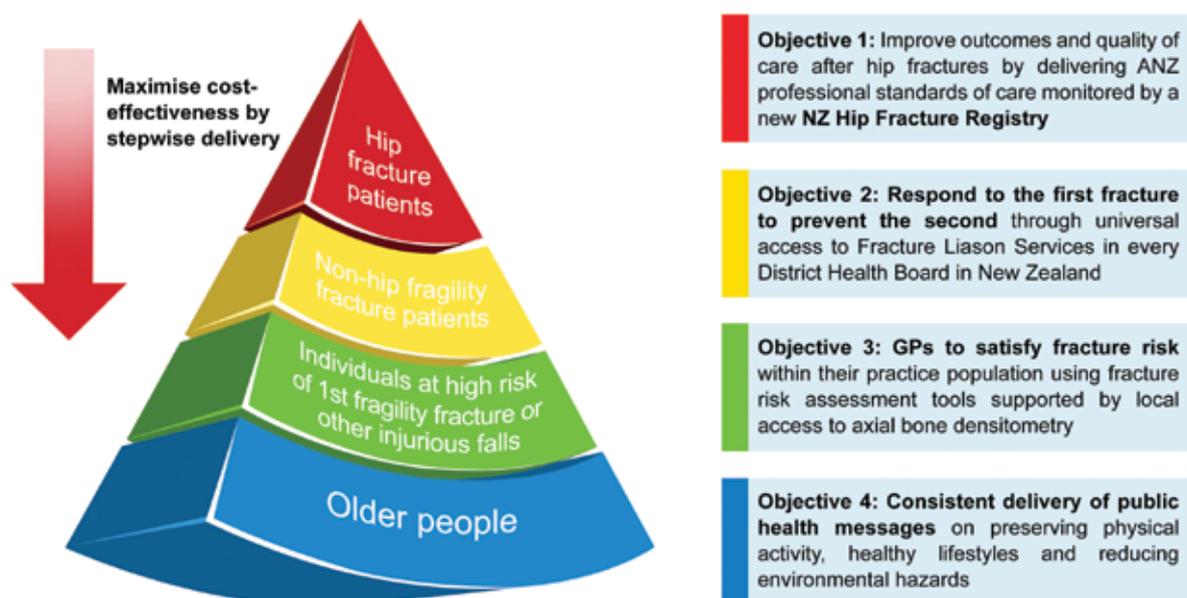
Recent publication of trans-Tasman guidelines for acute hip fracture care in September 2014⁹⁷, combined with development of hip fracture registries in both New Zealand and Australia⁹⁶, will support widespread implementation and benchmarking of Orthogeriatrics Services.

3.4 Implementation of Fracture Liaison Services in New Zealand

During 2012, the Australian and New Zealand Hip Fracture Registry Steering Group conducted a facilities level audit of all hospitals which perform hip fracture surgery in both countries¹³⁸. This audit was undertaken in the course of work to develop trans-Tasman guidelines for acute hip fracture care⁹⁷ and national hip fracture registries. The audit evaluated various elements of service provision pertaining to hip fracture patients, including the presence of a FLS. As of November 2012, there were no FLS established in New Zealand. In Australia, only 17 of the 116 hospitals (15%) had a FLS in place.

In December 2012, Osteoporosis New Zealand published *BoneCare 2020*, which made the case for implementation of a systematic approach to hip fracture care and prevention for New Zealand⁵⁸. Key components of the strategy included establishment of a NZ Hip Fracture Registry, to enable nationwide benchmarking of Australian and New Zealand professional standards of acute hip fracture care, and implementation of FLS in all DHBs to reliably deliver secondary fracture prevention (figure 6).

Figure 6. *BoneCare 2020: A systematic approach to hip fracture care and prevention for New Zealand*⁶⁸



BoneCare 2020 invited all relevant professional organisations, policy groups and private sector partners to join a National Fragility Fracture Alliance to implement this strategy. In this regard, many organisations have worked together in a spirit of collaboration to play a role in supporting implementation, including:

- **Ministry of Health:** Pursuant to setting an expectation that all DHBs implement FLS during 2013-14⁶⁷, the Ministry of Health worked with Osteoporosis New Zealand, the 4 regional DHB Alliances and clinical and administrative staff from the DHBs to deliver FLS Forums to share best practice and experience from elsewhere during Q4-2013 and Q1-2014. District Annual Planning guidance for 2014-15 states that DHBs should have fully operational FLS, and that implementation will be measured quarterly⁶⁸.
- **Health Quality & Safety Commission NZ:** The Commission's national programme, *Reducing Harm from Falls*, featured *BoneCare 2020* as one of 10 Topics, with Topic 6 looking at why hip fracture prevention and care matters¹³⁹. The programme aims to reduce the harm older people can suffer if they fall – especially when receiving care, whether in hospital, residential care, or in their own home.
- **ANZ Hip Fracture Registry Steering Group:** The ANZ HFR Steering Group has developed trans-Tasman Hip Fracture Care guidelines which were published in September 2014⁹⁷. ANZ HFR, in collaboration with Osteoporosis New Zealand, HQSC and the NZ Orthopaedic Association have developed an information technology platform for hip fracture audit in New Zealand.

In Q4-2014, the NZ Hip Fracture Registry will be tested in an evaluation project within the 4 Northern Region DHBs. With regards to FLS implementation, by August 2014:

- 6 DHBs had some form of FLS operating (albeit some at an early stage).
- The combined population of these DHBs is 2,271,708 people (over half New Zealand's population).
- The 6 DHBs that have an FLS account for approximately 282,500 people over the age of 65 (44% of the total population over 65).
- The 6 DHBs will continue to implement and monitor their FLS during 2014-15. The remaining 14 DHBs will also be implementing their FLS during 2014-15.

Evidently, significant progress towards universal access to FLS has been made in a comparatively short period of time. To further assist the ongoing development of FLS and fall prevention services, the Ministry of Health and ACC are working with their sector partners (including Osteoporosis NZ and the Health Quality and Safety Commission) to ensure fall and fracture prevention services continue to be integrated across agencies, and are accessible and relevant for older people. Osteoporosis NZ keenly awaits implementation of FLS by those DHBs that are yet to have a service in place. This resource pack and additional resources available from the new Osteoporosis NZ website - <http://osteoporosis.org.nz/> - provide support to health professionals and administrators in DHBs who are in the process of establishing their FLS. Furthermore, the following section on global standards for FLS from the International Osteoporosis Foundation and the subsequent sections on setting up an FLS, including a comprehensive, fully-referenced business plan template, will be helpful.

3.5 International Osteoporosis Foundation Capture the Fracture Campaign: Best Practice Framework Standards

In 2012, the International Osteoporosis Foundation (IOF) devoted the annual World Osteoporosis Day Report to launch the 'Capture the Fracture Campaign'^{57,140}. The stated objectives of Capture the Fracture for 2012–2013 were:

- Organise an international coalition to provide consensus on effective models of care for the prevention of secondary fractures.
- Develop a Best Practice Framework for secondary fracture prevention that can be adapted to diverse health care systems.
- Create an online educational portal to serve as a primary resource for the international community. The online portal will highlight the work of organizations around the world onto a global stage, providing examples that can facilitate the success of future programs.
- Provide online national toolkits in country and language specific format. Clinical sites will be able to access these toolkits to facilitate the development of their programs.
- Produce an interactive online map on which all qualified applicants will have the opportunity to highlight their systems.
- Develop a grant programme to aid clinical systems around the world which require financial assistance to develop their coordinated systems of care.

The Best Practice Framework (BPF) was published in 2013 and provides globally endorsed standards of care for FLS⁵⁶. Given the variation in structure of healthcare systems throughout the world, IOF consulted with leading experts from many countries who have established FLS in their localities and undertook beta-testing to ensure that the standards were internationally relevant and fit-for-purpose. Osteoporosis NZ personnel played a leading role in this process. The BPF sets an international benchmark for FLS, which defines essential and aspirational elements of service delivery. The 13 Best Practice Standards are (full details of each standard are provided in Appendix 1):

1. Patient Identification Standard
2. Patient Evaluation Standard
3. Post-fracture Assessment Timing Standard
4. Vertebral Fracture Standard
5. Assessment Guidelines Standard
6. Secondary Causes of Osteoporosis Standard
7. Falls Prevention Services Standard
8. Multifaceted health and lifestyle risk-factor Assessment Standard
9. Medication Initiation Standard
10. Medication Review Standard
11. Communication Strategy Standard
12. Long-term Management Standard
13. Database Standard

Each standard has three levels of achievement: Level 1, Level 2 or Level 3 (highest). The Medication Initiation Standard shown in figure 7 serves to illustrate how the BPF works. The BPF publication in Osteoporosis International is available as an open access paper through the SpringerLink button at <http://www.ncbi.nlm.nih.gov/pubmed/23589162>.

Figure 7. The IOF Best Practice Framework – Medication Initiation Standard⁶⁶

9.	Standard	Level 1	Level 2	Level 3
Medication Initiation	All fracture patients over 50yr, not on treatment at the time of fracture presentation, are initiated or are referred to their primary care physician/provider for initiation, where required, on osteoporosis treatment in accordance with evidence-based local/regional/national guidelines.	50% of fracture patients, who are eligible for treatment according to the evidence-based local/national/regional guideline, are initiated on osteoporosis medicines.	70% of fracture patients, who are eligible for treatment according to the evidence-based local/national/regional guideline, are initiated on osteoporosis medicines.	90% of fracture patients, who are eligible for treatment according to the evidence-based local/national/regional guideline, are initiated on osteoporosis medicines.
Guidance notes/rationale	The standard is not a general measurement of per cent of patients treated, but rather a measurement of the per cent of patients within the applicable guideline who are treated. The standard is cognisant that not all fracture patients over 50 years of age will require treatment.			
Footnote: This framework recognizes variations in the underlying health care system. Dependent on the nature of the health care system, the specialist may be able initiate treatment or, when the primary care physician/provider is the 'gatekeeper', the specialist can refer the patient to the primary care physician/provider for initiation of treatment. In either care, evidence is sought that this process is as robust as possible.				

In order to receive Capture the Fracture Best Practice Recognition, FLS are invited to submit an application which describes how the FLS delivers care for 4 fragility fracture patient groups – hip fractures, other in-patient fractures, outpatient fractures and vertebral fractures – and how it is organised. IOF will process the applications, generate a draft summary profile for each of the 5 domains (on a scale of gold, silver, bronze or unclassified), interact with the site to seek further clarification as needed and gain feedback on the draft summary profile before approving a final summary profile. At that point, the site will have the opportunity to feature on the 'Map of best practice'¹⁴¹ (see figure 8).

The map of best practice provides an opportunity for those undertaking FLS development to identify examples of best practice and learn from the experience of colleagues elsewhere who have successfully established an FLS. As of November 2014, 3 FLS in New Zealand feature on the map: North Shore Hospital (Auckland), Middlemore Hospital and Christchurch Hospital.

Figure 8. International Osteoporosis Foundation Capture the Fracture 'Map of best practice' as of November 2014¹⁴¹



In addition to the 3 key process steps of an effective FLS mentioned previously – identification, investigation and initiation – the BPF highlights another crucial element of effective post-fracture care; long-term adherence with treatment. As with many chronic diseases, a significant proportion of patients initiated on osteoporosis treatments will discontinue therapy without effective support¹⁴². In this regard, FLS are well placed to capitalise upon a 'teachable moment'¹⁴³ post-fracture and long-term adherence with treatment has been shown to be far superior for patients managed by FLS^{144, 145}.

Osteoporosis New Zealand endorses the International Osteoporosis Foundation Capture the Fracture Campaign, and encourages leaders of new Fracture Liaison Services in New Zealand to submit their FLS for IOF Best Practice Recognition at <http://capturethefracture.org/best-practice-framework>

3.6 Setting up a Fracture Liaison Service

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

3.6.1 Preparatory work prior to FLS 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
- Consultant Radiologist or Nuclear Medicine specialist
- Relevant specialist nurses, physiotherapists and other Allied Healthcare Professionals
- Personnel responsible for development/installation of FLS 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 FLS 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 FLS 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

3.6.2 Issues to consider when FLS is operational

Patient identification:

- Ensure FLS 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

Referral pathways:

- Ongoing evaluation of optimal terms to communicate the role of fracture risk assessment and falls assessment to patients

Communication with patients

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

Compliance with medication

- Consider options for regular contact with patients to review compliance with therapy

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 by GP at 3/6/12 months.
- Consider pro-active FLS-led 6 month review of all patients via GP questionnaire and patient questionnaire if appropriate

3.7 Optimisation of Fracture Liaison Services for patient identification

The primary challenge facing healthcare professionals during establishment of a FLS 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 FLS in this regard.

An approximation to the likely number of patients presenting to 'the average' New Zealand hospital with fragility fractures can be determined from national epidemiology. The incidence of hip fracture in New Zealand was estimated to be 3,803 cases per year in 2007⁸. Given that hip fractures represent up to 20% of all fragility fractures that come to clinical attention⁹, approximately 19,000 fragility fracture presentations to urgent care services occur in New Zealand every year. Based upon a New Zealand population of 4.5 million individuals¹, this would correspond to about 1,300 fracture presentations per year to a hospital serving a population of 300,000, including 260 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 FLS development and to maintain this group in a permanent fashion. Ongoing audit of FLS 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 FLS.

