

Coordinator-based systems for secondary prevention in fragility fracture patients

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Received: 31 January 2011 / Accepted: 13 April 2011 / Published online: 24 May 2011
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Abstract The underlying causes of incident fractures—bone fragility and the tendency to fall—remain underdiagnosed and under-treated. This care gap in secondary prevention must be addressed to minimise both the debilitating consequences of subsequent fractures for

patients and the associated economic burden to healthcare systems. Clinical systems aimed at ensuring appropriate management of patients following fracture have been developed around the world. A systematic review of the literature showed that 65% of systems reported include a dedicated coordinator who acts as the link between the orthopaedic team, the osteoporosis and falls services, the patient and the primary care physician. Coordinator-based systems facilitate bone mineral density testing, osteoporosis education and care in patients following a fragility fracture and have been shown to be cost-saving. Other success factors included a fracture registry and a database to

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This manuscript has been endorsed by the Committee of Scientific Advisors of the IOF.

A related editorial can be found at doi:10.1007/s00198-011-1643-9; other related articles at doi:10.1007/s00198-011-1534-0, doi:10.1007/s00198-011-1544-y, and doi:10.1007/s00198-011-1638-6.

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monitor the care provided to the fracture patient. Implementation of such a system requires an audit of existing arrangements, creation of a network of healthcare professionals with clearly defined roles and the identification of a ‘medical champion’ to lead the project. A business case is needed to acquire the necessary funding. Incremental, achievable targets should be identified. Clinical pathways should be supported by evidence-based recommendations from national or regional guidelines. Endorsement of the proposed model within national healthcare policies and advocacy programmes can achieve alignment of the objectives of policy makers, professionals and patients. Successful transformation of care relies upon consensus amongst all participants in the multi-disciplinary team that cares for fragility fracture patients.

Keywords Clinical systems · FLS · Fracture prevention · IOF · Osteoporosis · Osteoporotic fracture

Introduction

The number of people sustaining low trauma fractures has increased steeply in recent decades, constituting a major public health concern in terms of personal suffering and economic cost. Fractures related to bone fragility include those of the hip, spine, proximal humerus and distal forearm. It has been estimated that one-third of women and one-fifth of men over the age of 50 years will sustain a major fragility fracture through their remaining lifetime [1]. The ageing of the population in both developed and developing countries will ensure that the burden of fragility fractures will increase for several decades to come, despite the reduction of age-specific incidence observed in certain Western countries [2]. This is particularly so for hip fractures, which typically occur beyond the age of 70. They account for substantial inpatient and residential care costs, are associated with median survival of around 2 years and result in substantial post-fracture morbidity [3–5]. However, low trauma fractures at all skeletal sites are associated with increased risk of future fractures (as well as significant morbidity, loss of quality of life and even mortality). Pharmacological interventions have been shown to substantially attenuate the risk of second fracture, improve quality of life and even reduce mortality amongst such individuals [6–10]. All fragility fractures are therefore sentinel events that should prompt the healthcare system to capture and assess these patients for treatment for secondary prevention of fractures.

Since 16% of patients [11–13] who have sustained a fragility fracture over the age of 50 ultimately yield 45% of hip fracture cases [14–17], targeting of osteoporosis

services to them is highly cost-effective. Yet, recent reviews have demonstrated large unmet needs in the management of these patients: despite the evidence, few patients with fragility fractures receive osteoporosis investigation or treatment [18, 19]. Part of the problem is that the awareness of osteoporosis and the need for osteoporosis treatment are unacceptably low, even in patients with documented fragility fractures. But part of the problem is also that there are few established pathways to deliver the necessary assessments for treatment. These patients’ fractures are typically managed in the orthopaedic environment (e.g. Accident and Emergency Department, Orthopaedic Ward, Fracture Clinic and Orthopaedic Outpatient Department). This environment therefore provides an opportunity within which to capture a substantial proportion of patients who merit post-fracture assessment of future fracture risk and may benefit from intervention to reduce that risk. The goals of this review are to evaluate published models for the secondary prevention of fragility fractures, to assess the effectiveness of coordinator-based systems, to consider the most appropriate means of introducing such systems, to identify goals for advocacy and government relations to support such introduction and to provide models of successful programmes from different healthcare systems worldwide.

Review of case-finding systems in fracture units

A systematic review of the literature on osteoporosis (OP) care initiated in orthopaedic environments was conducted, seeking evidence of effectiveness [20]. To summarize, the databases Medline, EMBASE and CINAHL were searched to identify publications that addressed OP protocols following a fragility fracture. The population was defined broadly with the medical subject heading ‘fractures, spontaneous’, ‘bone fractures’ and ‘hip fracture’. These were combined with the medical subject heading ‘osteoporosis’. The population was combined with as many interventions as possible, including, but not limited to ‘programme evaluation’, ‘diagnostic tests’ and ‘bone density’. Manual searches through the reference lists of the manuscripts retrieved were not performed. The full details of the methodology and findings of the review are reported in more detail elsewhere [20]. In brief:

- Forty-eight studies focusing on OP intervention within 6 months following a fragility fracture were identified in the literature reviewed (up to September 2008).
- The systems described were analysed for their inclusion of various elements, including: whether a dedicated

coordinator was involved; whether patients were educated about OP; whether bone mineral density (BMD) measurement was provided within the programme; whether there was follow-up within the programme; whether there was an intensive, comprehensive, coordinated programme that included all elements of OP care (investigation, education, treatment and follow-up); whether education was provided to the primary care physician either directly, or indirectly via the patient; whether there were audits of implementation of clinical practice guidelines; and whether drug costs were covered.

