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Implementing and running a fracture liaison service: An integrated clinical service providing a comprehensive bone health assessment at the point of fracture management

Gavin Clunie MD FRCP (Consultant Rheumatologist) *, Sonya Stephenson (Specialist Bone Nurse)

The Ipswich Hospital NHS Trust, Heath Road, Ipswich Suffolk IP4 5PD, United Kingdom

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Falls

Summary The importance of screening adults who have fragility, atraumatic or low impact fractures for underlying osteoporosis has been highlighted in recent British Orthopaedic Association Guidelines and by The American Orthopaedic Association's 'Own the Bone' initiative. Fracture Liaison Services are an efficient way of managing patient screening in a population at high risk of osteoporosis. How a service might be devised, constructed and run in an acute Orthopaedic Unit is illustrated by reference to our own experience, in a UK Hospital serving a population of 320,000 and informed from our own audit data. We discuss the way that varying patient screening thresholds can be considered to focus resources and aim to provide information for those planning a Fracture Liaison Service within an Orthopaedic Unit. We also emphasise the existence of previously-undiagnosed occult conditions (in addition to osteoporosis) in patients <75 years old presenting with fracture but disclosed by routine detailed laboratory tests.

Editor's comment
Older patients who have suffered a fragility fracture remain the largest cohort of patients in any orthopedic trauma unit. Bone health is a significant issue in post-fracture management. This important paper adds significantly to the discussion about the management options that might improve outcomes for this group of individuals. Preventing future fractures and falls is central to providing high quality care. The paper offers advice, based on sound experience, to those considering developing a Fracture Liaison Service for elderly fracture patients and enhances our understanding of likely successful interventions for this large and vulnerable group. **PD**

* Corresponding author. Tel./fax: +44 1473 702039.
E-mail address: gavin.clunie@doctors.org.uk (G. Clunie).

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Introduction

Osteoporotic fractures can be prevented. The evidence for the success of osteoporosis drug treatment in preventing fractures is robust (Eastell et al., 2001; Liberman et al., 2006). Often the first indication of osteoporosis is a low trauma or insufficiency (fragility) fracture. Such fractures increase with age, are associated with age-related increases in morbidity as adults grow older, and high cost (Marsh, 2007). Although having a fragility fracture is one of many risk factors that might predict future fracture risk; it is the most obvious risk factor that will come to routine medical attention. It would seem logical to invoke an osteoporosis assessment at the time of fracture, identify those with osteoporosis and intervene with preventive therapy. Consensus opinion about the need for detecting osteoporosis in fracture patients and intervening with preventive management has been recognised as a key strategic aim of orthopaedic fracture care in a widely distributed British Orthopaedic Association (BOA) document (Marsh, 2007).

The 2007 BOA document rightly focuses on the need to establish good liaison services with Orthogeriatricians so that elderly fracture in-patients are evaluated for their medical needs including osteoporosis and falls risk (Stephenson, 2003). This is appropriate given the strong association of falls in the elderly with fracture risk and underlying medical problems (Albrand et al., 2003) and association of increasing age with increasing fracture risk generally. A comprehensive service needs to additionally capture both non-elderly patients less than 75 years old and those not hospitalised with fractures.

The process whereby patients presenting with fracture are systematically assessed for osteoporosis and then offered appropriate interventions to reduce their future fracture risk has been termed, by its pioneers, a 'Fracture Liaison Service' (FLS) (McClellan et al., 2003). Here we outline the requirements of such a service, its potential costs and required infrastructure, illustrated by reference to our own audit data. We will discuss the challenges to providing an FLS from our own experience. We hope these data and our experience provide useful information for those involved in the set-up and development of FLSs in other hospitals serving a similar population to our own.