3.7.1 Identification of In-patient fracture cases by FLS

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

- Regular visits by the Fracture Liaison Nurse (FLN) to the orthopaedic wards with orthopaedic ward staff maintaining a list of fracture admissions in between FLN visits⁷⁰
- Attendance by the FLN at daily Trauma team meetings¹⁴⁶
- 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 Wales⁷⁹, Kaiser Permanente's HealthConnect¹³⁷ or FITOS[®] (Fracture Identification Tool for Orthopaedic Surgeons, RioMed Limited)¹⁴⁷

3.7.2 Identification of Out-patient fracture cases by FLS

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

- Routine attendance by the FLN to fracture clinics^{70, 82}
- Face-to-face interaction with a medical registrar⁸⁰
- "Link-nurses" - Creation by fracture clinic nurses of a daily register of new fracture patients⁷⁰
- IT systems such as the Emergency Department weekly fracture report at the Royal Newcastle Centre and John Hunter Hospital in New South Wales⁷⁹, Kaiser Permanente's HealthConnect¹³⁷ or FITOS[®] (Fracture Identification Tool for Orthopaedic Surgeons, RioMed Limited)¹⁴⁷

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 FLS.

3.7.3 Identification of vertebral fracture patients by FLS

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 community-based fracture clinic setting. FLS 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, publications of audit data from several FLS demonstrate that relatively few patients come to the FLS' attention as a result of a vertebral fracture^{70, 148}.

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 factors¹⁴⁹:

- 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

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 fall¹⁵⁰. The IMPACT Study¹⁵¹ 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 download from <http://www.iofbonehealth.org/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.

3.7.4 The role of Vertebral Fracture Assessment in FLS assessment

Assessment of patients by the combination of bone density measurement with ascertainment of vertebral fracture status has been shown to improve fracture risk prediction¹⁵²:

“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 FLS setting^{153, 154}. Amongst patients presenting with non-vertebral fractures that were assessed by an FLS, the overall prevalence of vertebral deformity was of the order of a quarter to a fifth (25%¹⁵³ and 20%¹⁵⁴). 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%¹⁵³ and 3%¹⁵⁴). This is perhaps not surprising given that the patients investigated had a non-vertebral fracture which triggered FLS assessment. However, incorporation of VFA into FLS 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.

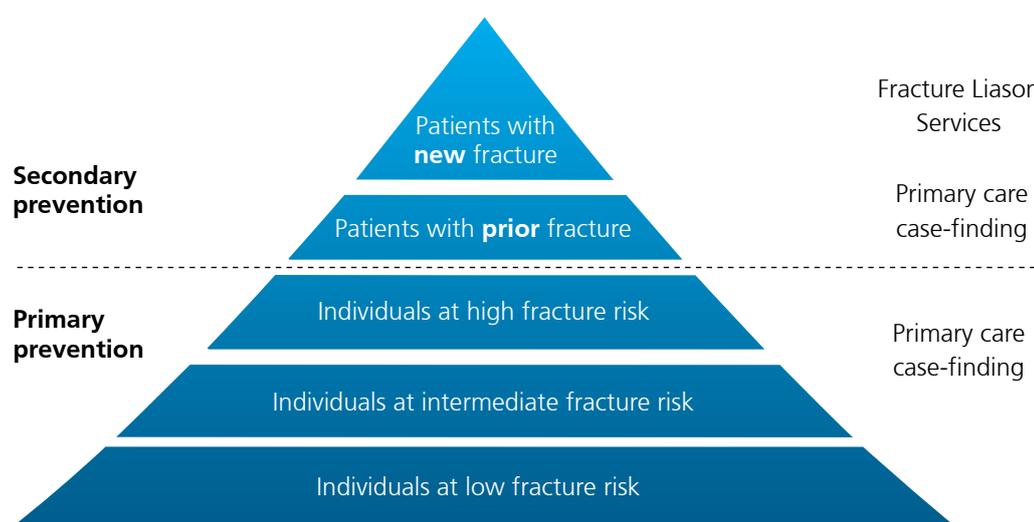
Another conclusion of the FLS VFA work was that VFA should ideally be conducted on all patients that are referred for DXA who do not have a clinical fracture history¹⁵³. This concept will be explored further in the next section concerned with integration with primary care services.

Appendix 2 provides a simple questionnaire for Lead Clinicians in Osteoporosis who are currently operating an FLS, or intend to establish a service, which considers the central challenges to delivery of an effective systematic approach to secondary fracture prevention in their hospital.

3.8 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 fractures⁵⁰. As such, the development and implementation of hospital-based FLS must be cognisant of the need for seamless integrated care between providers of both secondary and primary care. FLS 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 9.

Figure 9. Prioritisation of osteoporosis assessment in the older population



New Zealand's hospitals have only recently begun to implement FLS⁹⁸ and the majority of New Zealand fragility fracture patients do not receive secondary preventive care^{38-41, 46}. 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.

3.8.1 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 2009¹⁵⁵. 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 Study¹¹⁹ 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.

3.8.2 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 UK¹²⁰. All women aged 65 years and over (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 (n=43) had previously undergone a DXA scan and 9.4% (n=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 2007¹⁵⁶ reported only 25% of females aged 75 years and over 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 and over with a recorded prior fragility fracture had been DXA scanned. In response to this and other national audit data¹⁵⁷, 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 will be eligible for a component of their annual incentive payment to be made if they deliver the following quality metrics¹⁵⁸:

- **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 new standards of care, the UK National Osteoporosis Society and the Royal College of General Practitioners developed a web resource - <http://www.osteoporosis-resources.org.uk/>. It has been suggested that similar ventures could be collaboratively developed by Osteoporosis Australia and the Royal Australian College of General Practitioners¹⁵⁹. Similar collaboration could be explored between Osteoporosis New Zealand and the Royal New Zealand College of General Practitioners.

3.9 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/>)¹⁶⁰
- 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/>)¹⁶¹

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 fractures¹⁷⁻²⁰. 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 9, could be undertaken as time and resources permit.

3.10 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 hyperlipidaemia, adherence and persistence with osteoporosis treatments routinely diminishes to 50% within one year of initiation¹⁴². Several approaches have been associated with improvements in adherence and persistence to osteoporosis treatments including:

- Interaction and follow-up by an osteoporosis nurse specialist¹⁶²
- Correct patient understanding of bone density results¹⁶³
- Offering patients a choice of dosing interval¹⁶⁴

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 efficacy¹⁶⁵⁻¹⁶⁷. Many osteoporosis sufferers will experience non-hip ‘signal’ fragility fractures a decade or more prior to the average age for occurrence of hip fracture⁵⁰. 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 journey¹¹.

4. A case for a Fracture Liaison Service at St. Anywhere's Hospital

Establishing a Fracture Liaison Service 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, FLS provide an opportunity to intervene in half of all potential cases of hip fracture in the future.

FLS have been shown to deliver high quality care in a cost-effective manner throughout the world^{91, 93-95, 131, 132}.

In the event that your hospital is yet to establish a Fracture Liaison Service, resources are provided as Appendices to support you and your colleagues to construct an FLS business case.

A factor common to centres that have successfully developed an FLS 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
- Consultant Radiologist or Nuclear Medicine specialist
- Relevant specialist nurses, physiotherapists and other Allied Healthcare Professionals
- Personnel responsible for development/installation of FLS 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

Appendices 2 to 5 are also provided in electronic format are also available from <http://osteoporosis.org.nz/resources/health-professionals/fracture-liaison-services/> to support to support clinicians to establish FLS in their institutions:

Appendix 2 - Fracture Liaison Service Status Summary

Appendix 3 - Generic Fracture Liaison Service business plan template

Appendix 4 - Step-by-step guide to FLS development

Appendix 5 - Generic Fracture Liaison Nurse Specialist job description

Appendix 1: International Osteoporosis Foundation Capture the Fracture Campaign: Best Practice Framework Standards

The 13 IOF Capture the Fracture Best Practice Framework Standards

Osteoporosis New Zealand thanks the International Osteoporosis Foundation for granting permission to reproduce the 13 BPF standards in full overleaf⁵⁶. Osteoporosis NZ also thanks the following contributors to the IOF Capture the Fracture Best Practice Framework:

IOF Capture the Fracture Steering Committee

Professor Kristina Åkesson

Chair, Capture the Fracture Campaign
Department of Orthopaedics Malmö
Malmö Skåne University Hospital
Sweden

Professor Alastair McLellan

Gardiner Institute
Western Infirmary
Glasgow
UK

Professor Cyrus Cooper

Chair, IOF Committee of Scientific Advisors
MRC Epidemiology Resource Centre
Southampton General Hospital
UK

Paul Mitchell

Director
Synthesis Medical NZ Ltd
Auckland
New Zealand

Judy Stenmark

Chief Executive Officer
International Osteoporosis Foundation
Nyon
Switzerland

Dominique Pierroz

Science Manager
International Osteoporosis Foundation
Nyon
Switzerland

Carey Kyer*

Science Project Manager
International Osteoporosis Foundation
Switzerland

*Dr. Muriel Schneider is the current Science Project Coordinator at IOF
(Email: mschneider@iofbonehealth.org)

IOF Fracture Working Group

Åkesson K (chair), † Boonen S (Belgium), Brandi ML (Italy), Cooper C (UK), Dell R (USA) co-opted, Goemaere S (Belgium), Goldhahn J (Switzerland), Harvey N (UK), Hough S (South Africa), Javaid MK (UK), Lewiecki M (USA), Lyritis G (Greece), Marsh D (UK), Napoli N (Italy), Obrant K (Sweden), Silverman S (USA), Siris E (USA) and Sosa M (Spain).

1.	Standard	Level 1	Level 2	Level 3
Patient Identification Standard	Fracture patients within the scope of the institution (inpatient and/or outpatient facility or health care system) are identified to enable delivery of secondary fracture prevention.	Clinical fracture patients are being identified but no patient tracking system exists to evaluate percentage of patients that are identified versus those that are not.	Clinical fracture patients are being identified and a patient tracking system exists to evaluate percentage of patients that are identified versus those that are not.	Clinical fracture patients are being identified and a patient tracking system exists to evaluate percentage of patients that are identified versus those that are not. The quality of data capture has been subject to independent review .
Guidance notes/ rationale	This intention of this standard is to ascertain the ROUTE by which fracture patients are identified. The standard recognises that some institutions will manage just inpatients, some will manage just outpatients and others will manage both in- and outpatients. The Nomination Platform Questionnaire (NPQ) will identify which type of fracture patients are included within the scope of the institution.	The institution does not have a system to track every patient presenting to the institution with a fracture, so cannot accurately determine the proportion of all patients that are reached by the service.	The institution does have a system to track every patient presenting to the institution with a fracture, so can accurately determine the proportion of all patients that are reached by the service.	The institution does have a system to track every patient presenting to the institution with a fracture, and has data quality control assessment measures independent of the team that deliver post-fracture care e.g. an existing hospital-wide data quality assurance team or clinical coding quality team that is either internal or external to the hospital/system.
Footnote: It is recognized that health care institutions/systems will have varying methods to define their 'fracture patient' group, whether it be by diagnostic codes (ICD, CIM10), patient age, fracture type etc., from which to enable secondary fracture prevention.				

2.	Standard	Level 1	Level 2	Level 3
Patient Evaluation Standard	Identified fracture patients within the scope of the institution are assessed for future fracture risk.	Of those patients identified, in whom progression to immediate treatment is not warranted, 50% are assessed for subsequent fracture risk.	Of those patients identified, in whom progression to immediate treatment is not warranted, 70% are assessed for subsequent fracture risk.	Of those patients identified, in whom progression to immediate treatment is not warranted, 90% or more are assessed for subsequent fracture risk.
Guidance notes/ rationale	This standard is concerned with the number of patients being assessed for subsequent fracture risk. The intention of this standard is to ascertain what proportion of all patients presenting to the institution or system with a fracture are evaluated for future fracture risk. The standard recognises that some institutions will manage just inpatients, some will manage just outpatients and others will manage both in- and outpatients. Additionally, the standard recognises circumstances when the best practice is to bypass fracture evaluation and go straight to treatment protocols (e.g. for patients who are 80+).			
Footnote: Evaluation on this standard will take into account the difficulties associated with assessing patients with dementia or impaired cognitive function.				

3.	Standard	Level 1	Level 2	Level 3
Post Fracture Assessment Timing Standard	Post-fracture assessment for secondary fracture prevention is conducted in a timely fashion after fracture presentation.	Post-fracture assessment for secondary fracture prevention occurs within 12-16 weeks of clinical fracture presentation.	Post-fracture assessment for secondary fracture prevention occurs within 8-12 weeks of clinical fracture presentation.	Post-fracture assessment for secondary fracture prevention occurs within 8 weeks of clinical fracture presentation.
Guidance notes/ rationale	This standard is concerned with the timing of when subsequent fracture risk assessment is done. This assessment can be performed by any qualified provider but must be tracked by the FLS coordinator and must contain appropriate post-fracture assessment elements such as bone density testing, risk assessment or other assessment procedures relevant to the patient. This is to ensure a formal fracture risk assessment has been done.	The proportion of patients which this standard applies to is defined by the 50%, 70% and 90% ranges required to achieve Level 1, Level 2 or Level 3, respectively, in Standard 2.	The proportion of patients which this standard applies to is defined by the 50%, 70% and 90% ranges required to achieve Level 1, Level 2 or Level 3, respectively, in Standard 2.	The proportion of patients which this standard applies to is defined by the 50%, 70% and 90% ranges required to achieve Level 1, Level 2 or Level 3, respectively, in Standard 2.
Footnote: Utilizing the health care institution/system's average timing protocols, applicants are encouraged to give as accurate a time-frame as possible for when the post-fracture assessment for secondary fracture prevention is conducted. It is noted, however, that conducting post-fracture assessment at a time greater than four months post-fracture is too late.				

