Best Practice & Research Clinical Rheumatology

Chapter 9: Implementation of Models of Care for secondary osteoporotic fracture prevention and orthogeriatric models of care for osteoporotic hip fracture

Title page

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Abstract:

As the world's population ages, the prevalence of osteoporosis and the fragility fractures it causes is set to increase dramatically. This chapter focuses on current frameworks and major initiatives relating to the implementation of Fracture Liaison Services (FLS) and Orthogeriatrics (OG) Services, models of care designed to reliably implement secondary fracture prevention measures for individuals presenting to health services with fragility fractures. The current evidence base regarding the impact and effectiveness of FLS and OG Services is also considered.

Keywords: Fracture Liaison Service; Care Gap; Secondary Fracture Prevention; Evidence, Cost-effectiveness; Orthogeriatric; Hip Fracture Registry; Clinical Standards; Quality Standards; Consensus Guidelines; Hip Fracture; Fragility Fracture.

Burden of disease for osteoporosis and fractures – Level A heading

As the world's population ages, the prevalence of osteoporosis and its associated fragility fractures is set to increase dramatically. The epidemiology of fragility fracture has been reviewed extensively elsewhere. The International Osteoporosis Foundation (IOF) has conducted a series of regional audits which have summarised the burden of disease for all regions other than North America, and other studies provide data for Canada and the United States. Key findings from the IOF audits and some more recent studies include:

- Asia-Pacific (1): In 1995, 5.3% of the population living in Asia was aged 65 years and over, which is projected to increase to 9.3% by 2025. Almost 700,000 hip fractures occur annually in China alone. In India, 36 million people already have osteoporosis.
- Eastern Europe and Central Asia (2): In the Russian Federation, only 13% of hip fracture patients undergo surgical repair. Consequently, post-hip fracture mortality during the first year after fracture reaches approximately 50% in many Russian cities. In 2012, work undertaken to inform development of a FRAX® model for the Russian Federation provided estimates of fracture incidence for Russia (3). The total number of hip fractures estimated to have occurred in 2010 (112,000) was expected to rise to 159,000 in 2035. The estimated number of major fractures was expected to rise from 590,000 to 730,000 over the same time interval.
- European Union (4): The number of new fractures during 2010 in the EU was 3.5 million, comprising approximately 610,000 hip fractures, 520,000 vertebral fractures, 560,000 forearm fractures and 1.8 million other fractures.
- Latin America (5): In 2012, the proportion of the nations' populations aged 50 years and over was between 13% and 29%. By 2050, these figures were estimated to increase to between 28% and 49%. In 2015, Zerbini et al. estimated the annual incidence of hip fracture in Brazil

to be 80,640 cases among individuals aged 40 years and over. This is expected to rise to almost 193,000 cases annually by 2040 (6).

- Middle East and Africa (7): By 2050, the proportion of the population of this region aged over 50 years is expected to increase by 25% to 40%. In 2010, 24,000 cases of hip fracture occurred amongst Turks aged over 50 years, which is expected to increase by 50% by the end of the current decade.
- North America (8, 9): In 2007, Burge et al. modelled the incidence and economic burden of osteoporosis-related fractures in the United States for the period 2005 to 2025 (8). More than 2 million incident fractures at all skeletal sites were estimated to have occurred in 2005, which was projected to rise to more than 3 million by 2025. In 2012, Tarride et al. estimated that more than 57,000 Canadians were hospitalized on account of fractures caused by osteoporosis (9).

In 2013, an IOF report issued for World Osteoporosis Day summarised the current and future threat posed by osteoporosis (10):

'*Over the next 20 years, 450 million people will celebrate their 65th birthday. On account of this, absolute hip fracture incidence will remain high and costly in the West and presents a major threat to financing of health systems in the East*.'

The Global Burden of Disease Study 2010 analysed bone mineral density (BMD) as a risk factor for fractures, which formed part of the health burden due to falls (11). Global deaths and disability adjusted life years (DALYs) attributable to low BMD increased from 103,000 and 3,125,000 in 1990 to 188,000 and 5,216,000 in 2010, respectively. Around one-third of falls-related deaths were attributable to low BMD.

Prevention of the first fragility fracture is described as primary fracture prevention, while prevention of second and subsequent fragility fractures is described as secondary fracture prevention. Most osteoporosis clinical guidelines address both primary and secondary fracture prevention. However,

the National Institute for Health and Care Excellence (NICE) in the UK published separate guidelines (12, 13).

The time for widespread implementation of systematic approaches to fragility fracture care and prevention has come. Up to one half of individuals who suffer a hip fracture break another bone prior to breaking their hip (14-17). In terms of point prevalence, approximately one sixth of postmenopausal women, and a smaller proportion of men have had a history of fragility fracture since their 50th birthday (18). Taken together, these observations underpin the rationale for prioritisation of secondary fracture prevention. The remainder of this chapter focuses on Models of Care and their operational Models of Service Delivery for secondary fracture prevention and care of individuals who experience hip fractures. A musculoskeletal (MSK) Model of Care is best defined as a guide to describe how best-evidence for delivery of MSK care can be delivered at a systems level while considering practicalities of the local environment. A Model of Service Delivery is defined as a care component of a Model of Care that is specific for local conditions, such as a Fracture Liaison Service (FLS) or an Orthogeriatrics Service (OGS).

The evidence base for Fracture Liaison Services and Orthogeriatrics Services – Level A heading

Fracture Liaison Services – Level B heading

Introduction – Level C heading

The natural progression and trajectory of osteoporosis clearly demonstrates that fractures beget fractures (14-17). It is also well known that treating patients with previous fragility fractures can reduce subsequent fractures by up to 50% (19, 20). However, a ubiquitous and universal chasm of care appears to exist in the identification and treatment of osteoporosis in the fragility fracture patient.

What is being done to alleviate the problem? – Level C heading

FLS have been shown to successfully close or, at the least, narrow the secondary fracture prevention gap in many countries. Though models of secondary fracture prevention have existed since the time Coulson reported the employment of an orthopaedic co-ordinator to successfully liaise between orthopaedic, elderly care and community services in the early 1990's (21), it is only recently that efforts to systematically and operationally define FLS and their impact on fracture management have been attempted.

This brief review focuses on the evidence that exists for the beneficial effect of FLS, including data regarding their cost-effectiveness, the common structural components in successful FLS as well as the challenges faced during implementing and maintaining FLS. It has to be noted that these challenges may be different in different geopolitical and socio-economic environments.