FLS structure

There is an important need for an Orthogeriatric Service (OGS) in managing medical and rehabilitation needs of inpatient hip fracture patients (Marsh, 2007, Standard 4, Table 1). However, in providing a service to comprehensively screen all relevant 'at-risk' patients for osteoporosis, not just the elderly with hip fractures, it will be insufficient for Orthopaedic Units to provide an OGS alone. Inpatients under 70 years old and people above an age threshold (over 50 years old for example) seen only in Accident and Emergency (A&E) and fracture outpatients will ideally need to be captured. This has been outlined under Standard 5 in the BOA document (Marsh, 2007) (Table 1). Our data suggest that a typical UK Orthopaedic Unit will see about 200 patients per 100,000 population per year age 45—69 years with fractures (Table 2), the majority of whom will not need admission to hospital. About one fifth of this age-group overall will be diagnosed with osteoporosis on conventional World Health Organisation (WHO) bone mineral density (BMD) criteria (Table 3) and will require long-term treatment with osteoporosis drug therapy. It may be inappropriate for geriatricians to run an FLS for this patient age-group and ideally a bone physician, endocrinologist or rheumatologist should be sought to lead an FLS in tandem, but overlapping with, an OGS. Our FLS links

Table 1 BOA standards of care: The care of patients with fragility fractures

Standards of care
1. All patients with hip fracture should be admitted to an acute orthopaedic ward within 4 h of presentation
2. All patients with hip fracture who are medically fit should have surgery within 48 h 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 anti-resorptive 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

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Table 2 Patients >45years old with fracture seen in an Orthopaedic Unit over 2 years captured by the FLS

Fracture	Age range						
	45–59y	60–69y	70–79y	80–89y	90y+	Total	Total 2*
Hip	24	44	179	345	154	746	124
Forearm	195	171	185	73	12	636	106
Humerus	45	41	54	20	6	166	28
Lower Limb	133	100	65	28	8	334	56
Pelvis	4	3	17	33	13	70	12
Spine	5	6	18	11	6	46	8
Other	184	120	95	35	3	437	73
Not specified	21	16	12	9	1	59	10
Total	611	501	625	554	203	2491	
Total 2*	95	78	98	87	32		390*

Data also adjusted per 100,000 population/year. Data derived from 2y period January 1st 2005–31st December 2006.
* Data adjusted: patients with fracture per 100,000/yr population served by the hospital (approximately 320,000).

Table 3 Osteoporosis defined by lumbar spine, femoral neck or total hip BMD criteria (DXA) in fracture patients 45–70 years old (2 year data).

	WHO grade osteoporosis classification				
	Number of patients (% of scanned patients)				
	Osteoporosis	Osteopaenia	Normal	No DXA data	Totals
Fracture not specified	5 (14%)	15	16	1	37
Proximal femur	13 (37%)	12	10	33	68
Distal forearm	78 (22%)	146	123	16	366
Proximal humerus	19 (24%)	37	22	8	86
Distal lower leg	23 (11%)	81	99	29	233
Pelvis	2 (40%)	2	1	2	7
Vertebrae	4 (50%)	4	2	3	11
Other	39 (13%)	121	138	6	304
Totals	183 (18%)	418	411	98	1112

with an OGS, both are supervised by the same senior nurse and each operates using common guidelines utilising the same patient database and data sources for audit (Fig. 1).

FLS set-up: who should do it?

The involvement of key individuals is important in obtaining funding and developing a successful FLS. Key stakeholder involvement is appropriate and can be facilitative. Stakeholders in an FLS might include:

- A Public Health Consultant or General Practitioner (GP) with a formal role within the local Healthcare Commissioning Organisation for maintaining or developing services for chronic diseases (e.g. in The UK, The Primary Care Trust),
- An effective patient advocate (e.g. from The Local Osteoporosis Society),
- The proposed service lead consultant,
- Orthopaedic representative,
- The Unit/Department Service Manager,
- If already identified, the proposed lead nurse.

We would advise against placing responsibility for developing the service with those in temporary management or medical roles to avoid inertia and diluting the benefits of focussing ownership of the service development within a small team.

In the UK, involvement of a Primary Care Trust (PCT) representative is essential. There are three main areas where we have encountered service configuration difficulties for which specific PCT involvement may be necessary. First, absorbing the cost of an FLS within a national tariff for fracture may be difficult for some Orthopaedic Units. Specific funding streams may need to be identified. Secondly, transferring supervisory consultant