4.	Standard	Level 1	Level 2	Level 3
Vertebral Fracture Standard	Institution has a system whereby patients with previously unrecognised vertebral fractures are identified and undergo secondary fracture prevention evaluation.	Patients with clinical vertebral fractures undergo assessment and/or receive treatment for prevention of secondary fractures.	Patients with non-vertebral fractures routinely undergo assessment with lateral vertebral morphometry by DXA (or possibly by plain spine radiology) to assess for vertebral fractures.	Patients who are reported by the Institution's Radiologists to have vertebral fractures on plain Xrays, CT & MRI scans (whether these are serendipitous or not) are identified by the FLS in order that they undergo assessment for treatment for prevention of secondary fractures.
Guidance notes/ rationale	The majority of vertebral fractures are unrecognised or undetected. The intention of this standard is to establish what systems the institution has put in place to identify vertebral fractures amongst patients presenting and/or admitted to the institution for any condition. Knowledge of vertebral fracture status in addition to BMD has been shown to significantly improve fracture risk prediction for secondary fractures.	Up to a quarter of patients presenting to an FLS with non-vertebral fractures were shown to have vertebral deformities by Vertebral Fracture Assessment technology. The standard is cognisant that for some fracture patients conducting vertebral fracture assessment may not be practical for change management e.g. amongst hip fracture patients.	For those patients referred into a local bone densitometry unit for a DXA scan on account of reasons other than a prior fracture history, ascertaining vertebral fracture status may influence treatment decisions significantly for a proportion of patients.	A substantial volume of imaging is undertaken amongst over 50 year olds which presents an opportunity to significantly increase identification rates of patients with previously unrecognised vertebral fractures in the course of care for other conditions.
Footnote: This standard recognizes that vertebral fracture patients are difficult to identify. This standard is aspirational but since vertebral fractures are the most common fragility fracture it would be remiss to not include the attempt to identify them in this framework.				

5.	Standard	Level 1	Level 2	Level 3
Assessment Guidelines Standard	The institution's secondary fracture prevention assessment, to determine the need for intervention, is consistent with local/regional/national guidelines.	The institution's assessment is consistent with peer reviewed guidance developed by the local institution delivering the FLS, or by adaptation of international guidelines.	The institutions' assessment is consistent with regional or state guidelines.	The institution's assessment is consistent with national guidelines.
Guidance notes/ rationale	The intention of this standard is two-fold. Firstly, the standard requires institutions to adhere to guidance that has been subject to peer review at a local, regional or national level. Secondly, the standard highlights an important leadership role that an effective FLS can play in supporting colleagues across the national healthcare system. A well-established FLS should play a leading role in lobbying for, and drafting national guidelines on secondary fracture prevention.	Although local or adapted international guideline use is accepted at this level, there is an expectation that once regional, state or national guidelines are developed the site will work towards modifying their secondary fracture prevention assessments.	Although regional or state guideline use is accepted at this level, there is an expectation that once national guidelines are developed the site will work towards modifying their secondary fracture prevention assessments.	

Footnote: It is recognized that different health care institutions/systems may be limited to the guidelines that are available within their country.

6.	Standard	Level 1	Level 2	Level 3
Secondary Causes of Osteoporosis Standard	Institution can demonstrate what proportion of patients who require treatment for prevention of secondary fractures undergo further investigation (typically blood testing) to assess for underlying causes of low BMD.	Institution can demonstrate that 50% of patients who need treatment are routinely screened for secondary causes of osteoporosis.	Institution can demonstrate that 70% of patients who need treatment are routinely screened for secondary causes of osteoporosis.	Institution can demonstrate that 90% patients who need treatment are routinely screened for secondary causes of osteoporosis via site protocol and referral to specialists, if indicated, has been arranged.
Guidance notes/ rationale	It is Important to recognize why patients have osteoporosis. Assessment should follow an algorithm that screens for secondary causes.			For clarity, in healthcare systems where the primary care physician serves as the 'gate keeper' for referrals to specialists, the FLS is required to have a robust agreement with local primary care physicians to ensure that onward referral occurs.

Footnote: It is recognized that there will be varying methods used to identify secondary causes of osteoporosis. The philosophy of this standard is that post-fracture patients who are in need of treatment are assessed to identify secondary causes of osteoporosis in accordance with the institution or health care system's existing methods.

7.	Standard	Level 1	Level 2	Level 3
Falls Prevention Services Standard	Patients presenting with a fragility fracture, and who are perceived to be at risk of further falls, are evaluated to determine whether or not falls prevention intervention services are needed, and if so are subsequently referred to an established falls prevention service.	50% of patients presenting with fractures who are perceived to be at risk of further falls are evaluated to determine whether falls prevention services are needed.	70% of patients presenting with fractures who are perceived to be at risk of further falls are evaluated to determine whether falls prevention services are needed.	90% of patients presenting with fractures who are perceived to be at risk are evaluated to determine whether falls prevention services are needed, and appropriate patients are referred to an established falls prevention service that delivers evidence-based interventions
Guidance notes/ rationale	The grading of this standard will be based on whether falls prevention services are available. The basic standard will be that an assessment will be done to determine whether a patient needs falls prevention services. The standard rating will be raised if falls prevention services are available and whether patients can be referred to it.	All patients are evaluated for falls risk using a basic falls risk evaluation questionnaire.		Falls prevention service should deliver evidenced-based programs.
Footnote: This standard determines whether or not a falls prevention service is available, and if so how it is being utilized. If there is not an established falls service in the locality, this standard becomes aspirational and encourages the leadership of the FLS to lobby the institution/system to make a falls service available.				

8.	Standard	Level 1	Level 2	Level 3
Multifaceted health and lifestyle risk-factor Assessment Standard	Patients presenting with fragility fractures undergo a multifaceted risk-factor assessment as a preventative measure to identify any health and/or lifestyle changes that, if implemented, will reduce future fracture risk, and those patients in need are subsequently referred to the appropriate multidisciplinary practitioner for further evaluation and treatment.	50% of inpatients undergo multifaceted risk-factor assessments.	70% of inpatients undergo multifaceted risk-factor assessments.	90% of inpatients undergo multifaceted risk-factor assessments.
Guidance notes/ rationale	Going beyond treatment by medication, it is important to identify other needs for intervention that will reduce future fracture risk, including assessing for any underlying health or lifestyle risk-factors that may contribute to future fractures. Identifying risk-factors such as smoking, alcohol use, poor nutrition, lack of exercise, poor coordination, poor balance, etc. and referring the patient to the appropriate healthcare provider for intervention will help to prevent future fractures.			

Footnote: A multifaceted risk assessment can be done by one healthcare provider within the FLS (clinician, nurse, FLS coordinator etc.), and needed intervention services can be referred to the appropriate healthcare provider for further evaluation and treatment. For example, a very elderly patient presenting with a fragility fracture undergoes a multifaceted risk-factor assessment and is identified to have very poor coordination and balance. Identifying this, the FLS refers the patient to be fitted for hip protectors as a preventative measure for hip fracture from a fall.

It is recognized that there will be varying methods used to identify multifaceted risk-factors for future fractures. The philosophy of this standard is that post-fracture patients who are in need of treatment **are assessed** to identify "lifestyle" risk-factors in accordance with the institution or health care system's existing methods.

9.	Standard	Level 1	Level 2	Level 3
Medication Initiation Standard	All fracture patients over 50yr, not on treatment at the time of fracture presentation, are initiated or are referred to their primary care physician/provider for initiation, where required, on osteoporosis treatment in accordance with evidence-based local/regional/national guidelines.	50% of fracture patients, who are eligible for treatment according to the evidence-based local/national/regional guideline, are initiated on osteoporosis medicines.	70% of fracture patients, who are eligible for treatment according to the evidence-based local/national/regional guideline, are initiated on osteoporosis medicines.	90% of fracture patients, who are eligible for treatment according to the evidence-based local/national/regional guideline, are initiated on osteoporosis medicines.
Guidance notes/ rationale	Guidance notes/rationale The standard is not a general measurement of percent of patients treated, but rather a measurement of the percent of patients within the applicable guideline who are treated. The standard is cognisant that not all fracture patients over 50 years of age will require treatment.			

Footnote: This framework recognizes variations in the underlying health care system. Dependent on the nature of the health care system, the specialist may be able initiate treatment or, when the primary care physician/provider is the 'gatekeeper', the specialist can refer the patient to the primary care physician/provider for initiation of treatment. In either case, evidence is sought that this process is as robust as possible.

10.	Standard	Level 1	Level 2	Level 3
Medication Review Standard	For patients already receiving osteoporosis medications when they present with a fracture, reassessment is offered which includes review of medication compliance, consideration of alternative osteoporosis medications and optimisation of non-pharmacological interventions.	Institution demonstrates that it reviews the medications of $\geq 50\%$ of patients captured above (by the FLS), who are on treatment at time of fracture and performs a review of medication compliance and/or consideration of alternative interventions.	Institution demonstrates that it reviews the medications of $\geq 70\%$ of patients captured above (by the FLS), who are on treatment at time of fracture and performs a review of medication compliance and/or consideration of alternative interventions.	Institution demonstrates that it reviews the medications of $\geq 90\%$ of patients captured above (by the FLS), who are on treatment at time of fracture and performs a review of medication compliance and/or consideration of alternative interventions.
Guidance notes/ rationale	The intention of this standard is to assess whether the FLS reviews patients that have fractured whilst, seemingly, receiving treatment for osteoporosis, and what proportion of this sub-group of patients undergo thorough review.			

11.	Standard	Level 1	Level 2	Level 3
Communication Strategy Standard	Institution's FLS management plan is communicated to primary and secondary care clinicians and contains information required by and approved by local stakeholders.	Institution's FLS management plan is communicated to primary and secondary care physicians.	Institution demonstrates that the FLS management plan is communicated to primary and secondary care clinicians and contains at least 50% of criteria listed.*	Institution demonstrates that the FLS management plan is communicated to primary and secondary care clinicians and contains at least 90% of criteria listed.*
Guidance notes/ rationale	The intention of this standard is to understand to what extent the FLS management plan - and communication of it to relevant clinical colleagues in primary and secondary care – has sought those colleagues' opinions on how best to suit their needs to ensure optimum adherence with recommendations from the FLS.			
<p>Footnote: This standard pertains mainly to situations when patients present to an inpatient or outpatient facility for a non-orthopaedic related reason, and whilst there, it is opportunistically discovered that a fracture exists (i.e. chest x-ray for pneumonia discovers a vertebral fracture). In this case a post-fracture management plan is put into place and communicated to the patient as well as to all health care providers and payers (if referral required) involved with the patient's care.</p> <p>*The criteria mentioned in Level 2 and Level 3 includes:</p> <ul style="list-style-type: none"> • Fracture risk score • DXA – BMD • DXA – vertebral fracture assessment or spine Xray result if done instead • Primary osteoporosis risk factors • Secondary causes of osteoporosis (if applicable) • Fracture/fall risk factors • Current drug treatment (if applicable) • Medication compliance review • Follow-up plan • Lifestyle risk-factor assessment • Time since last fracture 				

12.	Standard	Level 1	Level 2	Level 3
Long-term Management Standard	Institution has a protocol in place for long-term follow up of evidence-based initial interventions and a long term adherence plan.	Treatment recommendations, for patients requiring drug treatments, include a long-term follow-up plan that occurs >12 months after fracture advising when the patient should undergo future reassessment of fracture risk and of need for treatment.		Treatment recommendations, for patients requiring drug treatments, include both a short-term follow-up plan <12 months after fracture, AND a long-term follow-up plan >12 after fracture, advising when the patient should undergo future reassessment of fracture risk, the need for treatment and clear guidance on when and with whom lies responsibility for monitoring adherence to treatment.
Guidance notes/ rationale	The intention of this standard is to ascertain what processes are in place to ensure that long-term management of fracture risk is reliably provided. In healthcare systems with established primary care infrastructure, local primary care must be involved in developing the processes that they will implement for this aspect of post-fracture care. In healthcare systems that lack primary care infrastructure, the FLS must establish effective feedback processes directly from the patient or carer and devise strategies to ensure follow-up by the FLS.	Institution can demonstrate the proportion of patients originally assessed by the FLS have a long-term follow-up plan in place that has been subject at years 1 & 2 and beyond.		Institution can demonstrate the proportion of patients originally assessed by the FLS have a short-term follow-up plan within 6-12 months, as well as a long term management plan in place that has been subject at years 1 & 2 and beyond.

Footnote: A key responsibility of an FLS of care is to have a protocol in place to ensure long-term follow-up will take place, and clear guidance on when and with whom lies the responsibility for monitoring adherence to treatment whether it be by the FLS, referred to the primary care physician/provider, or by another means that suits the underlying health care system.

13.	Standard	Level 1	Level 2	Level 3
Database Standard	All identified fragility fracture patients are recorded in a database which feeds into central national database.	Fragility fracture patient records (for patients captured above) are recorded in a local database.	Site demonstrates that all fragility fracture patient records identified above are recorded in a database that can be shared regionally for data comparison.	Site demonstrates that all fragility fracture patient records identified above are stored in a central, national database. The database can provide benchmarking against all provider units.
Guidance notes/ rationale	The intention of this standard is to highlight the importance of having an effective database to underpin the service. The standard also emphasises the aspirational objective of developing local, regional and national databases that would enable benchmarking of care against the other FLS provider units throughout the country.			
Footnote: A local database for recording fragility fracture patient records, Level 1, is essential to an FLS. A central, national database is aspirational and is important to strive toward, and therefore is set at Level 3.				