Evidence for the beneficial impact of FLS – Level C heading

Worldwide, good evidence exists regarding the beneficial impact of FLS. Implementation of FLS have shown benefits with regard to increased diagnostic rates for osteoporosis (22), increased rates of DXA evaluations (23), increased rates of investigations targeted at ruling out secondary causes of osteoporosis (24), improved prescription and initiation rates for osteoporosis medications (23-26) and, very importantly, enrolment into FLS have been shown to increase compliance and persistence to osteoporosis medications amongst patients with fragility fractures (27, 28). The evidence regarding the impact of FLS on reducing subsequent fractures is however, less clear cut and randomised controlled trials are lacking. In a prospective controlled observational study, patients with a symptomatic non-vertebral fracture followed up in a Minimal Trauma Fracture (MTF) program were compared with patients with similar fractures who opted to follow-up with primary care physicians (PCPs). The patients in the former group had significantly lower incidence of re-fracture (4.1% versus 19.7%, $p<0.01$) over 4 years (29). An estimated reduction of over 40% in hip fracture incidence with implementation of their Healthy Bones Program has been reported by the Kaiser Permanente Health Care System in the USA (30). The Healthy Bones Program used the services of a

FLS to target patients specifically at highest risk of secondary fracture to maximize the probability of reducing fracture incidences. The authors attributed the decrease in estimated fracture rates to the increase in DXA screening followed by appropriate osteoporosis treatment in patients enrolled into the program. It has to be noted that the comparison was made against estimated hip fracture incidence expected in the population if no interventional change was made, and therefore errors in this estimate could have affected the conclusions of this study. A historical cohort study of patients presenting with a minimal trauma fracture to the emergency departments of a tertiary hospital with a FLS, and one without a FLS found an approximate 30% reduction in any re-fractures and an approximate 40% reduction in major (hip, spine, femur, pelvis or humerus) re-fractures at the FLS hospital compared with the non-FLS hospital over a 3 year period (31). In another study, a time-dependent reduction in subsequent non-vertebral risk was noted over a 2 year follow-up period in patients who were followed up in a FLS as opposed to patients who underwent standard fracture care (32). A hazard ratio for non-vertebral fractures of 0.84 (95% CI: 0.64-1.10) at twelve months and 0.44 (95% CI: 0.25-0.79) at twenty-four months was seen in the patients who attended the FLS.

FLS may have potential beneficial effects on mortality outcomes. Patients followed up in a FLS were shown to have a significant reduction in mortality of 35% (hazard ratio: 0.65; 95% confidence interval [CI]: 0.53-0.79) over two years of follow-up when compared to patients who underwent standard non-FLS care in a study conducted in the Netherlands (32). The estimated impact of setting up or expanding an existent FLS on mortality was also explored in a population based longitudinal study in which Hospital Episode Statistics databases were linked to National Statistics mortality records for 11 acute hospitals in a region of England. Following the set up/expansion of the FLS, the associations on 30-day and 1 year mortality were as follows: HR = 0.80 (95% CI: 0.71-0.91) and HR = 0.84 (95% CI: 0.77-0.93) (33).

Cost-effectiveness of Fracture Liaison Services – Level C heading

Amongst the biggest challenges in successfully implementing and sustaining a FLS is to convince payers and hospital administrators of the cost-effectiveness of secondary fracture prevention programs. Costs of funding the salaries of FLS coordinators, performances of DXA scans, laboratory work up to rule out secondary contributors as well as the cost of osteoporosis medications may be looked upon unfavourably by payers and funding bodies. Justifying the cost of FLS personnel costs in the form of downstream revenue to the health system from ancillary services such as DXA, incentives to hospitals for providing high quality care and for avoiding re-admissions have been proposed (34). Properly conducted cost-effectiveness analyses (in addition to showing reduction in re-fracture rates) are needed to justify not only setting up FLS but also to sustain them. Third-party payers have to be reminded that benefits of fracture risk reduction accumulate over time and that FLS implementation is likely to reap significant financial benefits over periods of time such as 10 years or more. Though a study conducted in Australia evaluating the cost-effectiveness of a fracture liaison service showed that the FLS as compared to standard care increased costs by AUD 1,486 per patient compared to standard care, QALYs (Quality-of-life years) were improved by 0.089 years over the 10 year simulation period, and thus the incremental cost-effectiveness ratio (ICER) versus standard care was AUD 17,291 per QALY gained (35). A rigorous cost-effectiveness analysis using a Markov state-transition computer simulation model through a health-care system perspective in the United States estimated that an FLS would result in 153 fewer fractures, 37.43 more quality-adjusted life years (QALYs), and save US$66,879 compared with typical post fracture care per every 10,000 post fracture patients (36). FLS were also found to be cost-effective and even cost-saving for preventing further fractures in a study of patients with fragility fractures conducted in the UK utilising detailed audit data collected by the West Glasgow FLS. For a hypothetical cohort of 1,000 fragility fracture patients, it was found that 18 fractures were prevented and GBP 21,000 saved per 1,000 patients (37). A deterministic cost-effective analysis done in a hospital based Osteoporosis Exemplary Care Program in Toronto, Canada, showed that a tertiary care centre that hired a coordinator who manages 500 patients with fragility fractures annually could reduce the number of

hip fractures from 34 to 31 in the first year with a net hospital cost savings of CN$ 48,950 (in year - 2004 values) (38). It has to be noted that cost savings and/or cost-effectiveness may differ between open and closed health care systems (34) with reduction of costs shown through FLS programs only in closed and single payer health care systems in the US (30, 39).

The How of FLS: Structural components of successful FLS and implementation challenges and opportunities – Level C heading

Though multiple FLS around the world have been shown to be successful in terms of case finding rates, evaluation, treatment prescriptions, compliance rates and cost-effectiveness, the question of how best FLS should be structured, organized and implemented to deliver the most beneficial and cost-effective care continues to be the subject of ongoing debate. Bench marking individual FLS against global standards have been made possible by the development of the Best Practice Framework by the Capture the Fracture® Campaign of the IOF discussed later in this chapter (40). The essential elements for a FLS are shown in figure 1.

Insert figure 1

International consensus about the need for coordinator-based models of FLS care exist and only multipronged and all-encompassing services with care coordinators at the centre of services have demonstrated a significant reduction in re-fracture incidence (41-43). This has also been shown in a qualitative study conducted in the UK employing the Extended Normalization Process Theory in which it was found that fracture prevention coordinators were indispensable to effective implementation of FLS (44).

Though the coordinator plays a crucial role in the FLS, it is equally important to have a local bone health champion who will lead service development, work with hospital management and governmental bodies to secure funding, convince busy clinicians in multiple departments to ‘buy in’ into a program, the values of which may not be immediately apparent to them, oversee the

implementation of an identification system to identify fracture patients and facilitate set-up of outcomes tracking measures (34, 45).