- The reviewers sorted these models according to similarity in key elements, resulting in the identification of 12 descriptive categories or ‘clusters’, each representing a similar system of care (Table 1). Those programmes that employed personnel, dedicated solely to the organisation and delivery of secondary fracture prevention, were designated ‘coordinator-based’.
- These main outcomes were extracted: BMD testing rates, OP treatment initiation, OP treatment persistence/adherence.

The nature of the interventions varied considerably across the 48 studies. Some were highly facilitated with virtually all aspects of care (e.g. screening, testing, prescribing care) offered by the programme [21], while others focused on a educational component (e.g. letters sent to primary care physicians with patient BMD results and treatment recommendations [22]) and some were much less

intensive initiatives (e.g. audits of practices following release of new clinical practice guidelines [23, 24]). Some studies depended on the patient as the agent of change and sent all education to the primary care provider through the patient [25].

Thirty-one studies (65%) formally described the role of a dedicated coordinator who identified patients, facilitated BMD testing and the initiation of OP care following a fracture, often performing multiple functions within a programme. This dedicated employee (often a nurse or nurse practitioner) could provide a highly coordinated, often comprehensive and customised intervention for fragility fracture patients, acting as a liaison between the orthopaedic team, other specialists, the patient and the primary care physician. This type of intervention programme has been labelled a ‘Fracture Liaison Service’ (FLS) to emphasize the importance of the coordinator’s liaison role to the success of the programme [26–29].

For example, in Edmonton, Alberta, Canada [21], a dedicated OP case manager arranged for BMD testing, provided individual counselling and patient education and arranged for bisphosphonate therapy through the study’s physician in a randomised controlled trial of an intervention for hip fracture. In Sydney, Australia, a medical registrar provided fragility fracture patients with individualized education about OP and their risk factors, offered BMD testing and blood tests for secondary causes of OP, provided advice about nutritional supplementation and antiresorptive treatment and sent patient-specific information to the primary care physician [30]. In Madison, Wisconsin, USA, patients with fragility fracture were

Table 1 Broad descriptive categories of programmes used in an orthopaedic environment to facilitate guideline-based care after a low trauma fracture

Classification [20]

1. Dedicated coordinator screens and educates patients
2. Dedicated coordinator as part of intense programme with treatment and sometimes BMD done within programme
3. Dedicated coordinator, BMD + within intervention; customised education; return patient to GP for follow-up
4. No dedicated coordinator; BMD + within intervention; no follow-up described
5. Dedicated coordinator delivers general education to the patient; return patient to GP
6. Education to GP directly +/- dedicated coordinator
7. Education to the GP via the patient (rather than education directly to the GP); no dedicated coordinator
8. Education/alert from the surgeon to the specialist; no dedicated coordinator
9. Education to the GP directly, including BMD results; +/- dedicated coordinator
10. Audits of guidelines in practice; no dedicated coordinator
11. Increased drug coverage
12. Efforts to increase general awareness of need for OP management (to healthcare providers and/or patients); no dedicated coordinator

Categories 1, 2, 3, 5 and sometimes 6 and 9 involve coordinator-based systems for secondary prevention of fragility fractures. An ‘intense’ programme refers to a highly facilitated programme

BMD bone mineral density, *OP* osteoporosis, *GP* general practitioner

identified through orthopaedic monthly billing data and directly referred to an Osteoporosis Care Service, where a nurse manager provided OP consultation, arranged BMD testing and evaluation of metabolic bone disorders and recommended treatment to the primary care physician based on the patient's BMD results, with regular follow-up at 3- to 6-month intervals [31]. Recently, a large health maintenance organisation in southern California described their 'Healthy Bones' outreach programme, whereby fracture patients, over the age of 50 and other patient groups at high risk for OP (such as all women over the age of 65), are targeted by the computer system for BMD testing, OP education, a fall reduction programme, home safety checks, OP treatment and investigation and referral for investigation of secondary causes of OP [32].

Some coordinator-based systems encouraged greater involvement of primary care physicians in OP care. In one study, an interactive web-based tool at 14 orthopaedic care facilities collected data on fragility fracture patients and generated customised patient education materials and individualized, guideline-based OP diagnosis and treatment recommendations for primary care physicians [33]. Another intervention faxed OP guidelines endorsed by local opinion leaders to primary care physicians, and wrist fracture patients were educated about OP [34]. Thus, the role of the dedicated coordinator took many forms across these studies.

The remaining 17 studies did not always identify a dedicated staff person with specific tasks or describe how the responsibilities of implementing the programme were assigned. Most of these studies were educational interventions directed to the primary care provider either directly from the orthopaedic surgeon [35–39] or indirectly via the patient [25, 40–43]. One intervention focused on providing patient-specific education including BMD results directly to the primary care physician [22]. Two studies measured BMD within the programme as the focus of their work. van Helden and colleagues completed fracture risk assessment and then returned the patient to the primary care practitioner for care [44]. Hegeman and colleagues, on the other hand, provided a programme with BMD testing for all women with wrist fractures who were over 55 years of age. In those with low bone mass, treatment was recommended [45]. Two studies conducted audits of OP care based on clinical practice guidelines [23, 24], and one evaluated the effect of increased OP drug funding post-fracture [46]. It should be noted that some of these programmes may have also had a coordinator or dedicated staffing to mail letters or schedule BMD testing, for example.

In summary, the programmes were described in varying degrees of detail in the published papers. Key components were extracted and verified by 42 of the 48 corresponding authors (the remaining authors did not respond to the

emails). The clustering of programmes was solely designed to facilitate the description of the programmes and could be modified by other raters. One point that emerged clearly is that it is important for studies to describe their interventions in a comparable manner in order to facilitate comparisons across studies and elucidate trends in a review such as this.