Appendix 2: Fracture Liaison Service Status Summary

A Microsoft Word version of this FLS Status Summary is available from <http://osteoporosis.org.nz/resources/health-professionals/fracture-liaison-services/>

1. Fracture Liaison Service (FLS) details:

- Hospital:
 - Size of population served by hospital:
 - FLS Lead Clinician:
 - What is the source and duration of funding for post-fracture coordinator role?
-

2. When was the FLS established, or terminated if no longer operational?

3. Was a baseline audit of adherence to national secondary fracture prevention guidance conducted?

- If so, what proportion of fragility fracture patients were assessed in accordance with national guidance?
-

4. What is the scope of current FLS activities:

- Does the FLS serve in-patients only, out-patients only or both?
 - Approximately how many fragility fracture patients are assessed by the FLS annually?
 - What proportion of fracture patients aged over 50 years are assessed by the FLS?
 - Does the FLS receive referrals from the radiology department for patients with suspected vertebral fractures?
-

5. Is a hospital/locality-wide FLS protocol in place?

- If so, was this protocol developed in collaboration with local primary care organisations?
 - Has the FLS been subject to local audit?
 - If so, what proportion of fragility fracture patients received post-fracture assessment according to national guidance?
 - If so, what proportion of fragility fracture patients were recommended initiation of treatment according to national guidance?
 - Does the FLS have capacity to conduct follow-up of fragility fracture patient management?
 - If so, does the FLS protocol specify the frequency for follow-up?
 - If so, what proportion of fragility fracture patients persist with management according to national guidance at 6 months, 1 year and/or 3 years?
 - Does the hospital have a separate general osteoporosis assessment and management protocol in place?
-

6. Have any abstracts or publications been produced by the FLS team?

Appendix 3: Generic Fracture Liaison Service business plan template

An editable Microsoft Word version of this business plan template is available from <http://osteoporosis.org.nz/resources/health-professionals/fracture-liaison-services/>

[Insert name of local healthcare economy]

Executive Summary

Fracture Liaison Services improve quality and reduce costs through a reduction in unscheduled emergency admissions for hip and other fragility fractures

- XXX patients from [Insert District Health Board] present with hip fracture to [Insert hospital] incurring an annual cost of NZ\$YYY,YYY
- Half of hip fracture patients suffer a fragility fracture of the wrist, shoulder, humerus, hip or other skeletal sites prior to breaking their hip¹⁷⁻²⁰
- Osteoporosis treatments subsidised by the Ministry of Health¹⁶⁸⁻¹⁷¹ have the potential to halve secondary hip fracture incidence if initiated when patients present to hospital with their first fragility fracture²⁴⁻³²
- Fracture Liaison Services (FLS) have been recognised by many policymakers throughout the world⁵⁹⁻⁶⁸, professional organisations^{38, 50-53} and patient societies^{22, 54-58} as the optimal model of care to reliably deliver secondary preventive care for fragility fracture patients
- Successful FLS have been established in Australia⁷⁹⁻⁸³, Canada⁸⁴⁻⁸⁷, Europe⁶⁹⁻⁷⁸, Singapore^{131, 132} and the United States⁸⁸⁻⁹⁰
- The results of audits of secondary preventive care conducted in New Zealand^{38-41, 46} concur with findings from numerous similar reports from elsewhere^{172, 119, 155, 173-216}; in the absence of an FLS, fragility fracture patients are neither assessed nor treated for osteoporosis
- FLS have been demonstrated to be highly cost-effective in health economic evaluations from Australia⁹³, Canada⁹⁴, the UK^{60, 95} and the United States reference⁹¹
- [Insert name of local healthcare economy] does not have a Fracture Liaison Service as of [DD-MM-YYYY]
- The Ministry of Health requires all DHBs to operate a FLS in 2014-15 reference⁶⁸.

Fracture Liaison Services improve quality and reduce costs through a reduction in unscheduled emergency admissions for hip and other fragility fractures

The need for a Fracture Liaison Service in [Insert name of local healthcare economy]

Hip fractures are costly to patients and the New Zealand health care system

The incidence of hip fracture in New Zealand was estimated to be 3,803 cases per year in 2007, at a cost of NZ\$105 million⁸. Given that hip fractures represent up to 20% of all fragility fractures that come to clinical attention⁹, approximately 19,000 fragility fracture presentations to urgent care services occur in New Zealand every year. The annual incidence of hip fractures in women aged 60 years and over in 1991 was 1,830¹⁰ which had risen to 2,639 by 2007⁸, an increase of 44%. In 2007, the total direct cost of osteoporosis in New Zealand was estimated to be NZ\$330 million per year^{8, 112}. As New Zealand's 1 million baby boomers began to retire in 2011¹¹³, hip fractures will continue to exert a tremendous burden on older New Zealanders and the New Zealand healthcare system.

Half of hip fracture patients give advance notice

Studies from Australia¹⁸, the UK¹⁹ and the USA^{17,20} have demonstrated that approximately half of hip fracture patients suffer a fragility fracture at another skeletal site prior to breaking their hip. Amongst women aged over 50 years, approximately one sixth of the population has a history of fragility fracture^{22,23}. Based on policy developed by the Department of Health in England⁶¹, an estimate of number of post-menopausal women that would require secondary preventive assessment can be made for a District Health Board population:

'In a District Health Board Population population of 300,000, there are likely to be:

- 55,000 post-menopausal women
- 17,400 post-menopausal women with osteoporosis
- 6,900 post-menopausal women with a previous fracture of any kind
- 900 post-menopausal women with a new fracture each year

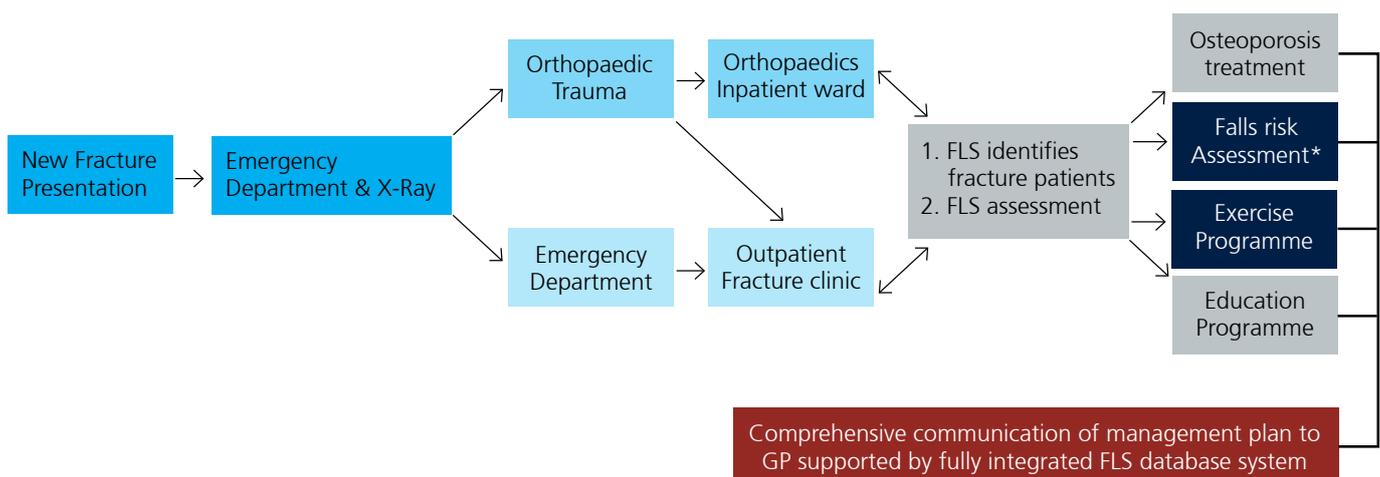
The last two groups above constitute just 16% of the local population. But it is among this 16% that half of the hip fractures occur. Targeting these groups in primary care and through Fracture Liaison case-finding Services in hospital provides ready access to those at greatest risk of hip fractures.'

Implementation of guidelines^{117, 217, 218} regarding secondary prevention of fracture has the potential to halve subsequent hip fracture incidence for patients that have suffered a fragility fracture at any skeletal site.

Fracture Liaison Services: clinically and cost-effective care

Definition of a Fracture Liaison Service: A Fracture Liaison Service (FLS) is a system to ensure fracture risk assessment, and treatment where appropriate, is delivered to all patients with fragility fractures. An FLS is usually comprised of a dedicated case worker, often a clinical nurse specialist, who works to pre-agreed protocols to case-find and assess fracture patients. An FLS is usually based in hospital and requires support from a medically qualified practitioner. The structure of a hospital-based FLS is indicated in the diagram below which was adapted from the UK 'Blue Book' on the care of patients with fragility fracture⁵⁰.

Figure 1. The structure of the Glasgow Fracture Liaison Service adapted from *The care of patients with fragility fracture*⁵⁰



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

FLS is clinically and cost-effective: The business plan authors may choose to insert one or more of the case studies on successful FLS described in section 3.2 of this Fracture Liaison Service Resource Pack e.g. the Minimal Trauma Fracture Liaison (MTFL) service⁸¹ at Concord Repatriation General Hospital, Sydney. Also please note that a case study on the first FLS to be established in New Zealand, the Waitemata DHB FLS¹³³, is available from the Osteoporosis New Zealand website at <http://osteoporosis.org.nz/resources/health-professionals/fracture-liaison-services/>.

Service structure: The Minimal Trauma Fracture Liaison (MTFL) service⁸¹ 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 FLS and the hospital's Orthogeriatrics Service; the MTFL provides care for non-frail patients with fragility fractures whilst the Orthogeriatrics Service¹³⁴ 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 analysis⁹³ 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 led 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

Endorsement of FLS: A growing number of professional organisations^{38, 50-53}, patient societies^{22, 54-58} and policymakers⁵⁹⁻⁶⁸ throughout the world – including the Ministry of Health in New Zealand^{67, 68} - 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 Europe⁶⁹⁻⁷⁸, Australia⁷⁹⁻⁸³ and Asia^{131, 132}, 'Co-ordinator Programs' in Canada⁸⁴⁻⁸⁷ and 'Care Manager Programs' in the United States⁸⁸⁻⁹⁰. 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.

[Insert name of local healthcare economy] does not have an FLS as of [DD-MM-YYYY].

A Fracture Liaison Service for [Insert name of local healthcare economy]

This business plan makes the case for urgent commissioning of a Fracture Liaison Service in [Insert name of local healthcare economy], structured in accordance with successful models from elsewhere, to reduce the incidence of hip fracture amongst our older people.

The Ministry of Health requires all DHBs to operate a FLS in 2014-15⁶⁸.

Aim: The aim of the proposed Fracture Liaison Service is to ensure that all patients aged ≥ 50 years presenting to urgent care services with fragility fractures receive assessment and treatment, where appropriate, for osteoporosis and referral to local falls prevention services to reduce their risk of subsequent fractures.

Current provision: An assessment of current service provision sets a context for funders to consider the merits of the business plan.

Service model: The Fracture Liaison Service will be structured in accordance with successful models from elsewhere. The author(s) of the business plan is/are referred to international publications below to inform the description of the proposed FLS model in their business plan including:

Seibel MJ, Lih A, Nandapalan H et al. Targeted intervention reduces refracture rates in patients with incident non-vertebral osteoporotic fractures: a 4-year prospective controlled study. *Osteoporosis International*. 2011 Mar;22(3):849-858. [PubMed ID 21107534](#)

Bogoch ER, Elliot-Gibson V, Beaton DE et al. Effective initiation of osteoporosis diagnosis and treatment for patients with a fragility fracture in an orthopaedic environment. *Journal of Bone and Joint Surgery (Am)*. 2006 Jan;88(1):25-34. [PubMed ID 16391246](#)

McLellan A, Gallacher S, Fraser M et al. The fracture liaison service: success of a program for the evaluation and management of patients with osteoporotic fracture. *Osteoporosis International*. 2003;14(12):1028-1034. [PubMed ID 14600804](#)

Greene D, Dell RM. Outcomes of an osteoporosis disease-management program managed by nurse practitioners. *Journal of the American Academy of Nurse Practitioners*. 2010 Jun;22(6):326-329. [PubMed ID 20536631](#)

Budgetary impact of an FLS for [Insert name of local healthcare economy]

The recurrent cost of the proposed Fracture Liaison Service of [NZ\$XXX,XXX] per year is less than/comparable to the cost of [H] hip fractures to the District Health Board service budget. If the service prevents [P%] of hip fractures overall, this would save [NZ\$YYY,YYY] in terms of averted fractures.

Number of hip fractures per year at this facility
(H)

Number of fragility fractures at all skeletal sites at this facility
(A)

Estimated cost of hip fracture (NZ\$ C)

Total Cost of hip fracture per year at this facility (NZ\$HxC)

Estimated average reduction in hip fracture readmission costs e.g. [P%] of (NZ\$HxC) = (S)

Cost of liaison service (NZ\$185xA)⁹³ = (L)

Cost saving per year (S)-(L)

Assumptions

- Based on Australian experience, the cost of liaison services average of NZ\$1,850 over ten years⁹³
- Only hip fractures are averted (about 20% of osteoporotic fractures are hip)
- Service models and hence success rates and costs vary between facilities

Proviso: This estimate is simplistic and contains many assumptions, not including the impact of approximately 20% to 30% one year mortality after hip fracture = 25% x (H).

Insert local data on the total number of hip fracture admissions and non-hip fragility fracture patients managed as in-patients and out-patients respectively. Consider producing a table as indicated below:

Fracture	Age Range (Years)					Total
	50 - 59	60 - 69	70 - 79	80 - 89	90+	
Hip						0
Forearm						0
Humerus						0
Lower Limb						0
Pelvis						0
Spine						0
Other						0
Not Specified						0
Total	0	0	0	0	0	0

Provide local costs associated with hospital, primary care and Local Authority funded social care related to these fractures.