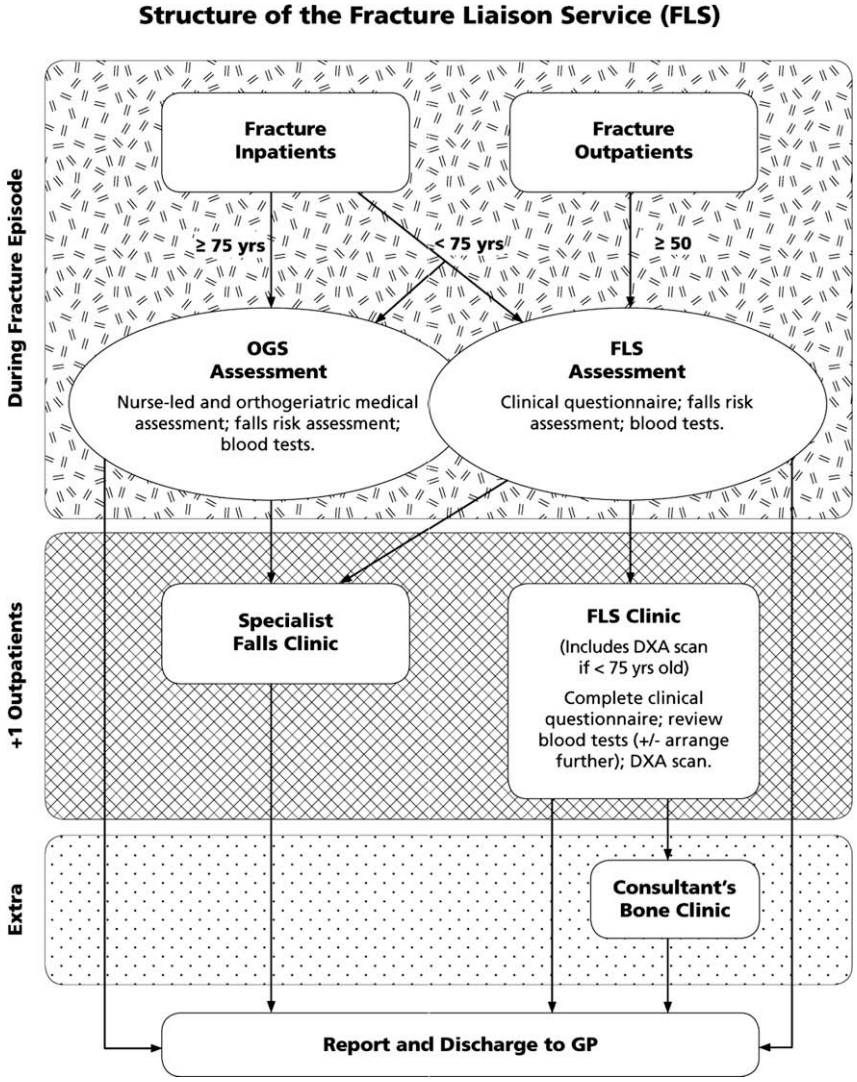

Figure 1 The structure of the Fracture Liaison Service. A majority of patients require a clinic visit (FLS Clinic) in addition to those arranged as part of their routine fracture care. Less than 1% of FLS patients require additional (specialist medical) follow-up (Consultant's Bone Clinic).

responsibilities for each FLS patient from Orthopaedic to the FLS lead (e.g. Rheumatologist) as a new patient may be necessary to avoid FLS activities, risking a breach of the ''18 week referral pathway'' (a UK NHS initiative to drive down patient waiting time from referral from primary care to start of treatment in secondary care once all assessments and investigations have been completed). Without recourse to a new GP referral, a within-hospital referral may need specific PCT agreement. Thirdly, achieving a maximum wait of 6 weeks for a Dual X-ray Absorptiometry (DXA) scan (the case for all diagnostic imaging procedures) may be difficult to achieve for some patients. It may be practically difficult or inappropriate to attend for a DXA scan so soon after their fracture. PCT-agreed protocols may need to be developed.

Deriving resources

If funding from existing budgets is to be realigned, then the role of an effective and imaginative managerial ally is essential. Related initiatives in service development can be useful to facilitate funding. For example, our group worked successfully to secure resources for our FLS at the same time as a highly publicised initiative to buy a DXA scanner. Also, linking such a new service to initiatives that are driven by local healthcare commissioners can facilitate the success of a new service, elevating its (perceived) legitimacy and creating 'buy-in' from healthcare purchasers. This allows bedding an FLS permanently within a wider service infrastructure. This may become easier in The UK if the management of patients with

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previous fragility fracture can be included as a relevant part of Healthcare Improvement Initiatives within the Quality Outcomes Framework (QOF) of the new General Medical Services (GMS) contract (NOS, 2007).