Outcomes of the various systems

Ultimately a comparison of effectiveness across the different models of care would require a meta-analysis of high quality studies of efficacy or effectiveness. This was not the focus of this review, as many of the reports were descriptive in nature rather than randomised trials. Secondly, the analysis of many reports was difficult because of inconsistency in the metrics used. For example, while one study reported treatment rates as a percentage of all patients presenting with a fragility fracture and consenting to a clinical trial [21], another reported treatment rates as a percentage of all patients who were seen by their general practitioner (GP) for OP care [47] or as a percentage of those with follow-up (rather than intention to treat analyses) [30] or of those who had a positive test result [25]. The resultant numbers were not comparable, and usually the data were not provided in a manner that allowed a common or equated value to be derived.

Nevertheless, the analysis provided useful lessons, especially from comparative studies. Models based solely on educational interventions for the patient and the physician have improved OP investigation (BMD testing) but have had limited success in improving OP treatment rates [25, 40, 43, 48–51]. In a recent clinical trial comparing a multi-component provider and community-based educational intervention versus usual care [52], the educational programme produced no statistical difference with regard to referral for a BMD test or prescription of OP medication and the authors called for an end of education-only interventions: 'It is clear that educational interventions alone are unlikely to improve osteoporosis management in the fracture population. This study adds to other similar negative published results and suggests to those interested in improving osteoporosis care to reconsider the hypothesis that increasing provider and public knowledge might improve the under-management of this and other chronic diseases' [52].

The ineffectiveness of education alone does not refute the importance of education as a component of an integrated system. General education for patients and primary care physicians was widely reported, with 16 interventions discussing patient-specific education that in some cases included informing patients of their BMD test results, calculated 10-year fracture risk and evidence-based recommendations [53]. These studies have recognized the

need to engage the patient as a partner in the process of OP care following a fracture. This is important as many studies have found low rates of participation in OP programmes after fracture. Che and colleagues reported that 62% of patients approached declined to participate in a programme [54]. Edwards and colleagues reported low compliance with follow-up to the primary care physician [55]. Those programmes that were intensive and provided follow-up and engagement with the patient resulted in higher adherence to the programme [51].

Coordinator-based systems showed a trend towards higher success rates in prospective randomised controlled trials [21, 42, 51, 54, 56]. In a study of low trauma hip fractures, 42% of patients in the intervention group compared to 19% of those subject to standard care received appropriate OP management (BMD testing or BP treatment) ($p=0.036$) [56]. Another study showed an increase in the proportion of participants offered one or more osteoporosis-specific best practices (BP treatment, BMD testing and/or calcium and vitamin D alone), from 35% in the comparative group to 68% in the intervention group ($p<0.05$) [42]. A coordinator-based system using an OP care manager improved BMD testing from 18% (usual care) to 52% (intervention group) (adjusted relative risk [RR] 2.8, 95% CI 1.9–4.2, $p<0.001$), and increased BP prescription from 7% to 22% (adjusted RR 2.6, 95% CI 1.3–5.1, $p=0.008$) in wrist fracture patients [51]. The effect of such programmes on fracture incidence has not been evaluated in a true randomised controlled trial. However, in a prospective observational study, Dell and colleagues found a decrease in the overall hip fracture rate of 38.1% compared to the expected number of hip fractures [57].

Measurement of BMD

Investigation remains an important element of OP care, including BMD testing by dual-energy X-ray absorptiometry (DXA). This is the current standard for diagnostic classification, assessment of fracture risk and monitoring for therapeutic effect and is validated for use with the World Health Organization fracture risk assessment tool (FRAX®). BMD testing was done as part of the OP care programme in the majority of the studies reviewed [21, 23, 26–31, 45, 48, 49, 54, 58–65]. In others, education about the need for OP follow-up and testing may have been provided, but the BMD was not ordered or done as part of the programme. Of those studies that actually reported the results of testing done in their programme, the majority of patients tested had evidence of at least some degree of bone loss, with DXA-defined osteopenia (T-score between -1 and -2.5 standard deviation) or DXA-defined OP (T-score equal or below -2.5 standard deviation) [45].

Given that overall only about one-third of patients over the age of 50 with clinical fracture presentations have DXA-defined osteoporosis [7, 66–68], there remains controversy about the necessity for DXA scanning in secondary prevention systems. On the one hand, BMD clearly lacks sensitivity—though it is highly specific—and many experts fear that insistence on a formal demonstration of osteoporosis before giving treatment will lead to fractures that could have been prevented. On the other hand, the evidence base that bone-protective treatments reduce the incidence of non-vertebral fractures (that account for 96% of clinical fracture presentations) has mainly been acquired in osteoporotic patients. However, prevention of secondary fractures (including non-vertebral fractures) has been demonstrated after hip fractures in response to IV zoledronic acid, without prior DXA scanning [7], and that after vertebral fracture, reduction in vertebral and non-vertebral fracture risk can be achieved at higher levels of BMD, or in the case of two or more baseline vertebral fractures, without the need for prior DXA [69]. Furthermore, zoledronic acid has been shown to reduce the risk of subsequent fractures in patients with a BMD T-score above -2.5 and existing vertebral [70] or hip fractures [7]. FRAX® without BMD has also been shown to effectively identify a population responsive to intervention [71].

In any event, the criteria for initiation of treatment are a matter of healthcare policy, which varies in different countries. Whatever the policy in a given location, its implementation in post-fracture patients will be smoother and more consistent if there is a coordinator-based system in place.