Projected Costs and Income

Capital Expenses	NZ\$XX,XXX
-------------------------	------------

Recurrent Expenses

1 Full time equivalent, band (X) Fracture Liaison Nurse	NZ\$XX,XXX
Clerical support as required	NZ\$X,XXX
Acquisition of database and support package	NZ\$XXX
Production and postage of reports and questionnaires	NZ\$X,XXX
Support literature	NZ\$XXX
DXA equipment service contract	NZ\$X,XXX
DXA equipment depreciation/replacement costs	NZ\$X,XXX
Room charges	NZ\$XXX
Other	NZ\$X,XXX

Total Recurrent Costs	NZ\$XX,XXX
------------------------------	-------------------

Revenue

Additional DXA scans	NZ\$XX,XXX
Additional outpatient appointments	NZ\$XX,XXX
Additional procedures e.g. i.v. therapy	NZ\$X,XXX
Total Additional Revenue	NZ\$XX,XXX

Revenue Surplus Generated (revenue-costs)	NZ\$XX,XXX
--	-------------------

Summary

Hip fractures exert a substantial toll on our local older people and the healthcare budgets. Half of hip fracture patients give us considerable advance notice that one day they will present to the local orthopaedic unit. Half of hip fracture patients suffer prior fragility fractures that could and should serve as a trigger for secondary preventive care.

Implementation of a Fracture Liaison Service in [Insert name of local healthcare economy] will close the secondary fracture prevention gap in our area. The Fracture Liaison Service will improve the quality of care we give and reduce costs associated with preventable fragility fractures. This business plan recommends commissioning of this service as a matter of urgency, in accordance with Ministry of Health requirements for 2014-15⁶⁸.

Appendix 4: Step-by-step guide to Fracture Liaison Service development

A Microsoft Word version of this Step-by-step guide to FLS development is available from <http://osteoporosis.org.nz/resources/health-professionals/fracture-liaison-services/>

Critical success factors

The success factors common to the establishment and operation of effective Fracture Liaison Services are provided in the check list below:

- Establishment of a multi-disciplinary strategy group from project outset
- Adequate local access to axial bone densitometry
- Appointment of a post-fracture coordinator
 - Delivery of a "one-stop-shop" coordinator-led assessment
- Protected time for input from the hospital Lead Clinician in Osteoporosis
- Agreement of assessment/management protocols with all stakeholders
- Acquisition of an FLS database to underpin communication and audit
- Agree specifics of communication mechanism with primary care
- Establish referral mechanism from FLS to local Falls Prevention Team
- Monitor adherence to management recommendations issued by FLS

Preparatory work prior to FLS becoming operational

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 FLS 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 local musculoskeletal/fragility fracture strategy group

Utilise Plan-Do-Study-Act methodology to plan initial FLS 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 FLS 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

Issues to consider when FLS is operational**Patient identification:**

- Ensure FLS 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
-

Referral pathways:

- Ongoing evaluation of optimal terms to communicate the role of fracture risk assessment and falls assessment to patients
-

Communication with patients

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

Compliance with medication

- Consider options for regular contact with patients to review compliance with therapy
-

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 by GP at 3/6/12 months.
 - Consider pro-active FLS-led 6 month review of all patients via GP questionnaire and patient questionnaire if appropriate
-

Appendix 5: Generic Fracture Liaison Nurse Specialist job description

An editable Microsoft Word version of this job description is available from <http://osteoporosis.org.nz/resources/health-professionals/fracture-liaison-services/>

Job title:	Fracture Liaison Specialist Nurse
Location:	As appropriate
Responsible to:	Managerially: To be completed locally
Professionally:	To be completed locally
Grade:	To be completed locally

Job Summary

1. To co-ordinate and be responsible for the development of the Fracture Liaison Service for [insert location]
2. To be aware of the Osteoporosis Guidelines for [insert location] involved in the Osteoporosis initiative.
3. To develop links and communication between the orthopaedic services and metabolic bone unit.
4. To develop appropriate referrals and pathways of care for patients admitted with fragility fractures that may have osteoporosis.
5. To be autonomous and be prepared to make decisions where appropriate, manage own time and workload and work individually as well as contributing to the team when necessary.
6. To assist in the establishment of a multidisciplinary unit for the diagnosis and management of bone disorders principally osteoporosis.
7. To act as a link person enhancing co-ordination and communication between the various members of the orthopaedic and medical teams, to the metabolic bone team as well as other areas that refer patients to the unit.
8. To help establish educational and health promotion programs for patients attending the unit and those seen at other sites.
9. To perform audit of the developing service and associated bone densitometry screening programs.
10. To be aware of time constraints and financial implications of developing the service projects.
11. To be responsible for accurate data entry and of data associated with research and be proficient in appropriate computer packages.
12. To identify any areas of opportunity within the unit for development of research, and assist in their evolution. To be involved in the submission of ethics proposals, grant applications and the setting up of research and audit.

Core Responsibilities

1. To ensure an efficient and effective service is given to patients who may have osteoporosis who are admitted with fragility fracture.
2. To liaise with all members of the team to ensure smooth running of the referral service and unit.
3. To develop and maintain accurate data collection and storage using computer skills.
4. To be skilled in patient assessment techniques such as taking histories and clinical skills including venepuncture for patients needing investigations.
5. To be a source of knowledge and provide educational support concerning osteoporosis and identification of research areas.
6. To be involved in the development of proposals, ethical requirements and implementation of research within the unit.
7. To maintain and update own knowledge and clinical skills of bone disorders to enable education and advice to be given to patients and their families.
8. To maintain and develop own personal and professional development according to UKCC guidelines.
9. To liaise with all members of the team to ensure smooth running of the unit.

This job description should be regarded only as a guide to the duties required and is not intended to be definitive.

Acknowledgements

Osteoporosis NZ would like to acknowledge colleagues at Lilly, MSD and Novartis for their funding of educational events and materials and provision of unrestricted grants to support efforts to implement Fracture Liaison Services in New Zealand. In relation to this FLS Resource Pack, we are grateful to Novartis for gifting the primary text of a previous version of this Resource Pack to Osteoporosis NZ, to enable this 2014 version of the document to be published.

References

1. Statistics New Zealand. Population clock. http://www.stats.govt.nz/tools_and_services/population_clock.aspx. Accessed 20 October 2014.
2. Statistics New Zealand. Life expectancy. <http://www2.stats.govt.nz/domino/external/web/nzstories.nsf/092edeb76ed5aa6bcc256afe0081d84e/cb7f0e37872b197ccc256b2500059e19?OpenDocument>. Accessed 9 April 2012.
3. New Zealand Government. New Zealand Period Life Tables: 2010-12. In: Statistics New Zealand, ed. Wellington; 2013.
4. New Zealand Government. Demographic Trends: 2011. In: Statistics New Zealand, ed. Wellington; 2012.
5. New Zealand Government. National Population Estimates: March 2011 quarter. In: Statistics New Zealand, ed. Wellington; 2011.
6. New Zealand Government. National Population Projections: 2009 (base)–2061. In: Statistics New Zealand, ed. Wellington; 2011.
7. Mauck KF, Clarke BL. Diagnosis, screening, prevention, and treatment of osteoporosis. *Mayo Clin Proc.* May 2006;81(5):662-672.
8. Brown P, McNeill R, Leung W, Radwan E, Willingale J. Current and future economic burden of osteoporosis in New Zealand. *Appl Health Econ Health Policy.* Mar 1 2011;9(2):111-123.
9. Kanis JA, Oden A, McCloskey EV, et al. A systematic review of hip fracture incidence and probability of fracture worldwide. *Osteoporos Int.* Mar 15 2012.
10. Lane A. Direct costs of osteoporosis for New Zealand women. *Pharmacoeconomics.* Mar 1996;9(3):231-245.
11. Mitchell PJ. Fracture Liaison Services: A systematic approach to secondary fracture prevention. *Osteoporosis Review* 2009;17(1):14-16.
12. Kanis JA, Johnell O, De Laet C, et al. A meta-analysis of previous fracture and subsequent fracture risk. *Bone.* Aug 2004;35(2):375-382.
13. Klotzbuecher CM, Ross PD, Landsman PB, Abbott TA, 3rd, Berger M. Patients with prior fractures have an increased risk of future fractures: a summary of the literature and statistical synthesis. *J Bone Miner Res.* Apr 2000;15(4):721-739.
14. Johnell O, Kanis JA, Oden A, et al. Fracture risk following an osteoporotic fracture. *Osteoporos Int.* Mar 2004;15(3):175-179.
15. Langridge CR, McQuillian C, Watson WS, Walker B, Mitchell L, Gallacher SJ. Refracture following fracture liaison service assessment illustrates the requirement for integrated falls and fracture services. *Calcif Tissue Int.* Aug 2007;81(2):85-91.
16. Center JR, Bliuc D, Nguyen TV, Eisman JA. Risk of subsequent fracture after low-trauma fracture in men and women. *JAMA.* Jan 24 2007;297(4):387-394.
17. Gallagher JC, Melton LJ, Riggs BL, Bergstrath E. Epidemiology of fractures of the proximal femur in Rochester, Minnesota. *Clin Orthop Relat Res.* Jul-Aug 1980(150):163-171.
18. Port L, Center J, Briffa NK, Nguyen T, Cumming R, Eisman J. Osteoporotic fracture: missed opportunity for intervention. *Osteoporos Int.* Sep 2003;14(9):780-784.
19. McLellan A, Reid D, Forbes K, et al. Effectiveness of Strategies for the Secondary Prevention of Osteoporotic Fractures in Scotland (CEPS 99/03): NHS Quality Improvement Scotland; 2004.
20. Edwards BJ, Bunta AD, Simonelli C, Bolander M, Fitzpatrick LA. Prior fractures are common in patients with subsequent hip fractures. *Clin Orthop Relat Res.* Aug 2007;461:226-230.
21. Eastell R, Reid DM, Compston J, et al. Secondary prevention of osteoporosis: when should a non-vertebral fracture be a trigger for action? *QJM.* Nov 2001;94(11):575-597.
22. Marsh D, Akesson K, Beaton DE, et al. Coordinator-based systems for secondary prevention in fragility fracture patients. *Osteoporos Int.* Jul 2011;22(7):2051-2065.

References Cont.

23. Mitchell PJ. Fracture Liaison Services: the UK experience. *Osteoporos Int.* Aug 2011;22 Suppl 3:487-494.
24. Black DM, Cummings SR, Karpf DB, et al. Randomised trial of effect of alendronate on risk of fracture in women with existing vertebral fractures. Fracture Intervention Trial Research Group. *Lancet.* Dec 7 1996;348(9041):1535-1541.
25. Black DM, Delmas PD, Eastell R, et al. Once-yearly zoledronic acid for treatment of postmenopausal osteoporosis. *N Engl J Med.* May 3 2007;356(18):1809-1822.
26. Cummings SR, Black DM, Thompson DE, et al. Effect of alendronate on risk of fracture in women with low bone density but without vertebral fractures: results from the Fracture Intervention Trial. *JAMA.* Dec 23-30 1998;280(24):2077-2082.
27. Ettinger B, Black DM, Mitlak BH, et al. Reduction of vertebral fracture risk in postmenopausal women with osteoporosis treated with raloxifene: results from a 3-year randomized clinical trial. Multiple Outcomes of Raloxifene Evaluation (MORE) Investigators. *JAMA.* Aug 18 1999;282(7):637-645.
28. Harris ST, Watts NB, Genant HK, et al. Effects of risedronate treatment on vertebral and nonvertebral fractures in women with postmenopausal osteoporosis: a randomized controlled trial. Vertebral Efficacy With Risedronate Therapy (VERT) Study Group. *JAMA.* Oct 13 1999;282(14):1344-1352.
29. Lyles KW, Colon-Emeric CS, Magaziner JS, et al. Zoledronic Acid in Reducing Clinical Fracture and Mortality after Hip Fracture. *N Engl J Med.* 2007;357:nihpa40967.
30. McClung MR, Geusens P, Miller PD, et al. Effect of risedronate on the risk of hip fracture in elderly women. Hip Intervention Program Study Group. *N Engl J Med.* Feb 1 2001;344(5):333-340.
31. Neer RM, Arnaud CD, Zanchetta JR, et al. Effect of parathyroid hormone (1-34) on fractures and bone mineral density in postmenopausal women with osteoporosis. *N Engl J Med.* May 10 2001;344(19):1434-1441.
32. Reginster J, Minne HW, Sorensen OH, et al. Randomized trial of the effects of risedronate on vertebral fractures in women with established postmenopausal osteoporosis. Vertebral Efficacy with Risedronate Therapy (VERT) Study Group. *Osteoporos Int.* 2000;11(1):83-91.
33. Ensrud KE, Black DM, Palermo L, et al. Treatment with alendronate prevents fractures in women at highest risk: results from the Fracture Intervention Trial. *Arch Intern Med.* Dec 8-22 1997;157(22):2617-2624.
34. Center JR, Bliuc D, Nguyen ND, Nguyen TV, Eisman JA. Osteoporosis medication and reduced mortality risk in elderly women and men. *J Clin Endocrinol Metab.* Apr 2011;96(4):1006-1014.
35. Beaupre LA, Morrish DW, Hanley DA, et al. Oral bisphosphonates are associated with reduced mortality after hip fracture. *Osteoporos Int.* Mar 2011;22(3):983-991.
36. Bolland MJ, Grey AB, Gamble GD, Reid IR. Effect of osteoporosis treatment on mortality: a meta-analysis. *J Clin Endocrinol Metab.* Mar 2010;95(3):1174-1181.
37. Sambrook PN, Cameron ID, Chen JS, et al. Oral bisphosphonates are associated with reduced mortality in frail older people: a prospective five-year study. *Osteoporos Int.* Sep 2011;22(9):2551-2556.
38. Dreinhofer KE, Feron JM, Herrera A, et al. Orthopaedic surgeons and fragility fractures. A survey by the Bone and Joint Decade and the International Osteoporosis Foundation. *J Bone Joint Surg Br.* Sep 2004;86(7):958-961.
39. Dreinhofer KE, Anderson M, Feron JM, et al. Multinational survey of osteoporotic fracture management. *Osteoporos Int.* Mar 2005;16 Suppl 2:S44-53.
40. Tracey-Clitherow H, Bossley C. Osteoporosis intervention by New Zealand orthopaedic units: A multi-centre audit. *J Bone Joint Surg Br.* 2009;91-B(SUPP II):342.
41. Tracey-Clitherow HD, Bossley CJ. Osteoporosis Intervention by New Zealand Orthopaedic Departments in Patients with Fragility Fractures: A multi-centre audit. Wellington 2009.
42. Sidwell AI, Wilkinson TJ, Hanger HC. Secondary prevention of fractures in older people: evaluation of a protocol for the investigation and treatment of osteoporosis. *Intern Med J.* Mar 2004;34(3):129-132.
43. Thwaites J, Mann F, Gilchrist N, McKie J, Sainsbury R. Older patients with hip fractures: evaluation of a long-term specialist orthopaedic medicine service in their outcomes. *N Z Med J.* 2007;120(1254):U2535.
44. Kenealy H, Paul S, Walker K, Garg A. Secondary prophylaxis of osteoporotic fractures in an orthogeriatric service. *Australas J Ageing.* Mar 2011;30(1):41.

