Fracture prevention services

An economic evaluation

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Fracture prevention services

An economic evaluation

Summary

This economic evaluation assesses the costs and benefits of services to reduce fractures among older people. Local communities can use this to develop their own proposals.

There is strong evidence about the impact and cost benefit arguments for fracture prevention interventions, based on systematic implementation of national guidance on secondary prevention of osteoporotic fractures and other interventions for a targeted at-risk population.

The following is a summary of the main findings of an economic model for the impact of a fracture liaison service, as described in the guide *Falls and fractures: effective interventions in health and social care*[1].

In this model, over a 5 year period **£290,708** is saved in NHS acute and community services and local authority social care costs, against an additional **£234,181** revenue costs (falling both in year 1 and covering drug therapy for five years spent by the NHS on this patient cohort). This is for an annual patient cohort of 797 hip, humerus, spine and forearm fractures, anticipated from a 320,000 population.

At a national level, this equates to approximately £8.5 million saving over 5 years.

1. Falls and fractures: who is affected?

Falls are a major cause of disability and mortality in the UK. Thirty percent of those aged 65 or over who live in the community fall each year, increasing to 45 percent in those aged 80 or above[1]. The main cause of falls is unsteadiness during movement. In addition, some are caused by blackouts (syncope) associated with cardiac or circulation problems. Both become more common with age, due to increasing prevalence of frailty and other long term conditions.

Recurrent falls are associated with increased mortality, increased rates of hospitalisation, curtailment of daily activities and higher rates of institutionalisation. This is compounded by the psychological consequences, such as loss of confidence, increased fear of falling and lower quality of life[2]. Half of fallers will have a further fall within the next 12 months[3]. The rate of falls among people in institutions is almost three times that of older people living in the community,[4] with injury rates also considerably higher.

Bone density and strength also fall with age, particularly in those with other long term conditions such as diabetes. Thus, the chance that a fall will result in a fracture will increase. Fractures which occur after a low impact injury, such as a fall from standing height, are called fragility fractures. Half of older women will experience one in their lifetime. The more frail the individual, the more likely a fracture. For example, 10-20 percent of institutional falls result in a hip fracture.

2. What is the size and cost of the challenge of fractures?

The population is growing older. In England, the number of people aged over 65 is due to rise by a third by 2025. In the same period the number of people over 80 will double and the number over 100 will increase fourfold. This welcome increase in life expectancy is however associated with an increase in years spent with some disabling illness. A significant rise in falls and associated fractures is therefore likely unless specific preventative interventions, outlined below, become widespread.

The numbers are large. For a PCT and local authority with a population of 320,000, there will be around 45,000 people aged over 65 in 2009. Of these[1]:

- 15,500 will fall each year, 6,700 twice or more
- most will not seek help
- 2,200 will attend A&E or a minor injury unit (MIU)
- a similar number will call the ambulance service
- 1,250 will have a fracture, with 360 of these likely to be hip fractures.

Hip fractures remain the most serious consequence of a fall. There is a significant increase in mortality, with 30% mortality at 12 months. Moreover, approximately half of those people who were previously independent become partly dependent following a hip fracture, while one-third become totally dependent.

Hip fractures account for more than 20 percent of orthopaedic bed occupancy in the UK, and in women over 45 hip fractures account for a higher proportion of hospital bed occupancy than many common disorders.

3. Why is identification of osteoporosis important?

Osteoporosis is a chronic disease that weakens bone strength and affects one in three women and one in 12 men aged over 50, particularly post-menopausal women. The incidence in both sexes rises rapidly as the population ages. Its onset is asymptomatic and it is often only recognised after an older person falls and sustains a fracture. Almost half of all women and one in six men experience an osteoporotic fracture before death.

Several studies have considered future fracture risk associated with different kinds of fractures, and identified that a prior fracture at any site is associated with a doubling of future fracture risk. Post-menopausal women are at high risk of fractures because they are at particular risk of osteoporosis.