Identifying patients with fragility fractures in multiple settings, both outpatient as well as inpatient within the particular health care system and making sure patients with fractures do not fall through the cracks is an important challenge that any FLS will encounter. Multiple methods such as using admitting diagnoses, office billing codes and radiological diagnosis codes could potentially be employed (46). Though algorithms and standardized pathways may be formulated to make work flows efficient and as decision aids, for a FLS to be useful to the individual patient, evaluation and management has to be individualized. A 'one-size fits all' approach will not work and should not be encouraged.

Ensuring continued follow-up and longitudinal care of patients enrolled into the FLS is important to ensure that patients do not fall off the 'wagon of care'. Seamless transition of care of the fragility fracture patient from the hospital or specialist medical centre setting to primary care requires that a clear communication pathway exists between the FLS and the PCP regarding the treatment plan. Effective communication with PCPs and transition of service into primary care were identified as significant challenges in the qualitative study conducted among FLS providers in the UK (44). Extending the services of the coordinator into the community through a coterie of specialist nurses who could work with PCPs was suggested as a possible solution to mitigate the problem encountered during transition of care in this study. The transitioning of care of hospitalized patients to nursing homes and rehabilitation centres may be made seamless and efficient via integration of FLS with OGS. This will be discussed in the subsequent section.

A very important component of a FLS should be the implementation of an effective system to track patients, care and outcome. Electronic prescriptions, medication dispensing and case records, data bases and registries are invaluable adjuncts that facilitate effective implementation and

sustainability of FLS. These data entry systems and registries can be customized to address local needs.

Several other system level as well as patient level challenges to implementing and sustaining FLS have been identified through follow-up audits of long-running FLS. Lack of adequate number of personnel in individual FLS to serve as coordinators and to manage patient load in large medical centres and hospitals was identified as a significant barrier to overcome whilst running a FLS in Singapore (45). This was not due to just funding issues, but also due to lack of understanding amongst hiring personnel and junior level staff of the importance and long-term value of FLS and their critical role in such programs. Incentives in the form of long-term career progression, awards of recognition and provision of continuing education program credits for osteoporosis and its management may help circumvent this problem. Failure to recognize silent vertebral fractures by healthcare providers remains a pervasive problem worldwide (47). Putting into practice robust identification systems such as vertebral fracture assessment (VFA) that will help to identify the occult vertebral fracture population may help overcome this problem (48). Patient level challenges such as attitudes, motivation for positive health seeking behaviour and financial, social and cultural limitations may substantially affect compliance to osteoporosis medications and persistence with follow-up care in the FLS. These limitations should be taken into account and patient and especially elder friendly educational tools and pathways of follow-up should be developed at the time of implementing FLS.

Summary – Level C heading

Focusing on keeping the patient with a fragility fracture at the centre of care and developing effective FLS that are multipronged and are developed through interdisciplinary efforts will ensure that no patient with a fragility fracture is ever neglected. The first fracture should really be the last.

Orthogeriatrics Services – Level B heading

Structural components of the Orthogeriatrics Services – Level C heading

OGS as models of service delivery are critical to the provision of optimal care for patients who are admitted to hospital with a hip fracture. An OGS consists of a team of health care professionals (orthopedic surgeons, geriatricians and nursing staff) who care for elderly patients admitted to hospital following a fracture (49). The service model consists of collaboration between the orthopaedic surgeons who are usually primarily responsible for the acute treatment of the fracture, together with the geriatrics team, responsible for the optimization of patient medical co-morbidities and managing complications prior to and after fixation of the fracture. Following the inpatient stay, both teams are responsible for communicating management plans to PCPs. Furthermore, the OGS team is pivotal in ensuring secondary fracture prevention measures are instituted through the recommendation or initiation of osteoporosis pharmacotherapy as well as overseeing the assessment and implementation of falls reduction strategies.

A systematic review and meta-analysis published in 2014, described three models of OG collaborative care (50):

1. Shared care: the responsibility for patient care is shared between orthopaedics and geriatrics teams.
2. Primary responsibility for the patient lies with the orthopaedics team with routine consultations by the geriatrics team.
3. Primary responsibility for patient care lies with the geriatrics team with orthopaedics providing consultation.

As described previously, FLS refers to the systematic identification of patients >50 years of age who present with a fragility fracture, followed by assessment of bone health and falls risk, coupled with management strategies targeted at preventing further osteoporotic fractures. These are generally

coordinator-based models of service delivery (41). The OGS and FLS are models of service delivery that undoubtedly complement each other to address the post-fracture care gap.

Differences between FLS and OG Services – Level C heading

The differences between FLS and OG Services are summarized in table 1. The FLS provides the ideal service model for the identification, investigation and management of bone health amongst those presenting with symptomatic non-hip, non-vertebral (NHNV) fragility fractures, which constitute the majority of fracture sites. It should be noted that assessment and treatment of patients by a FLS or OGS can occur as an outpatient or inpatient depending upon the healthcare system, however, it is more often the case that an inpatient is assessed by the OGS. Elderly patients (usually > 70 years of age) with fragility fractures of the hip, which constitute 20% of all symptomatic fragility fractures, are often too frail to attend a typical FLS outpatient clinic, which makes the OGS model ideal for secondary fracture prevention in this group. Moreover, sufferers of fragility fractures of the hip often have a number of barriers preventing them from being able to attend an outpatient FLS, including physical inability to attend due to frailty or comorbidities, prolonged hospital admission, or discharge to rehabilitation or institutional care such as a hostel or nursing home after the fracture. Therefore, the secondary fracture prevention pathway for patients with hip fractures needs to be different from those with fractures at NHNV sites. Furthermore, the function of an OGS is more broad-ranging than an FLS because it deals with more than secondary fracture prevention alone. The geriatric expertise is fundamental to ensuring patients are optimally medically managed prior to and after surgery. This includes treating co-morbidities, ensuring adequate fluid status prior to surgery, determining the cause for the fall that preceded the fracture, and managing post-operative complications such as infections, deep vein thromboses, bed sores and delirium.