References Cont.

45. Fergus L, Cutfield G, Harris R. Auckland City Hospital's ortho-geriatric service: an audit of patients aged over 65 with fractured neck of femur. *N Z Med J.* Jun 24 2011;124(1337):40-54.
46. Bloomfield K, Singh J. Secondary prevention of vertebral fractures in a large New Zealand District Health Board. *N Z Med J.* Nov 4 2011;124(1345):26-33.
47. Chami G, Jeys L, Freudmann M, Connor L, Siddiqi M. Are osteoporotic fractures being adequately investigated? A questionnaire of GP & orthopaedic surgeons. *BMC Fam Pract.* 2006;7:7.
48. Chakravarthy J, Ali A, Iyengar S, Porter K. Secondary prevention of fragility fractures by orthopaedic teams in the UK: a national survey. *Int J Clin Pract.* Mar 2008;62(3):382-387.
49. Kurup HV, Andrew JG. Secondary prevention of osteoporosis after Colles fracture: Current practice. *Joint Bone Spine.* Jan 2008;75(1):50-52.
50. British Orthopaedic Association, British Geriatrics Society. *The care of patients with fragility fracture 2007.*
51. International Society for Fracture Repair. Osteoporotic Fracture Campaign. http://www.fractures.com/about_ofc.html. Accessed 28-10-2011.
52. Eisman JA, Bogoch ER, Dell R, et al. Making the first fracture the last fracture: ASBMR task force report on secondary fracture prevention. *J Bone Miner Res.* Oct 2012;27(10):2039-2046.
53. National Bone Health Alliance. Fracture Prevention CENTRAL. <http://www.nbha.org/fpc>. Accessed 18 August 2014.
54. National Osteoporosis Society. Protecting fragile bones: A strategy to reduce the impact of osteoporosis and fragility fractures in England/Scotland/Wales/Northern Ireland May-Jun 2009 2009.
55. Osteoporosis Canada. *Osteoporosis: Towards a fracture free future.* Toronto 2011.
56. Akesson K, Marsh D, Mitchell PJ, et al. Capture the Fracture: a Best Practice Framework and global campaign to break the fragility fracture cycle. *Osteoporos Int.* Aug 2013;24(8):2135-2152.
57. Akesson K, Mitchell PJ. Capture the Fracture: A global campaign to break the fragility fracture cycle. Nyon, Switzerland: International Osteoporosis Foundation; 2012.
58. Osteoporosis New Zealand. *Bone Care 2020: A systematic approach to hip fracture care and prevention for New Zealand.* Wellington 2012.
59. Office of the Surgeon General. *Bone Health and Osteoporosis: A Report of the Surgeon General.* In: US Department of Health and Human Services, ed. Washington; 2004.
60. Department of Health. *Fracture prevention services: an economic evaluation.*; 2009.
61. Department of Health. *Falls and fractures: Effective interventions in health and social care.* In: Department of Health, ed; 2009.
62. Australian Government. *National service improvement framework for osteoarthritis, rheumatoid arthritis and osteoporosis.* In: Department of Health and Ageing, ed. Canberra; 2005.
63. NSW Government Health. *NSW Model of Care for Osteoporotic Refracture Prevention.* In: NSW Agency for Clinical Innovation Musculoskeletal Network, ed. Chatswood; 2011.
64. Statewide Orthopaedic Clinical Network and Rehabilitation Clinical Network. *Models of Care for Orthopaedic Rehabilitation-Fragility Fractures General Orthopaedic Trauma and Arthroplasty.* In: Government of South Australia, SA Health, eds. Adelaide; 2011.
65. Government of Western Australia. *Osteoporosis Model of Care.* In: Department of Health Musculoskeletal Diabetes & Endocrine Falls Prevention and Aged Care Health Networks (WA), ed. Perth; 2011.
66. Ministry of Health and Long-term Care, Ontario Women's Health Council, Osteoporosis Canada. *Ontario Osteoporosis Strategy.* <http://www.osteostategy.on.ca/>. Accessed 9 February, 2012.
67. Ministry of Health. *2013/14 Toolkit Annual Plan with statement of intent.* Wellington.; 2012.
68. Ministry of Health. *2014/15 ANNUAL PLAN Guidelines (Including Planning Priorities) WITH STATEMENT OF INTENT and STATEMENT OF PERFORMANCE EXPECTATIONS.* Wellington.; 2014.
69. Clunie G, Stephenson S. Implementing and running a fracture liaison service: An integrated clinical service providing a comprehensive bone health assessment at the point of fracture management. *Journal of Orthopaedic Nursing.* 2008;12:156-162.

References Cont.

70. McLellan AR, Gallacher SJ, Fraser M, McQuillan C. The fracture liaison service: success of a program for the evaluation and management of patients with osteoporotic fracture. *Osteoporos Int.* Dec 2003;14(12):1028-1034.
71. Premaor MO, Pilbrow L, Tonkin C, Adams M, Parker RA, Compston J. Low rates of treatment in postmenopausal women with a history of low trauma fractures: results of audit in a Fracture Liaison Service. *QJM.* Jan 2010;103(1):33-40.
72. Wright SA, McNally C, Beringer T, Marsh D, Finch MB. Osteoporosis fracture liaison experience: the Belfast experience. *Rheumatol Int.* Aug 2005;25(6):489-490.
73. Blonk MC, Erdtsieck RJ, Wernekinck MG, Schoon EJ. The fracture and osteoporosis clinic: 1-year results and 3-month compliance. *Bone.* Jun 2007;40(6):1643-1649.
74. Huntjens KM, van Geel TC, Geusens PP, et al. Impact of guideline implementation by a fracture nurse on subsequent fractures and mortality in patients presenting with non-vertebral fractures. *Injury.* Sep 2011;42 Suppl 4:S39-43.
75. van Helden S, Cauberg E, Geusens P, Winkes B, van der Weijden T, Brink P. The fracture and osteoporosis outpatient clinic: an effective strategy for improving implementation of an osteoporosis guideline. *J Eval Clin Pract.* Oct 2007;13(5):801-805.
76. Astrand J, Thorngren KG, Tagil M, Akesson K. 3-year follow-up of 215 fracture patients from a prospective and consecutive osteoporosis screening program. *Fracture patients care! Acta Orthop.* Jun 2008;79(3):404-409.
77. Carpintero P, Gil-Garay E, Hernandez-Vaquero D, Ferrer H, Munuera L. Interventions to improve inpatient osteoporosis management following first osteoporotic fracture: the PREVENT project. *Arch Orthop Trauma Surg.* Feb 2009;129(2):245-250.
78. Huntjens KM, van Geel TA, Blonk MC, et al. Implementation of osteoporosis guidelines: a survey of five large fracture liaison services in the Netherlands. *Osteoporos Int.* Jul 2011;22(7):2129-2135.
79. Giles M, Van Der Kallen J, Parker V, et al. A team approach: implementing a model of care for preventing osteoporosis related fractures. *Osteoporos Int.* Aug 2011;22(8):2321-2328.
80. Kuo I, Ong C, Simmons L, Bliuc D, Eisman J, Center J. Successful direct intervention for osteoporosis in patients with minimal trauma fractures. *Osteoporos Int.* Dec 2007;18(12):1633-1639.
81. Lih A, Nandapalan H, Kim M, et al. Targeted intervention reduces refracture rates in patients with incident non-vertebral osteoporotic fractures: a 4-year prospective controlled study. *Osteoporos Int.* Mar 2011;22(3):849-858.
82. Vaile J, Sullivan L, Bennett C, Bleasel J. First Fracture Project: addressing the osteoporosis care gap. *Intern Med J.* Oct 2007;37(10):717-720.
83. Inderjeeth CA, Glennon DA, Poland KE, et al. A multimodal intervention to improve fragility fracture management in patients presenting to emergency departments. *Med J Aust.* Aug 2 2010;193(3):149-153.
84. Bogoch ER, Elliot-Gibson V, Beaton DE, Jamal SA, Josse RG, Murray TM. Effective initiation of osteoporosis diagnosis and treatment for patients with a fragility fracture in an orthopaedic environment. *J Bone Joint Surg Am.* Jan 2006;88(1):25-34.
85. Majumdar SR, Beaupre LA, Harley CH, et al. Use of a case manager to improve osteoporosis treatment after hip fracture: results of a randomized controlled trial. *Arch Intern Med.* Oct 22 2007;167(19):2110-2115.
86. Majumdar SR, Johnson JA, Bellerose D, et al. Nurse case-manager vs multifaceted intervention to improve quality of osteoporosis care after wrist fracture: randomized controlled pilot study. *Osteoporos Int.* Jan 2011;22(1):223-230.
87. Ward SE, Laughren JJ, Escott BG, Elliot-Gibson V, Bogoch ER, Beaton DE. A program with a dedicated coordinator improved chart documentation of osteoporosis after fragility fracture. *Osteoporos Int.* Aug 2007;18(8):1127-1136.
88. Dell RM, Greene D, Anderson D, Williams K. Osteoporosis disease management: What every orthopaedic surgeon should know. *J Bone Joint Surg Am.* Nov 2009;91 Suppl 6:79-86.
89. Edwards BJ, Bunta AD, Madison LD, et al. An osteoporosis and fracture intervention program increases the diagnosis and treatment for osteoporosis for patients with minimal trauma fractures. *Jt Comm J Qual Patient Saf.* May 2005;31(5):267-274.
90. Harrington JT, Barash HL, Day S, Lease J. Redesigning the care of fragility fracture patients to improve osteoporosis management: a health care improvement project. *Arthritis Rheum.* Apr 15 2005;53(2):198-204.
91. Dell R, Greene D, Schelkun SR, Williams K. Osteoporosis disease management: the role of the orthopaedic surgeon. *J Bone Joint Surg Am.* Nov 2008;90 Suppl 4:188-194.
92. Skelton D, Neil F. NHS Greater Glasgow and Clyde Strategy for Osteoporosis and Falls Prevention 2006-2010: An evaluation 2007-2009 2009.

References Cont.

93. Cooper MS, Palmer AJ, Seibel MJ. Cost-effectiveness of the Concord Minimal Trauma Fracture Liaison service, a prospective, controlled fracture prevention study. *Osteoporos Int.* Jan 2012;23(1):97-107.
94. Sander B, Elliot-Gibson V, Beaton DE, Bogoch ER, Maetzel A. A coordinator program in post-fracture osteoporosis management improves outcomes and saves costs. *J Bone Joint Surg Am.* Jun 2008;90(6):1197-1205.
95. McLellan AR, Wolowacz SE, Zimovetz EA, et al. Fracture liaison services for the evaluation and management of patients with osteoporotic fracture: a cost-effectiveness evaluation based on data collected over 8 years of service provision. *Osteoporos Int.* Jul 2011;22(7):2083-2098.
96. Australian and New Zealand Hip Fracture Registry. Australian and New Zealand Hip Fracture Registry website. <http://www.anzhfr.org/>. Accessed 21 August 2014.
97. Australian and New Zealand Hip Fracture Registry (ANZHFR) Steering Group. Australian and New Zealand Guideline for Hip Fracture Care: Improving Outcomes in Hip Fracture Management of Adults. Sydney: Australian and New Zealand Hip Fracture Registry Steering Group; 2014.
98. Mitchell PJ, Cornish J, Milsom S, et al. BoneCare 2020: A systematic approach to hip fracture care and prevention for New Zealand. 3rd Fragility Fracture Network Congress 2014. Madrid, Spain.; 2014.
99. OECD. OECD Health Statistics 2014 How does New Zealand compare? Paris, France 2014.
100. Langley J, Samaranayaka A, Davie G, Campbell AJ. Age, cohort and period effects on hip fracture incidence: analysis and predictions from New Zealand data 1974-2007. *Osteoporos Int.* Jan 2011;22(1):105-111.
101. Fisher AA, O'Brien ED, Davis MW. Trends in hip fracture epidemiology in Australia: possible impact of bisphosphonates and hormone replacement therapy. *Bone.* Aug 2009;45(2):246-253.
102. Pasco JA, Brennan SL, Henry MJ, et al. Changes in hip fracture rates in southeastern Australia spanning the period 1994-2007. *J Bone Miner Res.* Jul 2011;26(7):1648-1654.
103. Cassell E, Clapperton A. A decreasing trend in fall-related hip fracture incidence in Victoria, Australia. *Osteoporos Int.* Feb 21 2012.
104. Kannus P, Niemi S, Parkkari J, Palvanen M, Vuori I, Jarvinen M. Nationwide decline in incidence of hip fracture. *J Bone Miner Res.* Dec 2006;21(12):1836-1838.
105. Nymark T, Lauritsen JM, Ovesen O, Rock ND, Jeune B. Decreasing incidence of hip fracture in the Funen County, Denmark. *Acta Orthop.* Feb 2006;77(1):109-113.
106. Maravic M, Taupin P, Landais P, Roux C. Change in hip fracture incidence over the last 6 years in France. *Osteoporos Int.* Mar 2011;22(3):797-801.
107. Holt G, Smith R, Duncan K, Hutchison JD, Reid D. Changes in population demographics and the future incidence of hip fracture. *Injury.* Jul 2009;40(7):722-726.
108. Lofman O, Berglund K, Larsson L, Toss G. Changes in hip fracture epidemiology: redistribution between ages, genders and fracture types. *Osteoporos Int.* Jan 2002;13(1):18-25.
109. Guilley E, Chevalley T, Herrmann F, et al. Reversal of the hip fracture secular trend is related to a decrease in the incidence in institution-dwelling elderly women. *Osteoporos Int.* Dec 2008;19(12):1741-1747.
110. Brauer CA, Coca-Perrailon M, Cutler DM, Rosen AB. Incidence and mortality of hip fractures in the United States. *JAMA.* Oct 14 2009;302(14):1573-1579.
111. Leslie WD, O'Donnell S, Jean S, et al. Trends in hip fracture rates in Canada. *JAMA.* Aug 26 2009;302(8):883-889.
112. Brown P, McNeill R, Radwan E, Willingale J. The Burden of Osteoporosis in New Zealand: 2007-2020. Auckland: School of Population, Health University of Auckland; 2007.
113. Cleaver M, Green BC, Muller TE. Using consumer behaviour research to understand the baby boomer tourist. *Journal of Hospitality & Tourism Research.* 2000;24(2):274-287.
114. Robinson CM, Royds M, Abraham A, McQueen MM, Court-Brown CM, Christie J. Refractures in patients at least forty-five years old. a prospective analysis of twenty-two thousand and sixty patients. *J Bone Joint Surg Am.* Sep 2002;84-A(9):1528-1533.