In a PCT population of 320,000, there are likely to be:

- 55,000 post-menopausal women
- 17,400 post-menopausal women with osteoporosis
- 6,900 post-menopausal women with a previous fracture of any kind
- 1,000 post-menopausal women with a new fracture each year.

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

4. What is the problem?

Most local communities lack any systematic local programme – such as a fracture liaison service covering fallers who fracture presenting to urgent care or a primary care-based case-finding service – to identify and treat osteoporosis in high-risk groups, particularly post-menopausal women.

Without such programmes or services, compliance with National Institute for Clinical Evidence (NICE) guidelines TA161[5] and CG21[6] on secondary prevention of osteoporotic fragility fractures is low. This has been highlighted most recently by the Royal College of Physicians (RCP) 2009 audit[7] of falls and bone health services. This confirmed that across much of the NHS in England NICE guidance is not being widely employed and "*systems to ensure initiation of secondary prevention medical treatments for osteoporotic fragility fractures are not in place*".

As a result, the opportunity to target key groups at most risk of hip fracture and initiate and oversee osteoporosis treatments that significantly reduce fracture risk is being missed. In the RCP national clinical audit of 2007, only 19 percent of over 5,000 patients presenting to hospital with a non-hip fragility fracture were on the appropriate bone medication three months later. This is a major opportunity lost as over 40% of people who sustain a hip fracture have had a previous non-hip fragility fracture.

5. The proposal for a fracture liaison service

The establishment of fracture liaison service, based with acute services, is for patients aged over 50 who are admitted to hospital or who attend outpatient clinics or A&E departments due to a low impact (fragility) fracture, gained from a fall, slip or trip. For a 320,000 population the service would assess about 1250 older people with fragility fractures each year, who will have a clinical assessment by a specialist Fracture liaison service (or Osteoporosis) nurse and some of whom will undergo DXA[8] bone density measurements at the spine and hip (in accordance with NICE guidance TA161). Osteoporosis treatment is typically recommended in about 75% of cases.

The role of the specialist nurse is to:

- investigate, using bone scans and local protocols, and start drug and other treatments, according to NICE guidance for women and local agreements for men, to reduce the risk of a future break if someone has osteoporosis
- link directly with falls services
- monitor and maintain medication adherence
- Support the monitoring and maintenance of medication adherence in collaboration with primary care.

The main costs are for the nurse, a consultant session for clinical support and supervision and some direct patient care, some clerical support, revenue costs for the scanning and pharmacy costs of osteoporosis treatment, usually comprised of a generic bisphosphonate in combination with calcium and vitamin D.

The input of the nurse relates primarily to the first year's membership of the cohort programme, with minimal contact thereafter (for example through letter contact and occasional telephone calls). So it falls to primary care to make the necessary arrangements to maintain medication adherence longer term.

6. Summary of interventions and their effect

The interventions and their effect have been modelled (Tables 1-5) and the service costs estimated. It is important to note that this study is based on a cohort of people. In other words, the model looks at the costs of an intervention for the total number of people identified who have fractured in any one year in a local population. The costs saved are then calculated to reflect the savings that can be achieved from that cohort over five years, with the implementation of this intervention.

Local communities can use the assumptions in this model to develop their own proposals, or include different assumptions that match local circumstances. There is an on-line modelling tool for a fracture liaison service business case at http://fracture-liaison-model.co.uk

Key assumptions built into the model are as follows:

- Out of a typical PCT population of around 320,000 there will, as highlighted above, be around 1,250 fragility fractures of any type per year**.** Published data from an existing Fracture Liaison Service[9] shows a likely breakdown by age and fracture type in Table 1 over a one year period.
- Of this group of around 1,250 fracture annually, this economic evaluation is focusing on the 797 **hip, humerus, spine and forearm fractures** per year, as there is robust research data on the impact of a fracture liaison services in these most significant fracture types. This is in terms of impact on quality of life and higher service cost. For the remaining one third of fractures (pelvis, lower limb, hands and feet) a fracture liaison service could reasonably expect to have a positive impact in reducing further fractures but the costs or benefits are not modelled in this study.
- All the 797 hip, humerus, spine and forearm fractures will be assessed by the fracture liaison nurse, and if necessary the consultant, and 20% of hip fracture patients and 80% of humerus, forearm and spine patients are anticipated to receive bone scans. This is a pragmatic interpretation of NICE TA161 combined with practical experience from existing fracture liaison services.