Falls assessment

Falls precede the majority of fractures, with the exception of vertebral fractures, and it has been suggested in recent reports that focus should shift towards fall prevention at least in the elderly [72]. However, although there is substantial evidence that fall prevention strategies reduce the number of falls, even in patients with dementia after hip fracture, less evidence is available about their effectiveness in preventing fractures [73–78]. Many of the established risk factors for falls have been shown to increase fracture risk as well [79], and this suggests the need for a coordinated programme, with an integrated approach for fall and fracture prevention.

Moving on to initiation of treatment

To a greater degree than with other chronic asymptomatic conditions (e.g. type 2 diabetes mellitus, hyperlipidemia or hypertension), the fragility fracture patient must navigate several steps prior to initiation of OP treatment, including

follow-up with the primary care physician, BMD testing, communication of results, treatment recommendations and prescription. A trend was noted to the reporting of the impact of the programme being mostly on short-term outcomes, and less so on long-term ones. For example, educational programmes led to further knowledge, with or without increased rates of BMD testing, but they did not translate to an increase in treatment initiation [43, 52]. More comprehensive programmes provided education, testing and communication of test results.

The importance of adherence

Clearly success, or improved clinical outcomes, depends on the long-term adherence to osteoporosis treatment [80]. Based on clinical trials, better initiation of and short-term compliance with treatment can be expected from comprehensive programmes that take responsibility for all steps, from the fracture to the initiation of osteoporosis treatment [21]. However, further work is required to investigate longer-term adherence.

Summary of lessons learned from the review

- Coordinator-based systems to facilitate care have become the most common intervention model reported in the literature, although the role of the dedicated personnel varies. The message appears clear that the orthopaedic surgeon requires support to effectively initiate comprehensive OP care in the fragility fracture patient. Coordinators were either directly attached to the fracture clinic or found patients through electronic links to fracture databases, health records, etc. Coordinators appear to be able to overcome many of the barriers that result in the widely reported low rates of OP intervention and treatment in fragility fracture patients around the world.
- The inclusion of customised education, including giving individual 10-year fragility fracture risk, recognises the need to engage the patient as a partner in the process of OP care following a fracture and achieves higher adherence to the programme. Programmes based exclusively on patient education are not sufficient in improving treatment rates, and thus reducing fracture risk.
- Most programmes have room for incremental improvement. While treatment rates may never reach 100%, because patients may be unable or unwilling to take medication, and because not every fragility fracture patient has an indication for pharmacological treatment, optimal levels of investigation and care for different patient groups must be defined: (1) naive to treatment but need it, (2) naive to treatment and do not need it and (3) those presenting with fracture while already receiving treatment.
- There is a need to standardise reporting of BMD testing rates, X-ray reports of vertebral fractures, treatment rates and denominators (i.e. the total number of patients at risk for fracture) in the published literature on secondary prevention systems to enable accurate comparisons of studies. The important outcome is treatment, rather than BMD assessment. A consensus on mode of reporting will assist in the current quest to refine effective intervention models.
- More work is needed to demonstrate consistent cost-effectiveness of coordinator-based secondary prevention systems in a variety of health service settings.

Cost-effectiveness of coordinator-based systems

Although cost-effectiveness was not addressed in the systematic review described above, two other Canadian studies provided information supporting the cost-effectiveness of an intense coordinator-based system for patients with a hip fracture [81, 82]. Both estimated the number of future hip fractures prevented and conducted sensitivity analyses that demonstrated a robust model with the coordinator programme dominant over usual care. Majumdar and colleagues [83] showed that the intervention cost \$12 per patient and, for every 100 patients receiving the intervention, 3 fractures (1 hip fracture) would be prevented, 1.1 quality-adjusted life year gained, and \$26,800 saved by the healthcare system over their remaining lifetime.

A recent health economic analysis has established that the Glasgow FLS, in the UK, is cost-effective for the prevention of secondary fractures and is cost-saving. Compared to usual care in the UK, for every 1,000 fragility fracture patients assessed by the FLS, 18 fractures (including 11 hip fractures) will be prevented, with net cost-saving of £21,000 (€23,350, US\$ 34,700) after taking into account all costs including costs of treatments [84]. In the UK, the Department of Health accepted the following arguments: based on the evidence (1) that half of hip fracture patients have suffered prior fractures [14–17] and (2) 16% of post-menopausal women have sustained a fracture [11–13], it follows that a FLS provides an opportunity for early intervention for half of all potential future cases of hip fracture by targeting only one sixth of the post-menopausal population. Cost savings from national implementation of FLS, potentially amount to £8.5 million over 5 years. Though these analyses support the cost-effectiveness of a coordinator-based approach to FLS provision, more work is needed to establish consistency of cost-effectiveness and cost-benefit in different health funding environments.

Implementation of coordinator-based systems—the authors' experience

The first step in the implementation of a coordinator-based system is to place the concept onto the provider's agenda (Table 2). The most powerful way to do this is through audit—both of the efficiency of the existing osteoporosis service, if there is one, and the reliability of delivery of secondary prevention to fragility fracture patients—perhaps starting with an easily retrievable, defined group such as hip fractures. The key question is whether the needs of those at highest fracture risk are being addressed through the existing service. Such review usually identifies (a) disproportionate use of resources (financial, personnel time and DXA scanning) for patients who are fundamentally at very low risk of fracture and (b) shockingly low rates of intervention post-fracture, where the need for, and cost-effectiveness of intervention is well documented.

Services developed by clinical networks tend to succeed while services set up by stand-alone units struggle to remain viable. Multidisciplinary support is now essential in service innovation and development and step two is therefore to assemble the development team. Examples of the disciplines that might be involved in service development are listed in Table 3. Multidisciplinary engagement in service provision, management and development will ensure that the service evolves in a way that addresses the needs of all interested parties; the service must be patient-centred.