Insert table 1

Evidence for effectiveness of OG Models of Care – Level C heading

In 2014, Grigoryan et al. published a systemic review of literature and meta-analysis to determine the effectiveness of OG models of care, covering literature from years 1992 to 2012 (50). The authors found 18 studies with valid control groups, most of which were retrospective cohort studies with a limited number (n=3) of randomized controlled trials. The mean age of patients in these studies were generally in the early 80s. The overall meta-analysis revealed a reduction in inpatient and long-term (6-12 months post-fracture) mortality (RR 0.60, 95%CI 0.43-0.84 and RR 0.83, 95%CI 0.74-0.94, respectively). Length of stay was reduced in the shared care model (SMD -0.25, 95%CI -0.95 to -0.28). Of note, the control groups consisted of 'standard care', which entailed geriatrics consultation for a patient only when the orthopaedics team thought it to be necessary. Unfortunately, a number of important outcome measures were not reported in many of these studies such as delirium, functional status, post-discharge destination of patients (rehabilitation, community, hostel or nursing home), time to surgery, post-surgical complications (e.g. infections, deep vein thrombosis, pressure sores), institution of falls risk assessment, measures to mitigate falls risk, institution of measures aimed at secondary fracture prevention (e.g. assessment of vitamin D status and for secondary causes for osteoporosis), and rates of initiation of and adherence to specific osteoporosis pharmacotherapy.

Since 2013, there have been further publications comparing outcome measures with OGS using some form of control group from across the globe. Swiss investigators demonstrated improvements in process measures (time to surgery) and financial indicators such as length of hospital admission following the implementation of an orthogeriatric clinical pathway (51). On the other hand, clinical outcome measures (e.g. delirium, pneumonia) did not significantly change. Mortality was not evaluated in this study. German investigators demonstrated non-significant trends towards improved outcomes such as fewer patients requiring ICU admission and lower inpatient mortality following the implementation of an OGS (52). However, length of hospital stay actually increased significantly. An Australian study demonstrated improvements in a number of measures after the institution of an OGS (53). This included reduced time in the emergency department, shorter time to

surgery, decreased length of hospital stay and an increase in the number of patients accessing rehabilitation. In 2016, Hawley et al. published a good quality study to indicate the effectiveness of OGS across 11 acute hospitals in England using linkage of national mortality data and hospital data (33). The authors demonstrated a reduction in 30 day and 1-year mortality with HR of 0.73, 95%CI (0.65-0.82) and HR 0.81, 95%CI (0.75-0.87), respectively. There was no significant impact on time to second hip fracture. In a prospective study utilising data from the Danish Multidisciplinary Hip Fracture Registry (n=11,461 patients), Kristensen et al. demonstrated improved mortality and quality of care amongst facilities using an OGS compared to those that did not (54). Patients treated in facilities with an OGS had a greater chance of fulfilling 5/6 process performance measures and had a lower 30 day mortality (OR 0.69, 95%CI 0.54-0.88). On the other hand, length of hospital stay and time to surgery were similar between the two groups.

Cost-effectiveness of OG Services – Level C heading

Evaluating the cost-effectiveness of the OGS model would require currently available data derived mostly from 'before and after' analyses. Such an analysis would need to take into account the cost of the intervention itself i.e. hiring staff (e.g. geriatrics team) to maintain the service model, balanced against the reductions in mortality, length of hospital stay, time to surgery, rate of complications related to the fracture, as well as reduction in re-fracture rates with institution of osteoporosis pharmacotherapy.

In 2016, a formal cost-effectiveness analysis using an economic decision analysis study was conducted by Swart et al., which compared an orthogeriatric model of post-hip fracture care vs. standard care (55). The OGS model was found to be more cost-effective than standard care with incremental cost-effectiveness ratio of US$41,000 per quality-adjusted life-year, as long as the case volume was >54 patients per annum (range 41-68) and resulted in cost savings when >318 patients were seen annually (range 238-397).

Implementation challenges and opportunities – Level C heading

Implementing an OGS requires dedicated personnel i.e. orthopaedics and geriatrics teams. Both teams would be led by consultants in each field together with other team members, usually junior doctors, who review patients on a daily basis. One of the challenges to overcome to ensure optimal implementation of OGS is that geriatricians need to have the confidence to initiate specific osteoporosis pharmacotherapy, especially parental treatment such as zoledronic acid or denosumab. Therefore, the advice of a bone specialist may be required in certain circumstances. Routine consultation with a bone specialist may be worthwhile incorporating into the OGS model.

Initiation of specific osteoporosis pharmacotherapy may also be problematic in the inpatient setting due to the high rate of vitamin D deficiency amongst the elderly. Administering parenteral osteoporosis pharmacotherapy to vitamin D deficient (vitamin D level < 50nmol/L) patients increases the risk of hypocalcaemia post-treatment. It may take several weeks of vitamin D supplementation before the vitamin D level is above 50nmol/L, by which time the patient may have been discharged from the acute care setting. Thus, ensuring adequate communication between the orthogeriatrics team and rehabilitation service or the general practitioner is critical.

A further challenge for the OGS is the fact that there are competing priorities in patient management. Secondary fracture prevention is only one of the aims of an OGS, which is also responsible for the management of the multiple medical comorbidities and complications to which inpatients with hip fractures are susceptible. Therefore, ensuring the OGS team has secondary fracture prevention as part of their routine assessment and evaluation should be emphasized in all services and should be incorporated into databases which benchmark performance.

Another hurdle to implementation is the supply of geriatricians. Learned societies responsible for training geriatricians will need to take into account the ageing population, and thus the growing number of patients with hip fractures. Therefore, specific efforts would need to be made to ensure there are a sufficient number of geriatricians in the future to meet the demands of the increasing

numbers of patients with hip fractures. It is also important to ensure that not only is there collaboration between geriatricians and orthopaedic surgeons, but also with bone specialists to expedite and optimize the secondary fracture prevention aspect of care.

The future is promising in terms of institution of OGS and their benchmarking with the establishment of national hip fracture databases in the UK, Europe, Australia and New Zealand (56). This will likely drive the standardization of outcome measures for patients with hip fractures, which will provide further data to enable the evaluation of the effectiveness of the OGS model.

Summary – Level C heading

The OGS is entirely complementary to the FLS and enables the optimal management of elderly patients who are admitted to hospital following a hip fracture. This model of service delivery has not only been shown to be critical in decreasing inpatient and long-term mortality in this vulnerable and frail cohort of individuals, but has shown improvements in a number of other process indicators in the acute care journey of the patient with a hip fracture. Although the evidence for mortality reduction seems to be the strongest amongst all outcome measures, the OGS has also been shown to be cost-effective and cost-saving. With the rapid establishment of national hip fracture databases throughout a number of nations over the last 10 years, the care of patients with osteoporotic fractures of the hip is likely to improve year on year from now.