- In line with NICE guidance[5], many but not all patients scanned will require treatment for osteoporosis: estimated at 100% of the hip fractures (373), 50% of the wrist fractures (159), 75% of spines (17) and 75% of humerus (62): a total of 611 out of 797.
- Using data from a retrospective study – from Johnell[10] about the incidence of secondary fracture, by type, over 5 years – the pattern of secondary fractures for a 320,000 population for each annual cohort can be identified (Table 2). This is based on the age profile expected for patients presenting with fractures at these skeletal sites.
- Factored in to the calculation is a) the percentage of each fracture type to be treated, ranging from 100% of hip fractures to only 50% of forearm fractures, and b) a relative risk reduction through a fracture liaison service of 40% (NICE TA 161[5]). From this therefore, can be estimated the number of fractures actually averted through the service over 5 years (Table 3).
- An assumption of only 80% medication compliance has been included (Table 4), giving actual fractures averted of 18 hips, 5 forearms, 6 spine and 4 humerus over 5 years for each annual cohort.

Table 1: Likely age breakdown by fracture type (Data from Ipswich Fracture Liaison Service)[9]

Fracture	Age Range (years) over 1 year period					
	45-59	**60-69**	**70-79**	**80-89**	**90+**	**Total**
Hip	12	22	90	173	77	**373**
Forearm	98	86	93	37	6	**318**
Humerus	23	21	27	10	3	**83**
Lower Limb	67	50	33	14	4	**167**
Pelvis	2	2	9	17	7	**35**
Spine	3	3	9	6	3	**23**
Other	92	60	48	18	2	**219**
Not Specified	11	8	6	5	1	**30**
Total	**306**	**251**	**313**	**277**	**102**	**1247**

- Research evidence[5] suggests that a fracture liaison service would produce a similar impact on the future fracture incidence for the 453 other fracture sites, in addition to hip, humerus, spine and forearm fractures (for example pelvis, ribs, hands and ankle fractures).

Table 2: Study of the incidence of secondary fractures by type over 5 years (Johnell et al 2004)[10]

	Year of study (No. Secondary Fractures)						Year of study (% Secondary Fractures)					
Site of new fracture	**0 – 1**	**1 – 2**	**2 – 3**	**3 – 4**	**4 – 5**	**0 – 5**	**0 – 1**	**1 – 2**	**2 – 3**	**3 – 4**	**4 – 5**	**0 – 5**
a. Prior humerus fracture (n=268)												
Hip	9	5	4	3	4	25	3.4	1.9	1.5	1.1	1.5	9.3
Forearm	13	3	2	2	2	22	4.9	1.1	0.7	0.7	0.7	8.2
Spine	8	3	1	3	1	16	3.0	1.1	0.4	1.1	0.4	6.0
Humerus	2	3	1	1	1	8	0.7	1.1	0.4	0.4	0.4	3.0
b. Prior spine fracture (n=500)												
Hip	19	11	20	10	5	65	3.8	2.2	4	2	1	13
Forearm	3	5	8	4	0	20	0.6	1	1.6	0.8	0	4
Spine	7	16	18	9	4	54	1.4	3.2	3.6	1.8	0.8	10.8
Humerus	6	2	3	3	1	15	1.2	0.4	0.6	0.6	0.2	3
c. Prior hip fracture (n=1150)												
Hip	27	23	16	12	7	85	2.3	2.0	1.4	1.0	0.6	7.4
Forearm	16	7	2	3	1	29	1.4	0.6	0.2	0.3	0.1	2.5
Spine	18	8	4	2	3	35	1.6	0.7	0.3	0.2	0.3	3.0
Humerus	11	5	6	5	6	33	1.0	0.4	0.5	0.4	0.5	2.9
d. Totals (n=1918)												
Hip	55	39	40	25	16	175	2.9	2.0	2.1	1.3	0.8	9.1
Forearm	32	15	12	9	3	71	1.7	0.8	0.6	0.5	0.2	3.7
Spine	33	27	23	14	8	105	1.7	1.4	1.2	0.7	0.4	5.5
Humerus	19	10	10	9	8	56	1.0	0.5	0.5	0.5	0.4	2.9
Totals	**139**	**91**	**85**	**57**	**35**	**407**	**7.2**	**4.7**	**4.4**	**3.0**	**1.8**	**21.2**