There is a necessity for a lead clinician who will act as a local champion, leading the service development, handling the politics of persuasion, securing funding and leading business case development. The lead clinician should have an ongoing commitment to lead the service, especially if the service is primarily to be delivered by nurse specialists. The lead clinician could be a consultant endocrinologist, a consultant rheumatologist, a consultant orthopaedic surgeon, a consultant geriatrician, a consultant radiologist or even a primary care clinician but probably should have a medical background. It is essential that one partner in the core team be an orthopaedic surgeon, an insider in the fracture clinic. The

Table 2 Steps in implementation

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- Get the idea onto the provider's agenda
 - Create the service development team, headed by a champion
 - Secure access to post-fracture patients
 - Estimate the workload and resources needed
 - Define the role of the coordinator
 - Engage with the local planning machinery
 - Start prospective data collection
 - Initiate the service and develop it iteratively
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Table 3 A typical multidisciplinary working group for osteoporosis service development

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1. Lead clinician/local champion
 2. Secondary care clinicians—consultant orthopaedic surgeon, consultant radiologist, consultant in care of the elderly medicine
 3. Nurse specialists/nurse practitioners (if appointed)
 4. Primary care clinicians
 5. Patient representatives
 6. Allied health professionals—physiotherapists
 7. Public health consultants
 8. Service manager
 9. Community pharmacists
 10. Prescribing management team member
-

key credentials are enthusiasm for the role and having the time to devote to developing and maintaining the new service. Coordinator programmes cannot be imposed from outside without internal support.

The essence of a coordinator-based system is that it takes the opportunity for secondary fracture prevention directly to the patients without requiring any additional referral process. By working seamlessly in an orthopaedic environment for case-finding, all that is required is free access to patients. The first job of persuasion, if the lead clinician is not an orthopaedic surgeon, is to secure this access.

If a strategic and comprehensive approach to secondary fracture prevention is to be provided, it is essential to model the proposed service for the potential workload. Where data exist regarding numbers of patients—for example women and men over 50 with new fractures—such data should be taken into account to ensure that the service provided has the capacity to address the needs of eligible patients. In defining exactly what is going to be offered, it is essential to build the service around evidence-based practice with regard to post-fracture risk assessment, where DXA feedback can be provided and treatment algorithms are used, that are consistent with agreed local and national guidelines.

If the proposed service is to deploy new personnel such as a dedicated coordinator, it is essential that the professional skills of that person are used optimally. For example, in the Glasgow FLS [28], a fracture liaison nurse (FLN) has the dual roles of case-finding and provision of the subsequent assessment for treatment for fracture secondary prevention. The FLN personally meets (where possible) patients with new fractures, both those attending the out-patient fracture clinic and those who are managed as in-patients in the orthopaedic ward; this initial contact is essential to raise awareness of osteoporosis and to invite the patients for their subsequent assessment. This contact also allows the FLN to provide the patient with written educational materials. Her/his skills are then used in post-

fracture assessment at a ‘one-stop’ nurse specialist clinic consultation at which DXA scanning is performed, absolute fracture risk assessed (taking into account fracture history, clinical risk factors and BMD) and treatment selected and tailored to the patients’ needs from written protocols.

To take into account most major clinical determinants of fracture risk, a calculation tool was recently developed (FRAX®) [53, 85]. FRAX® is a computer-based algorithm (<http://www.shef.ac.uk/FRAX>) that provides models for assessment of fracture probability in men and women from the information provided from clinical risk factors. In addition to the prior fragility fracture, age, sex and body mass index, the model includes determinants of fracture risk like the prior use of glucocorticoids. With FRAX®, the 10-year fracture probability can be derived from these clinical risk factors for fractures, alone or with femoral neck BMD, to enhance fracture risk prediction.

Other service models separate case identification from post-fracture assessment and management and deploy non-clinical personnel for case identification; in some settings, that may be appropriate. Clinical personnel bring added value but only if their skills are substantially utilised. By minimising the need for input from medical staff, there are cost advantages in building a coordinator-based service around nurse specialists. The definition of responsibilities typically would not necessitate any change in the practice of orthopaedic surgeons or primary care doctors, but an essential role of the coordinator is to provide communication links which include these clinicians.

Consensus and shared vision for service development are essential and it is therefore vital to work with local planning processes and structures and with those who commission services and provide funding. As already stated, this work should be founded on a local baseline audit to establish what currently is not happening with regard to providing treatment for fracture secondary prevention to patients with new fractures. Successful access to funding does require understanding of funding opportunities and awareness of the differences between capital funding (one-off, such as purchase of equipment) and revenue funding (recurring staffing costs). Sporadic funding opportunities often arise at short notice—and sufficiently often that it is strongly recommended that a business case is compiled and kept in readiness.

‘If you cannot measure it—you cannot improve it’ (Lord Kelvin). It is essential that the workload processed and outcomes (ideally the subsequent occurrence of secondary fractures but, more likely, the proportion of fracture patients assessed for future fracture risk and counselled about osteoporosis treatment) are recorded in an appropriate database, as ultimately, these data can be fed back to those who provide funding as evidence of service effectiveness and to facilitate ongoing commitment to future long-term

funding. If the database, in addition, is a clinical management tool and facilitates communication with other relevant clinicians such as primary care clinicians, as what happens in many healthcare systems, then there will be less requirement for ancillary and support staff such as secretarial or administrative input.

Drawing on the experience of other established exemplars is to be commended and there are now examples from around the world where successful service development with outcomes have been described. Inevitably, however, the development of a new service will be incremental. Such evolution requires ongoing engagement with all stakeholders and, crucially, continuous data. This is another benefit of having a database at the hub of the service.