Current Models of Care for Fracture Liaison Services and Orthogeriatrics Services – Level A heading

The International Osteoporosis Foundation Capture the Fracture® Programme Best Practice Framework – Level B heading

Introduction – Level C heading

To support and promote the use of effective models of care across the globe, IOF launched the Capture the Fracture® Programme at the IOF European Congress on Osteoporosis and Osteoarthritis in Bordeaux, France in March 2012. This expert-led and evidence-based programme aims to reduce secondary fractures by facilitating the implementation of FLS on a global level. A primary resource developed by the Capture the Fracture® Programme is the Best Practice Framework (BPF), which sets standards for FLS, serves as a benchmark for existing FLS and serves as a guidance tool for developing an effective FLS (41). In an effort to engage the global medical community, CTF offers a Best Practice Recognition programme where FLS can submit their service to IOF for evaluation against the BPF standards in order to receive a gold, silver or bronze star in recognition of achievements. The FLS is then included in the showcase of best practice and plotted on the CTF Map of Best Practice that displays participating FLS and their respective achievement level (figure 2). To influence change, the map can be used as a visual representation of FLS available worldwide, their achievements, as well as the areas for opportunity and development in secondary fracture prevention.

Please insert Figure 2

The Best Practice Framework (BPF) – Level C heading

The BPF has been developed by the CTF steering committee and shaped by input from leaders of established FLS throughout the world. It has developed internationally endorsed standards for best

practice based on prior systematic and other reviews (57), will facilitate change at the national level to ensure FLS models are effective and work for their local population, as well increase awareness of the challenges and opportunities presented by secondary fracture prevention to key stakeholders. The BPF sets an international benchmark for FLS, which defines essential and aspirational elements of service delivery and serves as the measurement tool for IOF to award 'Capture the Fracture® Best Practice Recognition' in recognition of successful FLS worldwide. Details of the 13 globally endorsed standards can be found in the supplementary information (41).

Best Practice Recognition Programme – Level C heading

The BPF provides a means for excellence in secondary fracture prevention to be recognized globally. Applicants achieving Best Practice Recognition will be recognized by IOF in the following ways:

1. The applicant's FLS will feature on the Capture the Fracture® website interactive map, including the health care system name, location, link and programme showcase.
2. The applicant will be awarded use of the IOF approved, Capture the Fracture® Best Practice Recognition logo for use on the applicant's websites and materials.

Application for Best Practice Recognition provides applicants with an opportunity for their FLS to be peer-reviewed and to identify potential opportunities to further improve delivery of care and outcomes for patients. This programme provides a unique platform to share the best practices developed within a FLS with colleagues throughout the world, and so make a significant contribution to improving the care of fragility fracture sufferers worldwide.

Sites will independently complete a fracture service questionnaire and submit this to the Capture the Fracture® committee. The committee will complete a draft summary profile of the FLS, a scoring from both administrative and clinical perspectives, which is determined by achievement against the BPF standards for four key fragility fracture patient groups - hip fractures, other inpatient fractures, outpatient fractures and vertebral fractures - and organizational characteristics. The draft summary

profile will be fed back to the site with a request for further information should there be areas requiring clarification. On receipt of the site's response, a suggested final summary profile will be presented to the committee for approval. The site will subsequently receive the final summary; those achieving Best Practice Recognition will feature on the Capture the Fracture® website interactive map and be awarded use of the IOF approved, Capture the Fracture® Best Practice Recognition logo and certificate for use on the applicant's websites and materials.

Results of the BPF – Level C heading

The BPF was designed to ensure that when a FLS is established, it meets recognized quality standards. The standards are around domains of fracture site (hip, non-hip inpatient, outpatient and vertebral fracture), depth of service scope (identification, investigation, initiation and monitoring) and organizational elements (figure 3). While a FLS is the recommended model to reliably close the secondary prevention care gap, there remains significant variability in the size and scope of services globally that is more than expected from local variations in health systems. There were marked differences by domain with secondary fracture prevention best delivered for hip fractures and least for vertebral fractures. The findings demonstrate that effective secondary fracture prevention in the vertebral fracture group remains sub-optimal and continuing work is needed to close this care gap within established services. Strategies include training for radiology trainees and specialists using the IOF vertebral fracture educational programme, development of automatic vertebral fracture assessment (VFA) tools to facilitate identification of incidental fractures, inclusion of VFA as part of the standard dual X-ray absorptiometry (DXA) assessment and clinical trials evaluating different methods of service delivery.

Insert Figure 3

There were also differences in service scope with proportionally more reaching the higher standards for identification and substantially lower standards achieved for falls prevention, database and long term medication adherence. While the FLS assessment is an ideal opportunity to identify patients

who also require urgent falls intervention, the traditional model has been to refer patients into a distinct falls service. Data from the submitted services demonstrate that while there is near universal adoption of the minimal assessment set for bone health, considerable variability remains for falls assessments with the potential of patients not being offered effective interventions to reduce falls risk. Despite the commonality of assessment questions as well as blood and imaging investigations, most institutions scored poorly on the database criteria. Data systems are important as they allow linkage across regions and countries can then demonstrate variability in patient outcomes, informing service design and commissioning. The national hip fracture databases are good examples of such existing systems and sharing and implementation of similar databases for non-hip fractures should be encouraged internationally (58-61). Finally, medication adherence is a key issue across all chronic diseases. It remains a particular challenge in bone health, given the lack of beneficial symptoms, unwanted effects such as indigestion, co-morbidities such as dementia and the often complex administration regimen to follow (62-64). There remains little consensus on how best to identify the non-adherent patient in terms of using patient report, physician report, bone turnover markers (65, 66) and/or bone density tests (67). Interventions to improve adherence have at best modest effects (68, 69).

Initial results of the programme have shown that it is possible to benchmark services internationally with a single tool despite the wide variations in national/local health systems, and this supports the ongoing implementation of this programme with the ambition of sharing results from all health systems globally (40). While the majority of FLS that feature on the map to date are in Europe or North America, applications are increasing from Asia, Latin America and Oceania, as indicated by the green stars on the map which represent those FLS currently under review. The FLS featured from Algeria represents the only centre on the African continent.

UK National Osteoporosis Society Clinical Standards for Fracture Liaison Services – Level B heading

Established in 1986, the National Osteoporosis Society (NOS) is a UK-wide charity dedicated to improving the diagnosis, prevention and treatment of osteoporosis. Since 2009, NOS has led a national campaign for universal access to FLS. In 2012, a multidisciplinary Falls and Fractures Alliance was established in England with the objective of reducing the rate of hospital admissions for hip fractures and falls and falls-related injuries in people over the age of 65 between 2012 and 2017.

In 2014, NOS brought together national and local stakeholders, clinicians and patient representatives to form the FLS Implementation Group (FLS-IG), to provide leadership and coordination across projects to increase FLS provision in the UK (70). Under the auspices of the FLS-IG, NOS developed a range of resources including:

- Clinical Standards for FLS
- FLS Implementation Toolkit
- FLS Benefits calculator
- Accredited online training certification for fracture prevention practitioners
- A peer review process to support development of a gold standard FLS

NOS has also established a Service Delivery Group which employs several very experienced FLS nurse practitioners and individuals with extensive experience in service commissioning within the UK National Health Service (NHS). The NOS Service Delivery Group is working with many hospitals across the NHS to support refinement of existing FLS and establishment of services where they do not currently exist.