Table 3: Anticipated secondary fractures if no intervention takes place

	Year of study (No. Secondary Fractures)						Year of study (% Secondary Fractures)					
Site of new fracture	0 – 1	1 – 2	2 – 3	3 – 4	4 – 5	0 – 5	0 – 1	1 – 2	2 – 3	3 – 4	4 – 5	0 – 5
a. Prior humerus fracture (n=83)												
Hip	3	2	1	1	1	8	3.4	1.9	1.5	1.1	1.5	9.3
Forearm	4	1	1	1	1	7	4.9	1.1	0.7	0.7	0.7	8.2
Spine	2	1	0	1	0	5	3.0	1.1	0.4	1.1	0.4	6.0
Humerus	1	1	0	0	0	2	0.7	1.1	0.4	0.4	0.4	3.0
b. Prior spine fracture (n=23)												
Hip	1	1	1	0	0	3	3.8	2.2	4	2	1	13
Forearm	0	0	0	0	0	1	0.6	1	1.6	0.8	0	4
Spine	0	1	1	0	0	2	1.4	3.2	3.6	1.8	0.8	10.8
Humerus	0	0	0	0	0	1	1.2	0.4	0.6	0.6	0.2	3
c. Prior hip fracture (n=373)												
Hip	9	7	5	4	2	28	2.3	2.0	1.4	1.0	0.6	7.4
Forearm	5	2	1	1	0	9	1.4	0.6	0.2	0.3	0.1	2.5
Spine	6	3	1	1	1	11	1.6	0.7	0.3	0.2	0.3	3.0
Humerus	4	2	2	2	2	11	1.0	0.4	0.5	0.4	0.5	2.9
d. Prior forearm fracture (318)*												
Hip	–	–	–	–	–	17	–	–	–	–	–	5.4

*Secondary fracture experience projection based upon estimates in Haentjens et al JBMR 2004:12;1933-1944

7. Summary of cost/benefit position

Anticipated savings or costs averted are as follows:

- NHS and local authority social care direct savings combined for a 320,000 population have been calculated at £290,708 over the 5 years, with the majority of fractures avoided, and consequent savings in the first three years (Table 4). There will in addition be reduced social care costs for people who fund their own care, which have not been included in this analysis.
- Key assumptions on cost savings (Table 4) are as follows, based on 2009/10 costs:
  - Each hip fracture averted will avoid commissioners incurring £10,170 PbR tariff costs[11], reduce NHS community service costs by £1,600 per community hospital admission and £400 per referral to intermediate care, and save £3,879 in local authority social care costs over 2 years on average per hip fracture (outlined in Appendix A).
  - Fractures of the humerus, spine and forearm averted will avoid commissioners incurring PbR tariff costs estimated for combined in and outpatients of £1,300, £3,246 and £1,082 respectively, plus local authority social care reduced by £225 per case on average for spine and forearm fractures (outlined in Appendix A).
  - The assumptions about community services input as are follows. For hip fractures, around 20% will have follow-up in a community unit, for an estimated stay of 8 days at a marginal cost of £200 per bed day. A further 20% will receive an intermediate care package of 20 hours, at around £20 per hour. Community service savings for humerus, spine and forearm fractures are estimated to be small and have not been included.
- The costs across primary and secondary care of running a fracture liaison service for each year's cohort of hip, humerus, spine and forearm fractures (comprising two thirds of all fragility fractures) is £234,181 outlined in Table 5. This consists of:
  - Staff costs: two thirds of the total fracture liaison service staff costs in year 1 (with staff time for the year 1 patient cohort covered by other years' cohort costs from year 2 onwards). This reflects the costs associated with