Advocacy and government relations

Coordinator-based systems for secondary fracture prevention provide healthcare commissioners with an effective mechanism to tackle a major burden on public health. They have been shown to be cost-effective, indeed cost-saving, but do require initial investment. Therefore, in these cash-limited times, it is necessary, in parallel with efforts to establish such systems in individual institutions, to cultivate endorsement of the model within healthcare policy at a national level. In seeking endorsement, the key stakeholder groups to be considered are policy makers, professional societies and patient associations.

The drivers and barriers to implementation vary between stakeholder groups within one country and between countries with differently structured healthcare systems. However, what must, in some form, happen everywhere is that the example of efficient systems in a few hospitals is used to spearhead the development of national policy. The key steps in achieving this are shown in Table 4.

It may well be helpful during this process to put the issue in the context of current, established healthcare priorities, particularly the issue of acute hip fracture management, which is universally seen as an expensive headache for health services. The coordinator-based system can then be presented as a potentially cost-saving solution, not another cost on healthcare.

Some examples follow.

UK

The exemplar system here was the FLS in Glasgow, mentioned above [28]. A programme of peer-to-peer education led to sharing of best practice across the UK, and by 2005, approximately 30% of UK hospitals had established a FLS [86]. The relevant professional societies (orthopaedics, geriatrics, endocrinologists, rheumatologists,

Table 4 Steps in advocacy at the national level

- Establish an exemplar system using the approach described in Table 2
- Use it for peer-to-peer education and establish new sites
- Collect and present data to demonstrate to professional peers and commissioners that it is working well
- Form a coalition of relevant professional societies and patient associations
- Define nationally agreed implementation guidelines
- Conduct national audit of secondary prevention delivery in units with and without the coordinator-based system
- Seek a government-supported policy working group to achieve uniform best practice
- Implement national policy

musculoskeletal specialists in primary care and trauma nurses) joined forces with patient groups (the UK National Osteoporosis Society and the charity Help the Aged) to lobby central government to establish universal provision of FLS. All contributed to the publication in 2007 of the ‘Blue Book’ on the care of patients with fragility fracture [87] which stated: ‘Establishment of an integrated Fracture Liaison Service in every UK hospital... offers the optimal system of healthcare delivery... for all patients presenting with fragility fractures’.

In response to this persuasion, the Health Secretary established a working group on falls and fragility fractures within the Department of Health [88], tasked with producing guidance to commissioners that would drive adoption of best practice. In 2009, this was released as government policy in the *Prevention Package for Older People* [89], which laid out four targets, in order of priority (see Fig. 1). The provision of coordinator-based, FLS-type systems was identified as the second priority, after transformation of acute services to hip fracture patients, with the overt objective of preventing hip fracture by implementing existing national guidance on secondary prevention [90].

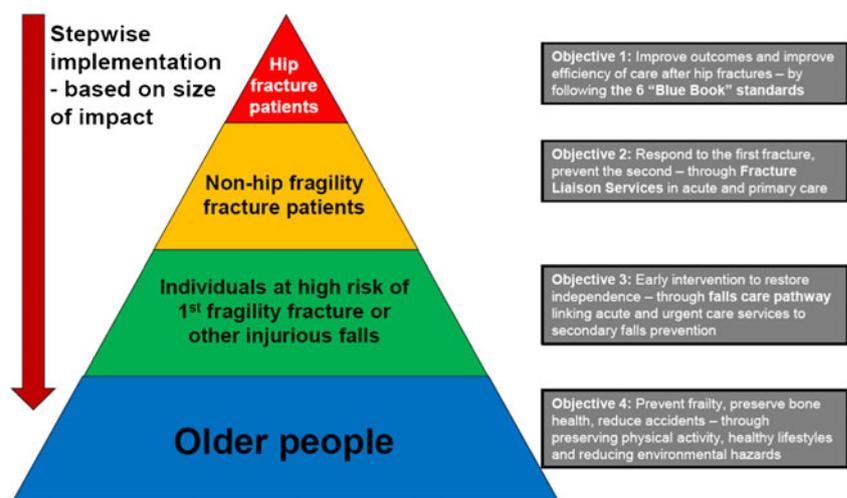
Following publication of the Prevention Package, the UK National Osteoporosis Society launched the ‘Fighting for Fracture Liaison Services’ campaign [91], encouraging

members to write to their local Member of Parliament and Chief Executive of the local health authority to ask them to improve falls and fracture services in their community, with a particular focus on provision of new FLS in localities lacking a service. During 2010, a national audit will re-evaluate provision of services [92] in 70% of the UK population shown to be lacking a local service in the audit of 2009.

Australia

Osteoporosis is a major focus of the 7th National Health Priority in Australia—Arthritis & Musculoskeletal Conditions. The National Steering Committee of the Health Priority determined in 2006 that a major objective for Osteoporosis should be ‘Secondary Fracture Prevention—Optimal Models of Care’. Toward that end, Osteoporosis Australia, the national patient organisation, was commissioned by the Federal Department of Health & Ageing in 2008, to undertake a Scoping Study to inform the development of a nationwide Next Fracture Prevention Program. The aim of this study was to provide a methodology and strategies for coordinating medical and healthcare professionals to provide optimal osteoporosis care for all Australians. Through the auspices of Osteopo-

Fig. 1 Department of Health for England: systematic approach to falls and fracture prevention [89]



rosis Australia, a Fracture Think-Tank was organised with all key experts and stakeholders to discuss outcomes and make recommendations for a change-package for best models of care for secondary fracture prevention in Australia. A national audit was undertaken that showed that less than 40% of centres concerned with fracture patients had a formal programme or protocol in place for identifying and managing these patients. A hospital-wide Fracture Protocol was in place in only 30% of centres surveyed. Most existing services involved a team of health providers and some were interdisciplinary but only a minority of services were government-funded. On the other hand, the analysis of existing literature showed that implementation of fracture services results in more patients being diagnosed and treated for osteoporosis. Following recommendations to the Federal Government to support the implementation of FLS in teaching hospitals across Australia, the response was that currently there was not enough evidence for cost-effectiveness to bring a national policy change.