Running a fracture liaison service

Responsibilities

FLSs can be protocolised and led by a specialist nurse. The FLS nurse (and his/her team) is responsible for identifying all fracture patients whether from the ward or from fracture clinic. Patient management protocols can then be applied depending on age and other thresholds for screening (see below) and assessments planned in a way to minimise the patient's journey. For example, some blood tests can be done at the time of initial management of the fracture and a further single visit booked to a clinic where the patient has a DXA scan and a clinic consultation with the lead nurse. The lead nurse can then undertake a clinical and falls assessment, and review of laboratory and DXA scan results (Fig. 1). Treatment guidelines constructed from an evidence base (SIGN, 2007; NICE, 2005) can be followed and the patient given recommendations or started on treatment with a report sent to their GP. Any assessments, which deviate from predicted outcomes/ranges, can be reviewed by the lead physician who might see patients or communicate directly with the patients' GPs.

Planning workload and managing patient numbers

Our experience suggests that about 1250 patients over 50 years old are seen annually with a fracture in our DGH (population 320,000). Should all such patients who fracture be assessed for osteoporosis within an FLS? The characterisation or definition of patients 'for capture' by an FLS is a debated point and services may be configured using different thresholds for capture, which we discuss here.

Should an FLS capture only patients with *low trauma/fragility* fractures or all fracture patients over a certain age? Firstly, *traumatic* as well as *fragility* fractures can be significantly associated with osteoporosis, particularly over the age of 65 years (Mackey et al., 2007). Also, 'any' fracture is a risk for further fracture (Kanis et al., 2004) mainly independently of bone mineral density (BMD), thus validating 'any' fracture as a key qualifying risk factor in finding osteoporosis patients. Finally, where services rely on non-specialised nursing staff to identify cases the subtlety and discrimination needed to screen fragility from traumatic fracture cases may be lost. Therefore capture of all fracture patients over a certain age (see below) is reasonable.

We would advocate that, even though certain fracture sites are recognised more frequently as 'osteoporotic fractures' (e.g. forearm, proximal humerus and hip), osteoporosis can present in a substantial minority of patients with fractures at other sites. Our data suggest osteoporosis is not uncommon in those 50–70 years old presenting with fractures of the lower leg as well as fractures at 'other' sites such as metacarpal, metatarsal, rib, clavicle, proximal tibia. Indeed, 62 out of 183 (34%) of our patients 50–70 years old found to be osteoporotic had presented with a distal lower leg fracture or a fracture classified as 'other'.

At what *age threshold* should an FLS capture patients for assessment? Advancing age is an independent risk factor for fracture and applying a higher age threshold would increase the proportion of those identified for treatment compared with using a lower age threshold. This would reduce patient throughput if resources were limited, be commensurate with the rigorous cost-effective analyses of osteoporosis treatments (NICE, 2005) and, ultimately, lead to a more cost-effective service. Some FLSs apply an age threshold of 60 years. However, our data show that 75/581 (13%) patients age 50–59 years old with a fracture had osteoporosis (based on BMD criteria). Our FLS is set up to capture all fracture patients $\geqslant$50 years old.

One objective of a ward-based OGS is to identify elderly fracture patients with recurrent falls or at high falls risk and identify and address underlying causes. From a simple independent audit of discharge data on fracture in-patients over 12 months (mean and median age of 82.5years old), 668 out of 780 (86%) of fractures in our unit were associated with a fall. A documented history or patient/relative/carer recall of falls showed that only 115 out of 668 (17%) of patients had had 2 or more falls in a year (multiple fallers). These data are commensurate with previously published data regarding falls frequency in the community, where recurrent falls occur in 15–20% of people over the age of 65 years old (Morris and Hawkins, 2007; American Geriatrics Society, 2001). Given the average age range of our patients, we were surprised that the number of multiple fallers was not higher. These data may highlight the possibility of self-report of falls in the elderly as an unreliable indicator of falls history.