NOS developed UK Clinical Standards for FLS addressing the whole pathway, from identification of the patient through to assessment of future risk and the provision of guidance, information and treatment for patients (71). A so-called '5IQ approach' describes the key objectives of a FLS:

- Identification: Finding patients with new fragility fractures, with the potential to extend scope to include identification of patients with prior fractures.

- Investigation: Incorporating fracture risk assessment with DXA to determine modifiable risk that merits intervention, tests to identify underlying causes of secondary osteoporosis, and assessment of falls risk.
- Information: Educating patients about their falls and fracture risk and the benefits and risks of treatment.
- Intervention: Implementing the necessary package of care, including drug treatments and non-pharmacological options for sustaining a reduction in secondary fracture risk and falls.
- Integration: Sharing patient-specific management plans with PCPs and with other professionals involved in the patient's ongoing care plan, and ensuring long-term treatment concordance among patients.
- Quality: Optimizing the delivery and organization of the FLS through data collection and audit, continuing professional development (CPD), peer review and benchmarking.

In 2016, Shipman et al. undertook a study of the performance of the University Hospital Birmingham FLS to determine whether the NOS Clinical Standards were realistically deliverable (72). The FLS reviewed 1,773 fracture patients during the period September 2014 to August 2015. The authors estimated that this represented approximately half of all fracture presentations to the hospital among individuals aged 50 years and over during the year. Notably, the workload of the FLS increased from four patients seen per working day in September 2014 to seven by the end of July 2015. Among the fracture patients identified, practically all audit standards were met. With regard to initiation of treatment in accordance with national clinical guidelines, among patients deemed to be at increased risk of further fracture, 94% of outpatients and 81% of inpatients received appropriate treatment, respectively. The authors concluded that the standards were deliverable in a real world setting.

Also in 2016, the UK Royal College of Physicians published the first national Fracture Liaison Service Database (FLS-DB) facilities audit (73). The audit was created to measure primarily against National

Institute for Health and Care Excellence (NICE) technology assessments and guidance on osteoporosis, and the NOS Clinical Standards for FLS. Every acute National Health Service hospital trust in England and Wales, regardless of whether it had an FLS, was contacted and eligible to participate. Eighty-two sites participated in the audit, which was estimated to be just under half of eligible sites. In short, the audit identified significant variation in how patients were identified, investigated, treated and monitored after a fracture. Later in 2016, the FLS-DB initiative will publish the findings of a patient-centred audit, which is collecting data about bone health investigations, treatment initiation, falls risk assessment and outcome monitoring for fragility fracture patients.

Osteoporosis Canada's Fracture Liaison Service Initiative – Level B heading

In 2013, Osteoporosis Canada (OC) launched '*Make the FIRST break the LAST with Fracture Liaison Services*', which aimed to drive implementation of secondary fracture prevention programmes across all Canadian provinces (74). In May 2014, OC held a national FLS Summit which brought together clinical champions, health system administrators and OC advocates from all Canadian provinces to develop provincial plans to implement FLS in relevant hospitals. During the following year a series of webinars were conducted to support individuals engaged in developed FLS. In 2016, OC launched the OC FLS Registry, an online map profiling FLS programmes across Canada, which meets OC's *Essential Elements of FLS* (75). The aim is to foster the implementation of effective FLS across Canada. OC has developed a list of 8 essential elements of an FLS:

1. A dedicated coordinator is central to the FLS model of service delivery.

2. Pro-active, system-wide case finding of new fragility fractures and/or newly reported vertebral fractures.

3. The FLS must target at least one of the World Health Organization (WHO) major osteoporotic fracture types (hip, spine, wrist, shoulder).

4. In 2013, a systematic review on post-fracture models of care provided a useful framework for classification (43). FLS models were classified according to their level of identification, investigation and initiation of fragility fracture patients (referred to as the '3 i's'), and were summarized in four types from A to D. Type A models deliver the 3 i's (identification, investigation and initiation); Type B models deliver the 2 i's (identification and investigation); Type C models deliver 1 i (identification); Type D models are the lowest level when no proactive case-finding occurs. In OC's Essential Elements of FLS, the FLS model must be at least 2 i (identification and investigation) or 3i (identification, investigation and initiation).

5. The FLS must determine the patient's fracture risk through an approved fracture risk assessment tool.

6. First line osteoporosis medications must be initiated (3 i FLS) or recommended (2 i FLS) for high risk patients.

7. Integration with primary care is a critical component of any FLS: written communication to the patient's PCP must include the patient's fracture risk and all osteoporosis treatments initiated and/or recommended for the patient.

8. To determine the FLS's ability to close the post-fracture care gap, data must be collected, especially in regard to the proportion of high risk patients initiated on first-line osteoporosis medications

As of May 2016, 25 hospitals across Canada featured on OC's FLS Registry.

US National Bone Health Alliance's Fracture Liaison Service Initiative – Level B heading

The US National Bone Health Alliance (NBHA) is a public-private partnership launched in 2010 that brings together the expertise and resources of its member organizations to collectively promote bone health and prevent disease, improve diagnosis and treatment of bone disease and enhance bone research, surveillance and evaluation (76). As part of NBHA's '20/20' vision to reduce fractures

by 20% by the year 2020, NBHA is pursuing implementation of a FLS model of service delivery in a number of health care settings, including Medicare, managed care, large hospitals systems and private payer. NBHA launched Fracture Prevention CENTRAL in March 2013, an online resource to help interested sites across the United States implement and maintain a secondary fracture prevention programme (77). Fracture Prevention CENTRAL includes materials collected from a number of successful programmes, some of which have been in operation for over 15 years. Specifically, NBHA is using the following programmes operating in the United States as models for this initiative:

- Kaiser Permanente's Healthy Bones programme, which has led to an overall 38% reduction in the expected hip fracture rate since 1998 (30, 78).
- Geisinger Health System osteoporosis disease management programme, which achieved US$ 7.8 million in cost savings over 5 years (39, 79).
- American Orthopaedic Association's Own the Bone programme. Own the Bone aims to change clinician behaviour, improve patient treatment and referral in the open system (80).

NBHA is leveraging the expertise of these model programmes in addition to the National Osteoporosis Foundation's (NOF) patient and healthcare professional education and training expertise. NBHA currently estimates there to be up to 350 FLS established in the United States (81). During 2016, NBHA plans to work with its partners to undertake a comprehensive FLS survey. In order to realize its goal to reduce fractures by 20% by 2020, NBHA estimates that 1,000 FLS will be required nationwide.