Canada

In 2005, the Ontario Government committed \$5 million per year for an Osteoporosis (OP) Strategy consisting of five components, with the primary goals of reducing morbidity, mortality and costs from osteoporosis-related fractures [93]. Responsibility for this integrated, comprehensive plan is shared across several professional and patient organisations and academic teaching hospitals. Osteoporosis Canada is involved in each initiative (www.osteostategy.on.ca).

A major focus of the Ontario OP Strategy is on post-fracture care. A multifaceted intervention programme was developed to improve osteoporosis diagnosis and treatment in the fracture population to prevent future fractures by increasing collaboration between orthopaedic surgeons and family physicians [61]. It aims to improve the osteoporosis knowledge of both patients and health professionals—including hospital administrative staff. Nineteen Osteoporosis Screening Coordinators are deployed in 36 medium to high volume fracture clinics across Ontario to screen and identify fragility fracture patients, educate them on osteoporosis and their risks and recommend follow-up with the family physician for further investigation and treatment. Family physicians receive a standardised form letter recommending follow-up testing and treatment. At 3- and 6-month follow-up, data are collated on (1) self-reported risk factors, osteoporosis treatment and adherence; (2) BMD results; (3) osteoporosis knowledge and beliefs; and (4) socio-demographics. Each hospital has identified an orthopaedic surgeon as the ‘Orthopaedic Champion’ to support the coordinators and promote the programme strategy. A website provides ongoing coordinator training

and facilitates communication. Analysis for programme evaluation and improvement is continuing. Approval from each hospital Research Ethics Board was obtained in order to access data for research use. Post-fracture best care practices are also being promoted and implemented in long-term care and rehabilitation centres. In rural and remote communities, a centralized coordinator identifies patients from emergency department records, provides telephone advice and provides referral to family physicians for appropriate osteoporosis testing and treatment.

The other components of the Ontario OP Strategy include:

- **Health Promotion (Primary Prevention):** Educational materials and programmes have been produced for three targeted groups (the elderly, post-menopausal women and children and adolescents) to promote bone health and increase OP awareness.
- **Bone Mineral Density (BMD) Testing, Access and Quality:** To increase the quality of BMD testing and reporting and appropriate utilization of BMD testing, a Canadian BMD Facility Accreditation Program (in collaboration with the Ontario Association of Radiologists), a Recommended Use Requisition form for BMD testing and a common BMD reporting system have been developed.
- **Professional Education:** To improve medical professionals’ utilization of clinical practice guidelines, the Ontario College of Family Physicians has created three evidence-based education modules (Male Osteoporosis, Breaking News about Breaking Bones and Post-Menopausal Women’s Health) and a practice toolkit.
- **Research and Evaluation:** An Osteoporosis Research, Monitoring and Evaluation Working Group consisting of representatives from the Ontario Ministry of Health and Long-term Care and all Strategy-funded projects has developed a monitoring and evaluation framework to evaluate the impact of the Strategy in improving OP prevention and treatment. The framework outlines a core set of performance indicators, data elements, data collection methodology and protocols for reporting.

USA

In the USA, a growing number of publications have described models of best practice within individual institutions [31, 55, 94] and initiatives to disseminate the coordinated model across healthcare regions [32, 95]. There is strong evidence in the USA that aggressive osteoporosis management programmes in integrated healthcare systems can reduce the risk of fractures and save money [57, 96]. At a national level, several initiatives are committed to improving the quality of post-fracture care for patients.

The American Orthopaedic Association's *Own the Bone* Initiative provides tools to improve the prevention of secondary fractures and a structure to monitor physician compliance [33]. In June 2009, the National Coalition for Osteoporosis and Related Bone Diseases published a *National Action Plan for Bone Health* [97] for the purpose of implementing recommendations for OP care made by the US Surgeon General in 2004 [98]. The American Society for Bone and Mineral Research and the National Osteoporosis Foundation are members of The Bone Coalition. The National Action Plan describes fracture as a sentinel event in bone health management: 'Just as a first heart attack is now seen as a sentinel event for treating cardiovascular disease, the first fragility or low-impact fracture must be seen as an intervention opportunity.' In line with this, the Joint Commission are developing measures for hospital accreditation based on whether fragility fractures are diagnosed and/or treated, and Healthcare Effectiveness Data and Information Set for managed care groups.

The coordinator-led approach of delivering secondary fracture prevention by a case manager, usually a nurse, is advocated in addition to the concept of multidisciplinary bone health teams charged with ensuring seamless patient care across specialities. A major challenge to implementing fracture prevention programmes in the USA is fragmentation in providing medical services in many locations, where hospital care, rehabilitation, nursing home and office care may be provided by individuals with poor communication methods and perhaps differing incentives and motivation. In these situations, the role of a local medical champion and nurse-coordinator takes on particular importance.

Sweden

Coordinator-led programmes, most commonly based around a specialist nurse, have been developed in a number of local hospitals in the various regions, while the success rate has varied depending on access or no access to bone densitometry. Other approaches include orthogeriatric units, applying a comprehensive view on the health of the aged with a fracture, including limiting the propensity to fall by both training and systematic reduction of medications. The national agency governing healthcare, the National Board of Health and Welfare, is currently reviewing the evidence for efficacy of osteoporosis treatment and is highlighting systems systematically evaluating secondary fracture risk and its prevention.