The degree to which laboratory tests are essential or advisable and cost-effective within an FLS has not

been rigorously studied. The type and extent of laboratory tests arranged on elderly fracture in-patients will chiefly be dictated by clinical assessment on the ward, supervised by the OGS team in the context of any current illness and surgical or anaesthetic requirements. But what of apparently 'well' patients who present via A&E to fracture clinic? Do they need any laboratory investigations? To diagnose simple postmenopausal osteoporosis the answer is ''no'' as no abnormalities would be expected. But osteoporosis has a number of recognised causes (secondary osteoporosis). The incidence and spectrum of secondary osteoporosis contributing to fracture in patients from a single Orthopaedic Unit has not been extensively studied. We have audited new conditions identified in fracture patients 50–75 years old who were tested routinely (regardless of DXA results) with a set of blood tests including bone biochemistry, 25-hydroxyvitamin D, parathyroid hormone (PTH), thyroid and liver function tests, serum protein electrophoresis (if there is osteoporotic-range BMD) and 9am testosterone with luteinising hormone in men (Clunie et al., 2005).

Of 774 consecutive patients we made 52 new diagnoses (other than osteoporosis) in 45 patients (6%). In some patients more than one new diagnosis was made. 'New diagnosis' was defined as a *substantial but previously undisclosed* condition. Thus, over and above any *known* condition previously diagnosed or identified clinically as contributing to the risk of fracture, 1 in 17 fracture clinic patients had a *previously-unknown* condition disclosed for the first time specifically by 'blind' laboratory testing regardless of the (nurse-led) clinical assessment in the FLS. Notably, the major conditions identified (Primary Hyperparathyroidism (PHPT), hyperthyroid disease, chronic liver disease, hypopituitarism, primary testicular failure, osteomalacia, myeloma) were invariably chronic, related to poor skeletal health and were found in 'osteopaenic' as well as 'osteoporotic' patients as defined by BMD. Failure to detect these conditions, at best, would have been an opportunity missed and, at worst, negligent. Furthermore, routine recommendation of (say) a bisphosphonate drug together with calcium and vitamin-D supplements for some of these patients without knowledge of the presence of (some of) these underlying disorders, would have been clinically inappropriate and potentially dangerous.

Importantly, patient numbers through 'The Bone Clinic', which had been set up to follow-up patients with laboratory screening abnormalities (Fig. 1), was manageable – just over 1 patient per week on average. Also, given these patients were initially investigated in a clinic run by a Rheumatologist, additional musculoskeletal morbidity, not disclosed by FLS nurse-led assessment, but relevant to poor skeletal health, was identified as well. Such abnormalities, not recorded here, were frequently seen, often relevant to further fracture risk given musculoskeletal pain, weakness or mobility issues relevant to falls risk (e.g. hypovitaminosis-D related myopathy, arthritis in weight bearing joints, lumbar canal spinal stenosis, leg-length inequalities and other biomechanical conditions such as joint hypermobility syndrome etc).

The degree to which 'blind' laboratory testing should be done, in which patients, at what age and where in the 'patient's FLS journey', needs rigorous study particularly in terms of cost-effectiveness.

Data recording

Orthopaedic Units will regularly be recording fracture workload and increasingly UK units may provide data for the Hip Fracture Database (UK National Hip Fracture Database, 2007). However, recording all FLS data on a dedicated database e.g. *Cellma* (Riomed; www.riomed.com) or *GISMO* (http://www.gismo-glasgow.com) allows clinical, DXA scan and other information to be compiled, exported and audited and results used to inform local service development. Ultimately, the success of fracture prevention strategies for the elderly, such as an FLS, can only be proved by specific recording of osteoporosis and fracture incidence over time in the appropriate adult population, primarily the elderly. The latest version of *Cellma* (*Cellma-3*; RIOMED) can be run on the Secure Health Application Block (e.g. NHS network), which facilitates its usability, allowing it to link Primary and Secondary Care Trusts.

Fracture liaison service resource needs

The following suggestions for initial resource needs are based on our own experience in a typical District General Hospital serving a (relatively stable) population of around 320,000:

- Rheumatology/Endocrinology Consultant lead 1 session/week;
- A lead nurse (0.75 whole time equivalent – WTE);
- 2–3 mid-grade (database literate) orthopaedic/musculoskeletal trained nurses committing, in total, about 1WTE to The FLS with operational duties in Fracture Clinic and the Orthopaedic ward overlapping with OGS duties;

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- OGS regular ward-round medical support;
- On-site DXA scanning. Scans on those >75 years old are not needed. For fracture patients 50–75 years old, a DXA scanning capacity of about 250–300 scans per 100,000 population served per year is required;
- Use of a dedicated database for recording clinical and DXA information, good IT support facilitates and time/support from an audit department;
- Provision to request a limited screen of laboratory tests in most patients;
- A capacity to refer on a small proportion of patients for detailed medical assessment given identified new pathology.