The impact of the NBHA FLS initiative cannot be assessed in isolation, because in the year prior to the launch of this campaign, NBHA launched the 2Million2Many disease awareness campaign in 2013 (82), which focused on secondary fracture prevention, and, in collaboration with NOF, a Qualified Clinical Data Registry focused on outcomes in osteoporosis and post-fracture care in 2014 (77). In 2015, the National Committee on Quality Assurance (NCQA) published *The State of Health*

Care Quality 2015 which reported on post-fracture osteoporosis care for women for the period 2007 to 2014 (83). The concurrence of the NBHA/NOF initiatives and a significant improvement in post-fracture care in the United States is clearly illustrated in figure 4

Insert figure 4

Fracture Liaison Service initiatives in Australia and New Zealand – Level B heading

In 2015, the Australian and New Zealand Bone and Mineral Society (ANZBMS) published a Position Paper and Call to Action which described efforts to improve the quality of secondary fracture prevention in Australia and New Zealand (84).

Since 2002, osteoporosis has been a National Health Priority Area in Australia. The New South Wales (NSW) government is currently attempting to integrate and standardize post-fracture care through the Agency for Clinical Innovation (ACI) (85). An ongoing initiative by the ACI and ANZBMS is occurring to develop secondary fracture prevention programmes in the primary care setting. The governments of South Australia (86) and Western Australia (WA) (87) also published strategy documents which called for the implementation of secondary fracture prevention programmes. The NSW and WA models of care provided the policy-level framework to guide service planning and delivery across the states, and were, therefore, key enablers of system-wide implementation.

In 2012, Osteoporosis New Zealand (ONZ) published *BoneCare 2020: A systematic approach to hip fracture care and prevention for New Zealand* (88). BoneCare 2020 called for implementation of FLS in all District Health Boards (DHBs) in New Zealand. From 2013 to the present day, ONZ has collaborated extensively with a multi-sector group to enable implementation of the strategy, including the Ministry of Health (MoH), the Accident Compensation Corporation (ACC), the Crown Agent responsible for injury prevention, the Health, Quality and Safety Commission New Zealand (HQSC) and all relevant learned societies (89). Since 2013, MoH district annual planning guidance has stated that MoH expects DHBs to implement a FLS. In 2016, ACC announced an investment of

NZ$30.5 million to deliver services for falls and fracture prevention over the next 4 years, which includes FLS (90).

In 2016, ONZ published their Strategic Plan for 2016-2020 (91). This plan noted that all DHBs were at various stages of FLS implementation. In May 2016, Clinical Standards for FLS in New Zealand were in development pending publication later in the year. These standards, akin to the UK NOS Clinical Standards mentioned above, will provide an opportunity for FLS in New Zealand to benchmark their performance against nationally agreed standards of care.

Secondary fracture prevention initiatives in Sweden – Level B heading

In 2012 the National Board of Health and Welfare for the first time presented national guidelines on osteoporosis and fracture prevention aimed at the systems level (92). Prior guidelines were only physician's guidelines without designating implementation requirements at the provider level. The priority levels are designed to fit across all disease areas to allow for comparison and equality of care. The osteoporosis guidelines were developed based on evaluation of best evidence (systematic reviews, meta-analyses, pivotal trials) for risk assessment, diagnosis and intervention of fracture prevention measures. A second step included a cost-effectiveness analysis followed by prioritization to provide guidance to the health care providers. A high priority for assessment was given to DXA and FRAX®; for treatment with oral and i.v. bisphosphonates and later to denosumab; as well as for coordinator-based fracture services. The top organizational and accountability level is regional for healthcare in Sweden and fracture coordinators are now being implemented across most regional hospitals managing orthopedic trauma since 2013-2014. For fragility fractures, treatment with bone active drugs within 6-12 months after fracture is the key indicator and monitored annually at the national level, along with time to surgery for hip fracture. The proportion treated is increasing most obviously in regions with well-functioning systems, as is also shown in a 2015 comprehensive report (93). Furthermore, a fracture registry has been initiated, covering all fractures in addition to the hip

fracture register, and while not yet including all hospitals, it will allow for improved identification and audit in the coming years (94).

Secondary fracture prevention initiatives in Singapore – Level B heading

In 2008, a secondary fracture prevention programme called Osteoporosis Patient Targeted and Integrated Management for Active Living (OPTIMAL) was instituted in all public hospitals in Singapore (23). In this programme, all patients aged over 50 years who have suffered a fragility fracture are offered the option of being included in an osteoporosis disease management programme aimed at preventing the occurrence of a second fragility fracture through the judicious combination of appropriate medications, physiotherapy and dedicated nurse manager follow-up. Thanks to OPTIMAL, more than half of the hospitals in Singapore have implemented a FLS. This represents the highest level of implementation of FLS in the Asia-Pacific region and excellent diagnosis, assessment and treatment rates for fragility fractures have been demonstrated in a follow-up study conducted at the largest tertiary teaching hospital that had implemented the programme (23).

Orthogeriatrics Services: Clinical guidelines, quality standards and hip fracture registries – Level B heading

During the last two decades, orthopaedic – geriatric co-care of patients admitted to hospital with hip fractures has become well recognised in professional guidance. The Fragility Fracture Network (FFN) has summarised guidelines throughout the world on the FFN website (56). Such models of care focus on expediting surgery, ensuring optimal management of the acute phase through adherence to a care plan overseen by senior orthopaedic and geriatrician/internal medicine personnel, and delivery of secondary fracture prevention through osteoporosis management and falls prevention. The strategic focus of the FFN for the period 2016-2020 concisely illustrates the key steps in

development of best practice for patients with fragility fractures in general, and hip fractures in particular at the national level (95):

- Consensus guidelines.
- Quality standards (aka Clinical Standards).
- Systematic performance measurement (e.g. national hip fracture registries).

Descriptions of the implementation of this strategic approach in the UK from 2007 onwards and Australia and New Zealand from 2011 onwards follow, as examples.

Orthogeriatrics Services in the UK – Level C heading

In 2007, the British Orthopaedic Association (BOA) and British Geriatrics Society (BGS) published the so-called 'Blue Book' on the care of patients with fragility fracture (49). The Blue Book was endorsed by many learned societies in the UK, and focused on three themes:

- Improving hip fracture care.
- Secondary fracture prevention.
- High quality information: using audit, standards and feedback to improve care and secondary prevention.