References Cont.

115. Campbell AJ, Reinken J, Allan BC, Martinez GS. Falls in old age: a study of frequency and related clinical factors. *Age Ageing*. Nov 1981;10(4):264-270.
116. Close JC, Lord SL, Menz HB, Sherrington C. What is the role of falls? *Best Pract Res Clin Rheumatol*. Dec 2005;19(6):913-935.
117. Mak J, Wong E, Cameron I, Australian, New Zealand Society for Geriatric M. Australian and New Zealand Society for Geriatric Medicine. Position statement--orthogeriatric care. *Australas J Ageing*. Sep 2011;30(3):162-169.
118. Kates SL, Mears SC, Sieber F, et al. A Guide to Improving the Care of Patients with Fragility Fractures. *Geriatric Orthopaedic Surgery & Rehabilitation*. 2011;2(1):5-37.
119. Eisman J, Clapham S, Kehoe L, Australian BoneCare S. Osteoporosis prevalence and levels of treatment in primary care: the Australian BoneCare Study. *J Bone Miner Res*. Dec 2004;19(12):1969-1975.
120. Brankin E, Mitchell C, Munro R, Lanarkshire Osteoporosis S. Closing the osteoporosis management gap in primary care: a secondary prevention of fracture programme. *Curr Med Res Opin*. Apr 2005;21(4):475-482.
121. Amamra N, Berr C, Clavel-Chapelon F, et al. Estimated number of women likely to benefit from bone mineral density measurement in France. *Joint Bone Spine*. Sep 2004;71(5):409-418.
122. Johnell O, Kanis JA. An estimate of the worldwide prevalence and disability associated with osteoporotic fractures. *Osteoporos Int*. Dec 2006;17(12):1726-1733.
123. Ebeling PR. Osteoporosis in men: Why change needs to happen. Nyons, Switzerland: International Osteoporosis Foundation; 2014.
124. Nevitt MC, Cummings SR, Browner WS, et al. The accuracy of self-report of fractures in elderly women: evidence from a prospective study. *Am J Epidemiol*. Mar 1 1992;135(5):490-499.
125. Hundrup YA, Hoidrup S, Obel EB, Rasmussen NK. The validity of self-reported fractures among Danish female nurses: comparison with fractures registered in the Danish National Hospital Register. *Scand J Public Health*. 2004;32(2):136-143.
126. Ivers RQ, Cumming RG, Mitchell P, Peduto AJ. The accuracy of self-reported fractures in older people. *J Clin Epidemiol*. May 2002;55(5):452-457.
127. Harrington J. Dilemmas in providing osteoporosis care for fragility fracture patients. *US Musculoskeletal Review - Touch Briefings*. December 2006 2006;11:64-65.
128. Elliot-Gibson V, Bogoch ER, Jamal SA, Beaton DE. Practice patterns in the diagnosis and treatment of osteoporosis after a fragility fracture: a systematic review. *Osteoporos Int*. Oct 2004;15(10):767-778.
129. Giangregorio L, Papaioannou A, Cranney A, Zytaruk N, Adachi JD. Fragility fractures and the osteoporosis care gap: an international phenomenon. *Semin Arthritis Rheum*. Apr 2006;35(5):293-305.
130. Gehlbach SH, Bigelow C, Heimisdottir M, May S, Walker M, Kirkwood JR. Recognition of vertebral fracture in a clinical setting. *Osteoporos Int*. 2000;11(7):577-582.
131. Chandran M. Fracture liaison services in an open system: how was it done? what were the barriers and how were they overcome? *Curr Osteoporos Rep*. Dec 2013;11(4):385-390.
132. Chandran M, Tan MZ, Cheen M, Tan SB, Leong M, Lau TC. Secondary prevention of osteoporotic fractures--an "OPTIMAL" model of care from Singapore. *Osteoporos Int*. Nov 2013;24(11):2809-2817.
133. Waitemata District Health Board. Board Meeting Agenda; 2013.
134. NSW Government Health. The Orthogeriatric Model of Care: Summary of Evidence 2010. In: New South Wales Agency for Clinical Innovation, ed. North Ryde; 2010.
135. McLellan AR, Gallacher SJ. Reference for Australian and NZ FLS Resource Packs. In: Mitchell PJ, ed; 2012.
136. Royal College of Physicians' Clinical Effectiveness and Evaluation Unit. Falling standards, broken promises: Report of the national audit of falls and bone health in older people 2010. 2011.
137. Kaiser Permanente. Kaiser Permanente HealthConnect® Electronic Health Record. <http://xnet.kp.org/newscenter/aboutkp/healthconnect/index.html>. Accessed 24 February, 2012.

References Cont.

138. Australian and New Zealand Hip Fracture Registry. Facility level audit of hospitals in Australia and New Zealand performing surgery for hip fracture. Sydney 2013.
139. Health Quality and Safety Commission. Topic 6: Why hip fracture prevention and care matters. <http://www.hqsc.govt.nz/our-programmes/reducing-harm-from-falls/10-topics/topic-6/>. Accessed 18 August 2014.
140. International Osteoporosis Foundation. Capture the Fracture: Break the worldwide fragility fracture cycle. <http://www.capturethefracture.org/>. Accessed 18 August 2014.
141. International Osteoporosis Foundation. Capture the Fracture: Map of best practice. <http://www.capturethefracture.org/map-of-best-practice>. Accessed 23 October 2014.
142. Seeman E, Compston J, Adachi J, et al. Non-compliance: the Achilles' heel of anti-fracture efficacy. *Osteoporos Int.* Jun 2007;18(6):711-719.
143. Bunta AD. It is time for everyone to own the bone. *Osteoporos Int.* Aug 2011;22 Suppl 3:477-482.
144. Beaulieu M-C, Cabana F, Beaulieu M, Carrier N, Roux S, Boire G. Improving treatment adherence through rapid integrated interdisciplinary intervention after a fragility fracture: The OPTIMUS initiative. 2nd FFN Global Congress 2013. Langenbeck-Virchow-Haus, Berlin, Germany; 2013.
145. Boudou L, Gerbay B, Chopin F, Ollagnier E, Collet P, Thomas T. Management of osteoporosis in fracture liaison service associated with long-term adherence to treatment. *Osteoporos Int.* Jul 2011;22(7):2099-2106.
146. Stephenson S. Developing an orthopaedic elderly care liaison service. *J Ortho Nursing.* 2003;7(3):150-155.
147. Riomed Limited. FITOS = FRACTURE IDENTIFICATION TOOL FOR ORTHOPAEDIC SURGEONS. <http://www.riomed.com/fitos.html>. Accessed 27 February, 2012.
148. Gallacher SJ. Setting up an osteoporosis fracture liaison service: background and potential outcomes. *Best Pract Res Clin Rheumatol.* Dec 2005;19(6):1081-1094.
149. Lems WF. Clinical relevance of vertebral fractures. *Ann Rheum Dis.* Jan 2007;66(1):2-4.
150. Cooper C, Atkinson EJ, O'Fallon WM, Melton LJ, 3rd. Incidence of clinically diagnosed vertebral fractures: a population-based study in Rochester, Minnesota, 1985-1989. *J Bone Miner Res.* Feb 1992;7(2):221-227.
151. Delmas PD, van de Langerijt L, Watts NB, et al. Underdiagnosis of vertebral fractures is a worldwide problem: the IMPACT study. *J Bone Miner Res.* Apr 2005;20(4):557-563.
152. Siris ES, Genant HK, Laster AJ, Chen P, Misurski DA, Krege JH. Enhanced prediction of fracture risk combining vertebral fracture status and BMD. *Osteoporos Int.* Jun 2007;18(6):761-770.
153. Gallacher SJ, Gallagher AP, McQuillian C, Mitchell PJ, Dixon T. The prevalence of vertebral fracture amongst patients presenting with non-vertebral fractures. *Osteoporos Int.* Feb 2007;18(2):185-192.
154. Howat I, Carty D, Harrison J, Fraser M, McLellan AR. Vertebral fracture assessment in patients presenting with incident nonvertebral fractures. *Clin Endocrinol (Oxf).* Dec 2007;67(6):923-930.
155. Chen JS, Hogan C, Lyubomirsky G, Sambrook PN. Management of osteoporosis in primary care in Australia. *Osteoporos Int.* Mar 2009;20(3):491-496.
156. Hippisley-Cox J, Bayly J, Potter J, Fenty J, Parker C. Evaluation of standards of care for osteoporosis and falls in primary care 2007.
157. Royal College of Physicians. National Audit of Falls and Bone Health in Older People. <http://www.rcplondon.ac.uk/resources/national-audit-falls-and-bone-health-older-people>. Accessed 22 February, 2012.
158. NHS Employers. Summary of 2012/13 QOF Changes. <http://www.nhsemployers.org/SiteCollectionDocuments/Summary%20of%20QOF%20changes%20for%202012-13%20-ja21111.pdf>. Accessed 24 February, 2012.
159. Ebeling PR, Davenport G, Evans S, Mitchell PJ. Osteoporosis challenges. *Aust Fam Physician.* 2012;41(4):169.
160. Garvan Institute of Medical Research. Fracture Risk Calculator. <http://www.garvan.org.au/bone-fracture-risk/>. Accessed 26 March 2012.

References Cont.