Summary

Setting up and running a FLS requires specific funding, personnel, DXA scan capacity and laboratory resources. Absorbing costs within existing healthcare funding streams and adhering to conventional patient 'journey' targets (e.g. for UK NHS) may be difficult to ensure for a variety of reasons. The costs of an FLS are relatively predictable and can be based on data from a number of units including ours (McCLellan et al., 2003; Clunie et al., 2005). Arrangements for an FLS will need to differ from, but overlap with, arrangements made for an OGS for elderly fracture inpatients. Relevant pathology is *hidden* in a minority of fracture patients age 50–75 years old. Though unusual this pathology is important not to miss and it can be uncovered by a screen of laboratory tests. A dedicated database is useful in recording activity, helping run and plan the service. Recording incident fracture rates will reveal the worth of the FLS and other initiatives in lowering fracture rate in the local population.

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References

American Geriatrics Society. British Geriatrics Society and American Academy of Orthopaedic Surgeons Panel on Falls Prevention. Guideline for the Prevention of Falls in Older Persons. JAGS 49: 664-672, 2001. <http://www.americangeriatrics.org/products/positionpapers/Falls.pdf>.

Albrand, G., Munoz, F., Sornay-Rendu, E., et al., 2003. Independent predictors of all osteoporosis-related fractures in healthy postmenopausal women: the OFELY study. Bone 32, 78–85.

Clunie, G.P.R., Parkinson, C., Stephenson, S., 2005. Screening patients with fragility fracture: the occurrence of previously undetected disease, particularly endocrine disease, is significant. ASBMR Abstract M319. Supplement: J Bone Miner Res, July. <http://www.abstractsonline.com/viewer/SearchResults.asp>.

Eastell, R., Reid, D.M., Compston, J., et al., 2001. Secondary prevention of osteoporosis: when should a non-vertebral fracture be a trigger for action? Quart J Med 94, 575–597.

Kanis, J.A., Johnell, O., De Laet, C., et al., 2004. A meta-analysis of previous fracture and subsequent fracture risk. Bone 35 (2), 375–382.

Liberman, U.A., Hochberg, M.C., Geusens, P., et al., 2006. Hip and non-spine fracture risk reductions differ among antiresorptive agents: evidence from randomised controlled trials. Int J Clin Pract 60 (11), 1394–1400.

Mackey, D.C., Lui, L.Y., Cawthorn, P.M., et al., 2007. High trauma fractures and low bone mineral density in older women and men. JAMA 298 (20), 2381–2888.

Marsh, D., on behalf of The Authorship Group 2007. The care of fragility fracture patients. British Orthopaedic Association. BOA, London <http://www.boa.ac.uk/site/showpublications.aspx?ID=59>.

McClellan, A., Gallacher, S.J., Fraser, M., 2003. The fracture liaison service: success of a program for the evaluation and management of patients with osteoporotic fracture. Osteoporosis Int 14, 1028–1034.

Morris, R., Hawkins, R., 2007. Assessment and management of falls. In: Clunie, GPR, Keen, R.W. (Eds.), Oxford Rheumatology Library: Osteoporosis. Oxford University Press, Oxford, pp. 169–178.

National Osteoporosis Society (NOS, 2007) to submit case for inclusion of osteoporosis in the GP's contract. 07 02 27 NOS QOF Submission (pdf document). National Osteoporosis Society, February 2007. <http://www.nos.org.uk/>.

NICE (National Institute for Clinical Excellence), TA87. Osteoporosis prevention: secondary prevention. January 2005. <http://www.nice.org.uk/guidance/index.jsp?action=download&o=32998>.

SIGN (Scottish Intercollegiate Guidelines Network) Guideline 71. <http://www.sign.ac.uk/pdf/2007osteoporosis.pdf>.

Stephenson, S., 2003. Developing an orthopaedic elderly care liaison service. J Orthop Nurs 7, 150–155.

UK National Hip Fracture Database, 2007. <http://www.shfa.scot.nhs.uk/Workshop/NextStepsMay2007/David_Marsh_NHFD.pdf>.