Six core standards for best practice in hip fracture care were proposed:

1. All patients with hip fracture should be admitted to an acute orthopaedic ward within 4 hours of presentation.
2. All patients with hip fracture who are medically fit should have surgery within 48 hours of admission, and during normal working hours.
3. All patients with hip fracture should be assessed and cared for with a view to minimising their risk of developing a pressure ulcer.

4. All patients presenting with a fragility fracture should be managed on an orthopaedic ward with routine access to acute orthogeriatric medical support from the time of admission.
5. All patients presenting with fragility fracture should be assessed to determine their need for antiresorptive therapy to prevent future osteoporotic fractures.
6. All patients presenting with a fragility fracture following a fall should be offered multidisciplinary assessment and intervention to prevent future falls.

The UK National Hip Fracture Database (NHFD) was launched contemporaneously with the Blue Book, providing a mechanism to benchmark care by hospital units against the professionally defined standards (96). Nationwide participation in the NHFD was facilitated by (97):

- A small central implementation group with a strong clinical focus
- 2 project coordinators who:
    - Provided a telephone helpline
    - Organised data quality workshops for hospital audit staff and regular regional NHFD meetings
    - Brought together multidisciplinary teams to share national developments and local good practice
- A NHFD website was developed which included:
    - A database of hip fracture literature
    - Case studies of best practice
    - Model business cases and job descriptions

In 2009, the Department of Health (DH) in England formed a policy working group which was tasked to draft an overarching policy document to consolidate the various falls and fracture care and prevention initiatives that had been established (98). Delivery of the Blue Book standards for hip fracture patients featured as the first objective of the policy. In 2010, DH went further with introduction of the Best Practice Tariff for hip fracture, a financial incentive which linked the level of

reimbursement to the hospital, at the level of an individual patient, to delivery of key performance indicators based upon the Blue Book standards. In 2011, NICE published clinical guidelines for hip fracture care (99) which informed development of a NICE Quality Standard in 2012 (100). Collectively, these initiatives have resulted in significant improvements in hip fracture care in secondary prevention in the UK, including a significant reduction in 30-day mortality (97). With regard to secondary fracture prevention, for the 64,102 patients' care that was described in the 2015 NHFD Report (101):

- 80.1% of patients had been started on bone protection treatment, or were referred for DXA scan or bone clinic assessment. A further 16.0% of patients were recorded as having been assessed but not considered appropriate for treatment.
- 96.1% of patients were offered a multifactorial risk assessment to identify and address future falls risk, and are offered individualised intervention if appropriate.

Orthogeriatrics Services in Australia and New Zealand – Level C heading

In Australia and New Zealand, the development of consensus guidelines, clinical standards and a hip fracture registry have followed a similar path to the UK experience:

- In 2011, an Australian and New Zealand Hip Fracture Registry (ANZHFR) Steering Group was formed, comprised of representatives of learned societies for both countries and Osteoporosis Australia and Osteoporosis New Zealand.
- The Australian and New Zealand Guideline for Hip Fracture Care (ANZ Guideline) was published in 2014 (102).
- The Australian and New Zealand arms of the registry also went live in 2014.

Clinical Standards for hip fracture, derived from the ANZ Guideline are in development by the Australian Commission for Safety and Quality in Healthcare and the Health Quality and Safety Commission in New Zealand. These are scheduled for publication in mid-2016.At the time of writing,

there were 4,148 and 865 cases recorded on the Australian and New Zealand arms of the registry, respectively (103). The first annual report from the ANZHFR is also scheduled for publication during 2016.

Research agenda – Level A heading

- Fracture Liaison Services (FLS) must be subject to ongoing evaluation of clinical effectiveness and cost-effectiveness in health systems across the world. This should include:
    - Analysis of adherence to clinical standards set in the IOF Capture the Fracture® Best Practice Framework and/or national Clinical Standards or Quality Standards for FLS.
    - Analysis of re-fracture rates for fracture patients managed by an FLS at the national, regional or local level.
    - Comparative cost-effectiveness analysis of FLS in countries with differently financed health systems (e.g. single payer versus open-system fee-for-service environments).
- Orthogeriatrics (OG) Services should also be subject to ongoing evaluation of clinical effectiveness and cost-effectiveness in health systems across the world. This should include:
    - Specifically, with respect to secondary fracture prevention, analysis of adherence to clinical standards set in the IOF Capture the Fracture® Best Practice Framework and/or national Clinical Standards or Quality Standards for FLS.
    - Analysis of the impact of financial incentives related to OG Services.
    - Comparative analysis of the impact of national hip fracture registries in countries with differently financed health systems (e.g. single payer versus open-system fee-for-service environments).

Summary – Level A heading

In 2016, the first of the Baby Boom generation celebrated their 70th birthdays. As a direct consequence, the incidence of fractures caused by osteoporosis is set to rise rapidly. A number of international and national frameworks have been developed to provide standards for FLS to benchmark their performance. These frameworks are useful both to clinicians and health administrators who intend to establish a new FLS and those wanting to refine existing FLS. The frameworks clearly describe the various steps in delivering best practice in secondary fracture prevention for individuals presenting with new fragility fractures. Similarly, in a number of countries, consensus guidelines, Quality Standards or Clinical Standards, and national hip fracture registries have been established to improve the quality of acute care for hip fracture patients, and secondary prevention to prevent subsequent falls and fractures.

The evidence base concerning the clinical effectiveness and cost-effectiveness of FLS and OGS has developed significantly during the last decade. While both FLS and OGS are healthcare delivery systems designed to implement consensus guidance in the acute care of hip fracture patients, and secondary preventive care of all fragility fracture patients, scope exists for further research of the effectiveness of these models of service delivery. Studies which aim to analyze adherence with Quality Standards will determine how achievable delivery of best practice is in different health systems. Analysis of the impact of FLS and OGS on re-fracture rates will provide further evidence to support the ongoing funding of existing clinical services, national policies and financial incentives to reduce the burden of fractures caused by osteoporosis.

Practice Points

At the national level, enablers to the implementation of effective Models of Care for the secondary prevention of fragility fracture that incorporate Orthogeriatrics Services (OGS) or Fracture Liaison Services (FLS) include:

- Establish a clinically-led, national alliance of learned societies, consumer advocacy organisations and relevant government agencies.
- Identify existing Centres of Excellence within the country to illustrate how best practice can be delivered within the context of the particular country.
- Develop the following:
    - Consensus clinical guidelines endorsed by all relevant learned societies and national guidelines accreditation groups.
    - Core Clinical/Quality Standards derived from the consensus clinical guidelines to clearly describe what a high-performing OGS or FLS actually delivers in practice.
    - A mechanism to benchmark individual units' performance against the Clinical/Quality Standards, such as a National Hip Fracture Registry or National FLS Registry.

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