hip, humerus, spine and forearm fractures, which comprise two-thirds of toal fractures in this model. On this basis, staff costs of running a Fracture Liaison Service for these fracture types for a 320,000 population for 1 year are £36,850

- DXA: bone scanning in year 1 is a further £20,690, based on a marginal cost per scan of £50. Based on the age profile and a pragmatic application of NICE TA161 around 20% of hip fracture patients will need a DXA, with a higher proportion (estimated at 80%) for forearm, spine and humerus patients.
- Drug costs: The total treatment cost distributed over 5 years is calculated in this model at £176,641 taking into account 12% mortality, 80% compliance and the availability over the next few years of **generic** risedronate (from 2010), ibandronate (2011) and zoledronate (2012), based on a forecast reduction of 50% overall over four years in the cost of these drugs.

- In addition to savings and capacity released in NHS acute and community and local authority social care, there will also be a very significant quality of life gain for older people who do not incur a secondary fracture. This has not been reviewed in detail in this economic evaluation but is documented in the DH publication: *Falls and fractures: effective interventions in health and social care* (2009).
- Therefore in this model, over a 5 year period **£290,708** will be saved in NHS acute and community services and local authority social care costs, against an additional **£234,181** revenue costs in year 1 and covering drug therapy for five years spent by the NHS on this patient cohort. This is for an annual patient cohort of 797 hip, shoulder, spine and forearm fractures. A sensitivity analysis of the base case estimate is provided in Appendix B.

Table 4: Direct NHS and local authority costs saved

	Years												
Site of fracture averted	**0–1**	**1–2**	**2–3**	**3–4**	**4–5**	**0–5**	**% of patients receiving medication**	**RRR** (%)**	**Fractures averted**	**80%*** compliance**	**Acute care savings (£)**	**Social care savings (£)**	**NHS community services savings**	**Total savings (£)**
Hip	12	10	7	5	4	55*	100.0	40.0	22	18	180,984	69,030	7,118	£257,133
Forearm	9	3	2	2	1	17	50.0	40.0	7	5	5,934	0	–	£5,934
Spine	9	4	2	2	1	19	75.0	40.0	8	6	19,519	1,353	–	£20,872
Humerus	4	3	2	2	2	14	75.0	40.0	6	4	5,770	999	–	£6,769
Totals	**34**	**20**	**13**	**11**	**8**	**105**			**43**	**33**	**212,208**	**71,382**	**7,118**	**£290,708**

These are the number of hip, forearm, spine & humerus fractures averted for an annual cohort of 797 previous fragility fractures, and the direct NHS & local authority costs saved over 5 years, as a medication regime is followed.

* Total of 55 hip fractures averted includes data from prior forearm fractures (in Table 3) which is not broken down by year over years 0-5.

** RRR%= Relative risk reduction (%) achieved by drug regime.

*** 80% Compliance = Anticipated compliance with the drug regime over 5 years.

Table 5: Fracture liaison service costs for a one year patient cohort

1 Year of 0.67 FTE FLS Operating Costs	Cost (£)
Nurse salary	£26,800
Lead Clinician – 1 session per week	£6,700
Bone Densitometry costs of hip fracture patients[12]	£3,730
80% of humerus, forearm and spine patients[13]	£16,960
Clerical support	£3,350
5 Year Drug Treatment Costs @ 80% compliance[14]	
80% treated with generic ALN + Calcium/Vitamin-D[15]	£112,067
20% treated with branded BP + Calcium/Vitamin-D[16]	£64,574
Total	**£234,181**

These costs are based on two-thirds of full FLS staff costs, reflecting that hip, spine, forearm and humerus fractures comprise two-thirds of total fractures in this model.