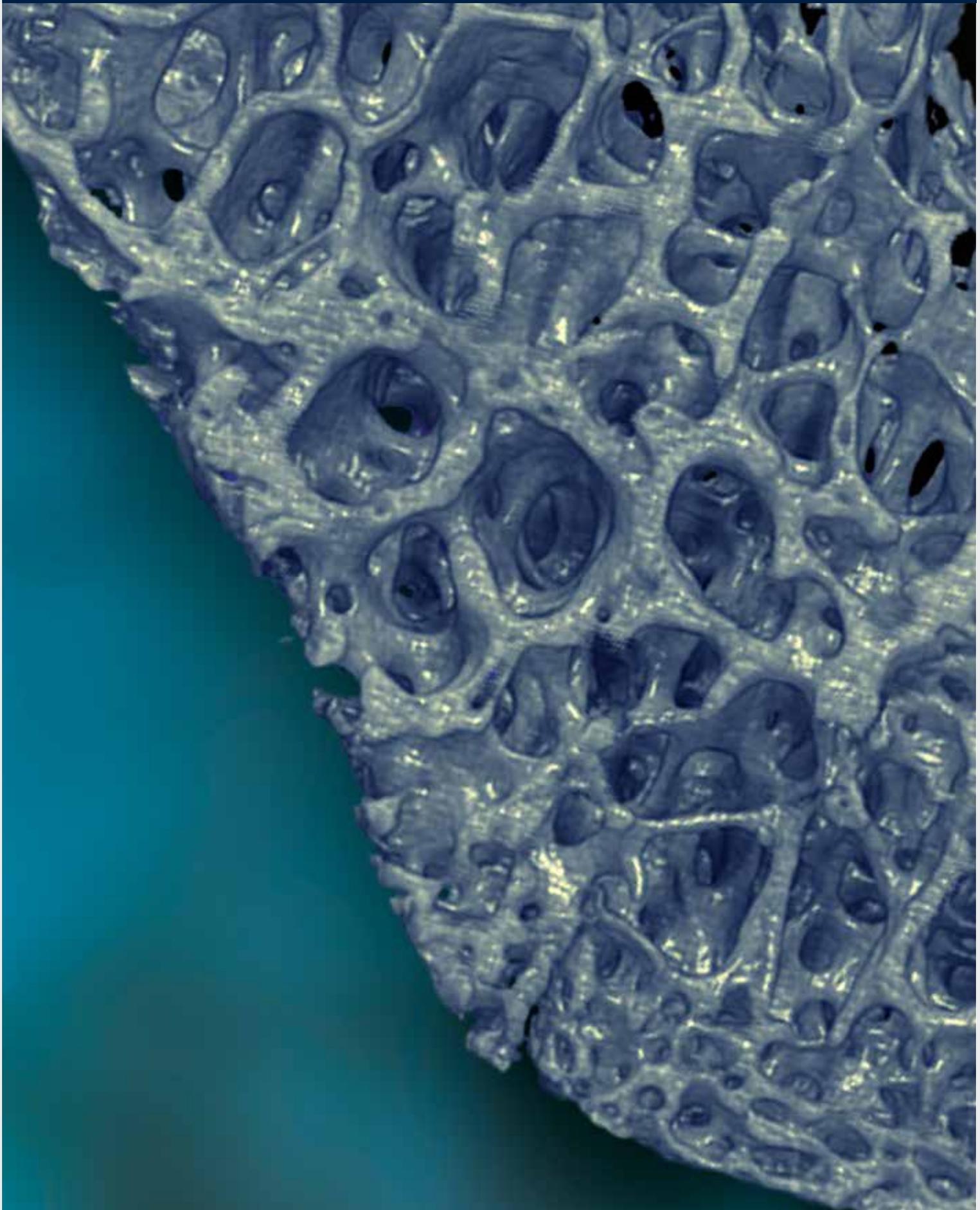
161. World Health Organization Collaborating Centre for Metabolic Bone Diseases University of Sheffield UK. FRAX® WHO Fracture Risk Assessment Tool. <http://www.shef.ac.uk/FRAX/>. Accessed 26 March 2012.
162. Clowes JA, Peel NF, Eastell R. The impact of monitoring on adherence and persistence with antiresorptive treatment for postmenopausal osteoporosis: a randomized controlled trial. *J Clin Endocrinol Metab.* Mar 2004;89(3):1117-1123.
163. Pickney CS, Arnason JA. Correlation between patient recall of bone densitometry results and subsequent treatment adherence. *Osteoporos Int.* Sep 2005;16(9):1156-1160.
164. Bock O, Felsenberg D. Bisphosphonates in the management of postmenopausal osteoporosis--optimizing efficacy in clinical practice. *Clin Interv Aging.* 2008;3(2):279-297.
165. Huybrechts KF, Ishak KJ, Caro JJ. Assessment of compliance with osteoporosis treatment and its consequences in a managed care population. *Bone.* Jun 2006;38(6):922-928.
166. Caro JJ, Ishak KJ, Huybrechts KF, Raggio G, Naujoks C. The impact of compliance with osteoporosis therapy on fracture rates in actual practice. *Osteoporos Int.* Dec 2004;15(12):1003-1008.
167. Weycker D, Macarios D, Edelsberg J, Oster G. Compliance with drug therapy for postmenopausal osteoporosis. *Osteoporos Int.* 2006;17(11):1645-1652.
168. New Zealand Government. Form SA1039 Application for subsidy by special authority: Alendronate Tab 70 mg - with or without Cholecalciferol. In: Ministry of Health, ed. Wanganui; 2012.
169. New Zealand Government. Form SA1138 Application for subsidy by special authority: Raloxifene. In: Ministry of Health, ed. Wanganui; 2012.
170. New Zealand Government. Form SA1139 Application for subsidy by special authority: Teriparatide. In: Ministry of Health, ed. Wanganui; 2012.
171. New Zealand Government. Form SA1187 Application for subsidy by special authority: Zoledronic acid. In: Health Mo, ed. Wanganui; 2012.
172. Teede HJ, Jayasuriya IA, Gilfillan CP. Fracture prevention strategies in patients presenting to Australian hospitals with minimal-trauma fractures: a major treatment gap. *Intern Med J.* Oct 2007;37(10):674-679.
173. Barrack CM, McGirr EE, Fuller JD, Foster NM, Ewald DP. Secondary prevention of osteoporosis post minimal trauma fracture in an Australian regional and rural population. *Aust J Rural Health.* Dec 2009;17(6):310-315.
174. Bliuc D, Ong CR, Eisman JA, Center JR. Barriers to effective management of osteoporosis in moderate and minimal trauma fractures: a prospective study. *Osteoporos Int.* Aug 2005;16(8):977-982.
175. Inderjeeth CA, Glennon D, Petta A. Study of osteoporosis awareness, investigation and treatment of patients discharged from a tertiary public teaching hospital. *Intern Med J.* Sep 2006;36(9):547-551.
176. Kelly AM, Clooney M, Kerr D, Ebeling PR. When continuity of care breaks down: a systems failure in identification of osteoporosis risk in older patients treated for minimal trauma fractures. *Med J Aust.* Apr 7 2008;188(7):389-391.
177. Kimber CM, Grimmer-Somers KA. Evaluation of current practice: compliance with osteoporosis clinical guidelines in an outpatient fracture clinic. *Aust Health Rev.* Feb 2008;32(1):34-43.
178. Aboyousssef M, Vierkoetter KR. Underdiagnosis and under-treatment of osteoporosis following fragility fracture. *Hawaii Med J.* Jul 2007;66(7):185-187.
179. All Wales Osteoporosis Advisory Group. All Wales Audit of Secondary Prevention of Osteoporotic Fractures 2009. Aberystwyth 2009.
180. Andrade SE, Majumdar SR, Chan KA, et al. Low frequency of treatment of osteoporosis among postmenopausal women following a fracture. *Arch Intern Med.* Sep 22 2003;163(17):2052-2057.
181. Bahl S, Coates PS, Greenspan SL. The management of osteoporosis following hip fracture: have we improved our care? *Osteoporos Int.* Nov 2003;14(11):884-888.
182. Beringer TR, Finch M, Mc ATH, et al. A study of bone mineral density in women with forearm fracture in Northern Ireland. *Osteoporos Int.* Apr 2005;16(4):430-434.

References Cont.

184. Briancon D, de Gaudemar JB, Forestier R. Management of osteoporosis in women with peripheral osteoporotic fractures after 50 years of age: a study of practices. *Joint Bone Spine*. Mar 2004;71(2):128-130.
185. Cadarette SM, Katz JN, Brookhart MA, et al. Trends in drug prescribing for osteoporosis after hip fracture, 1995-2004. *J Rheumatol*. Feb 2008;35(2):319-326.
186. Carnevale V, Nieddu L, Romagnoli E, et al. Osteoporosis intervention in ambulatory patients with previous hip fracture: a multicentric, nationwide Italian survey. *Osteoporos Int*. 2006;17(3):478-483.
187. Castel H, Bonneh DY, Sherf M, Liel Y. Awareness of osteoporosis and compliance with management guidelines in patients with newly diagnosed low-impact fractures. *Osteoporos Int*. 2001;12(7):559-564.
188. Cuddihy MT, Gabriel SE, Crowson CS, et al. Osteoporosis intervention following distal forearm fractures: a missed opportunity? *Arch Intern Med*. Feb 25 2002;162(4):421-426.
189. Feldstein A, Elmer PJ, Orwoll E, Herson M, Hillier T. Bone mineral density measurement and treatment for osteoporosis in older individuals with fractures: a gap in evidence-based practice guideline implementation. *Arch Intern Med*. Oct 13 2003;163(18):2165-2172.
190. Feldstein AC, Nichols GA, Elmer PJ, Smith DH, Aickin M, Herson M. Older women with fractures: patients falling through the cracks of guideline-recommended osteoporosis screening and treatment. *J Bone Joint Surg Am*. Dec 2003;85-A(12):2294-2302.
191. Formiga F, Rivera A, Nolla JM, Coscujuela A, Sole A, Pujol R. Failure to treat osteoporosis and the risk of subsequent fractures in elderly patients with previous hip fracture: a five-year retrospective study. *Aging Clin Exp Res*. Apr 2005;17(2):96-99.
192. Fortes EM, Raffaelli MP, Bracco OL, et al. [High morbid-mortality and reduced level of osteoporosis diagnosis among elderly people who had hip fractures in Sao Paulo City]. *Arq Bras Endocrinol Metabol*. Oct 2008;52(7):1106-1114.
193. Gehlbach SH, Avrunin JS, Puleo E, Spaeth R. Fracture risk and antiresorptive medication use in older women in the USA. *Osteoporos Int*. Jun 2007;18(6):805-810.
194. Gidwani S, Davidson N, Trigkilidas D, Blick C, Harborne R, Maurice HD. The detection of patients with 'fragility fractures' in fracture clinic - an audit of practice with reference to recent British Orthopaedic Association guidelines. *Ann R Coll Surg Engl*. Mar 2007;89(2):147-150.
195. Hajcsar EE, Hawker G, Bogoch ER. Investigation and treatment of osteoporosis in patients with fragility fractures. *CMAJ*. Oct 3 2000;163(7):819-822.
196. Hooven F, Gehlbach SH, Pekow P, Bertone E, Benjamin E. Follow-up treatment for osteoporosis after fracture. *Osteoporos Int*. Mar 2005;16(3):296-301.
197. Javid KS, Thien A, Hill R. Implementation of and compliance with NICE guidelines in the secondary prevention of osteoporotic fractures in postmenopausal women. *Ann R Coll Surg Engl*. Apr 2008;90(3):213-215.
198. Jennings LA, Auerbach AD, Maselli J, Pekow PS, Lindenauer PK, Lee SJ. Missed opportunities for osteoporosis treatment in patients hospitalized for hip fracture. *J Am Geriatr Soc*. Apr 2010;58(4):650-657.
199. Kamel HK. Secondary prevention of hip fractures among the hospitalized elderly: are we doing enough? *J Clin Rheumatol*. Apr 2005;11(2):68-71.
200. Khan SA, de Geus C, Holroyd B, Russell AS. Osteoporosis follow-up after wrist fractures following minor trauma. *Arch Intern Med*. May 28 2001;161(10):1309-1312.
201. Kiebzak GM, Beinart GA, Perser K, Ambrose CG, Siff SJ, Heggeness MH. Undertreatment of osteoporosis in men with hip fracture. *Arch Intern Med*. Oct 28 2002;162(19):2217-2222.
202. Lofman O, Hallberg I, Berglund K, et al. Women with low-energy fracture should be investigated for osteoporosis. *Acta Orthop*. Dec 2007;78(6):813-821.
203. Luthje P, Nurmi-Luthje I, Kaukonen JP, Kuurne S, Naboulsi H, Kataja M. Undertreatment of osteoporosis following hip fracture in the elderly. *Arch Gerontol Geriatr*. Jul-Aug 2009;49(1):153-157.

References Cont.

- 204.** Malochet-Guinamand S, Chalard N, Billault C, Breuil N, Ristori JM, Schmidt J. Osteoporosis treatment in postmenopausal women after peripheral fractures: impact of information to general practitioners. *Joint Bone Spine*. Dec 2005;72(6):562-566.
- 205.** Metge CJ, Leslie WD, Manness LJ, et al. Postfracture care for older women: gaps between optimal care and actual care. *Can Fam Physician*. Sep 2008;54(9):1270-1276.
- 206.** Nixon MF, Ibrahim T, Johari Y, Eltayef S, Hariharan D, Taylor GJ. Managing osteoporosis in patients with fragility fractures: did the British Orthopaedic Association guidelines have any impact? *Ann R Coll Surg Engl*. Jul 2007;89(5):504-509.
- 207.** Panneman MJ, Lips P, Sen SS, Herings RM. Undertreatment with anti-osteoporotic drugs after hospitalization for fracture. *Osteoporos Int*. Feb 2004;15(2):120-124.
- 208.** Papaioannou A, Kennedy CC, Ioannidis G, et al. The osteoporosis care gap in men with fragility fractures: the Canadian Multicentre Osteoporosis Study. *Osteoporos Int*. Apr 2008;19(4):581-587.
- 209.** Peng EW, Elnikety S, Hatrick NC. Preventing fragility hip fracture in high risk groups: an opportunity missed. *Postgrad Med J*. Aug 2006;82(970):528-531.
- 210.** Prasad N, Sunderamoorthy D, Martin J, Murray JM. Secondary prevention of fragility fractures: are we following the guidelines? Closing the audit loop. *Ann R Coll Surg Engl*. Sep 2006;88(5):470-474.
- 211.** Seagger R, Howell J, David H, Gregg-Smith S. Prevention of secondary osteoporotic fractures--why are we ignoring the evidence? *Injury*. Oct 2004;35(10):986-988.
- 212.** Smektala R, Endres HG, Dasch B, Bonnaire F, Trampisch HJ, Pientka L. Quality of care after distal radius fracture in Germany. Results of a fracture register of 1,201 elderly patients. *Unfallchirurg*. Jan 2009;112(1):46-54.
- 213.** Solomon DH, Finkelstein JS, Katz JN, Mogun H, Avorn J. Underuse of osteoporosis medications in elderly patients with fractures. *Am J Med*. Oct 1 2003;115(5):398-400.
- 214.** Suhm N, Lamy O, Lippuner K, OsteoCare study g. Management of fragility fractures in Switzerland: results of a nationwide survey. *Swiss Med Wkly*. Nov 15 2008;138(45-46):674-683.
- 215.** Talbot JC, Elener C, Praveen P, Shaw DL. Secondary prevention of osteoporosis: Calcium, Vitamin D and bisphosphonate prescribing following distal radial fracture. *Injury*. Nov 2007;38(11):1236-1240.
- 216.** Tosi LL, Gliklich R, Kannan K, Koval KJ. The American Orthopaedic Association's "own the bone" initiative to prevent secondary fractures. *J Bone Joint Surg Am*. Jan 2008;90(1):163-173.
- 217.** New Zealand Guidelines Group. Prevention of hip fracture amongst people aged 65 years and over. Wellington 2003.
- 218.** Osteoporosis New Zealand. Recommendations for the management of osteoporosis. Wellington 2010.



OSTEOPOROSIS
NEW ZEALAND

Better bones, fewer fractures

Osteoporosis New Zealand, PO Box 688, Wellington 6140

P + 64 4 499 4862

E info@osteoporosis.org.nz

F www.facebook.com/osteoporosisnz

W www.osteoporosis.org.nz