Belgium

A coordinator-based system for secondary prevention in fragility fracture patients was recently initiated at the Leuven University Hospitals, the largest academic hospital

setting in the country. The project is currently supported by research funding and serves as a pilot project that may ultimately result in government funding in a selected number of institutions. In the programme, all patients admitted to the Leuven University Division of Traumatology with hip fractures or other types of non-vertebral fractures are counselled by a consultant orthopaedic surgeon (the lead clinician acting as local champion) about the significance and consequences of the underlying osteoporosis and the need to treat the underlying disease, are supplemented with calcium and vitamin D and, within 4–6 weeks following fracture, referred to the Leuven University Center for Metabolic Bone Diseases. This centre is a multidisciplinary initiative of the Divisions of Geriatric Medicine, Rheumatology, Traumatology, and Physical Therapy and Rehabilitation—it provides patients with osteoporosis with the full range of diagnostic and therapeutic options, including DXA measurements, comprehensive fall risk assessments, fall-preventive measures, antiresorptive and anabolic treatments, post-fracture rehabilitation programmes and minimally invasive surgical procedures. Based on this coordinator-based systemic referral pathway, some 80% of all patients admitted to the hospital (Division of Traumatology) with a fragility fracture ultimately end up attending the osteoporosis clinic (Center for Metabolic Bone Diseases). The key challenge will be to obtain structural funding.

Italy

Given the need to ensure a proper anti-fracture treatment to elderly people suffering hip fractures, regional databases in Italy are being used for early identification of fractured patients who are not treated or not compliant to therapies. The use of a regional database allows the identification of patients discharged from the orthopaedic division following hip fracture and monitoring the medication prescribed to them, in order to be sure that they receive appropriate therapy. For example, in 2010, the University of Florence and the Tuscany Region launched the *TARGET* project (Appropriate Treatment of Elderly People occurring in Hip Fractures) (Delibera Regionale N.12 of 25 March 2009; website <http://www.target-project.net>) [99–101]. The Regional Healthcare Authority has instructed that all patients aged over 65, hospitalised because of hip fracture to both public and private hospitals, will be systematically enrolled in the *TARGET* project by the time of their discharge from the orthopaedic division (whether they undergo a surgical procedure or not). The project has a 4-year prospective phase from 2010 to 2013 and a retrospective control period from 2006 to 2009 (based on analysis of the regional hospitalisation and prescriptions database). Since the project is expected to decrease the number of hip re-

fractures, reductions of fracture incidence and costs sustained from the healthcare system between prospective and retrospective phases will be compared and analysed, so that the *TARGET* project can serve as an evaluated model which can be applied in other healthcare settings.

The Tuscany Regional Healthcare Authority will lead the process of informing both the general population and the medical community about the project through official meetings with orthopaedics, other medical specialists, GPs, mini-meetings at local level and leaflets distributed in GP surgeries and the orthopaedic hospital. A monthly newsletter will be sent to all specialists and GPs involved in the project, in order to feed back statistics concerning patients' enrolment and compliance to therapy. Local health authorities and hospital executive boards will be informed of the percentage of elderly hip fractured patients properly treated with anti-fracture drugs, their compliance and persistence rate. This will put a positive pressure on administrative authorities and consequently will foster patients' enrolment by all the specialists and GPs involved. An annual report concerning the project's results will be shared between the University and the Regional Health Authority. The *TARGET* patient database will also be integrated in the national registry of fragility fractures recently launched by the Italian Ministry of Health.

Conclusion

Local and national prevention strategies must be put in place rapidly to overturn the increasing number of fragility fractures occurring worldwide. Patients with fragility fractures are at high risk for future osteoporotic fractures and should be properly managed after their event. To optimise outcome in these patients, a system is needed that integrates rapid referral, effective treatment and secondary prevention. Different clinical pathways have been published in the literature with varying protocols and improved outcomes. However, those using coordinator-based systems have proven their efficacy in improving diagnosis and treatment of osteoporosis in these patients, as well as being cost-effective. Other success factors include an open-access fracture registry and a database to monitor the care provided to the fracture patient.

Examples of progressive initiatives have been outlined, all intended to elevate the priority of secondary fracture prevention and coordinator-based systems as a means of delivery. Despite considerable differences in national healthcare policy and systems, they all have similar components. Whether at the level of a local general hospital or a national healthcare system, successful transformation of care relies upon consensus being achieved amongst all players in the multi-disciplinary team that care for fracture

patients. As many millions of patients present to hospitals worldwide with fragility fractures every year, the opportunity to improve outcomes is too good to miss.

Acknowledgments The Fracture Working Group of the IOF Committee of Scientific Advisors was supported by the International Osteoporosis Foundation. David Marsh, Earl R. Bogoch, Alastair McLellan and Paul J. Mitchell are also members of the ASBMR Working Group on Systems-Based Approaches to Secondary Fracture Prevention. Steven Boonen is a senior clinical investigator of the Fund for Scientific Research, Flanders, Belgium (F.W.O.-Vlaanderen) and holder of the Leuven University Chair in Gerontology and Geriatrics.

Conflicts of interest DM—advisory board for Amgen, Novartis, Servier, Medtronic and Striker Biotech but not in conflict with this manuscript. KA, DB, ERB, SB, MLB, ARM, JS and DAW declare no conflict of interest with this manuscript. PJM has participated in advisory boards and/or provided consultancy to Amgen, Daiichi Sankyo UK Ltd, GSK, MSD-Asia, Novartis, ProStrakan, Roche, Shire and Servier.

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