Appendix A: Cost benefits for local authority social care from reducing fractures

In addition to the cost savings for the NHS in reducing the incidence of hip fracture, there is also the positive impact from reduced hip fractures on local authority-funded social care services. These costs are an integral part of the cost-benefit case for FLS.

(The following are illustrative estimates only, and local costs and service patterns are known to vary considerably, notably based on the extent of homecare reablement services locally)

- For each **10** hip fractures averted, the working assumption is that there will be a local authority cost saving of:
  - 0.9 care home placements….

    This is based on 10 % rate of post-hip fracture direct transfer from hospital to care home[17]and within this group a 60% rate of local authority funded placements, compared to self-funders[18]. The duration of this placement could vary from a few months to several years. A working assumption is that each care home placement is for 2 years at £600 per week, though cost and duration of average stay varies considerably across regions and between localities.

    Thus, total local authority care home costs = £37,440 over 2 years for every 10 hip fractures, or **an average of £3,744 per hip fracture.**
  - plus three home care packages

    This is based on 6 out of 10 hip fractures discharged from hospital back to their own home requiring a home care package; and of these 1 in 2 are eligible for local authority funding. Intensity of support will vary according to need – such as frailty, need for double handed packages, and home environment – and the extent to which reablement services are commissioned.

    A working assumption is that for each group of 10 hip fractures 3 out of 10 would incur costs of a care package costed as follows: 3 x (1 hours per day on weekdays for 6 weeks at £15 per hour[19], or £450) x 3 hip fractures.

This totals £1,350 (for every 10 hip fractures), or **£135 per hip fracture.**

The combined value of both the care home and the care package saving element is £3,744 + £135 = **£3,879 per hip fracture**

  - The mortality rate for hip fractures is 30% at 12 months, so 3 in 10 of averted hip fractures would not incur any social care costs.

- For every anticipated reduction in **2** vertebra or ankle fractures (at 1 in 2 eligibility for LA funding within the client group) a similar local authority saving in home care is anticipated: of (1 hours per day on weekdays for 6 weeks at £15 per hour, or £450) x 50% or **£225 per vertebra/ankle fracture**

A working assumption is that wrist fracture social care support can be met at minimal cost, through low cast aids and adaptations for example.

Appendix B: Sensitivity Analysis of Base Case Estimate

A Sensitivity Analysis can be defined as investigation into how projected performance varies along with changes in the key assumptions on which the projections are based. The following Sensitivity Analysis provides commissioners of services with an indication of the potential range of costs and savings that might be achieved in real world practice. The base case estimate presented in the body of the document above has been informed by a pragmatic synthesis of all relevant research evidence and so provides the most likely indication of the cost-effectiveness of implementing a Fracture Liaison Service.

The base case makes the following assumptions:

1. **Fracture incidence:** In the absence of intervention, the number of secondary fractures by site is 56 hip, 17 forearm, 19 spine and 14 humerus.

2. **Drug efficacy:** The Relative Risk Reduction (RRR) for secondary prevention of fracture is 40% for all secondary fractures after incident fractures at all sites. This estimate is based upon NICE Technology Appraisal estimates.

3. **Drug compliance:** Several Fracture Liaison Services have presented drug compliance data as posters at national congresses which suggest 80% compliance with osteoporosis medications can be achieved[20,21,22,23]. Accordingly, drug compliance is set at 80%.

4. **Treatment rates:** Based on NICE Technology Appraisals, the proportion of patients treated by fracture site would be 100% of hips, 75% of humerus, 75% of spines and 50% of forearms.

5. **Drug spend:** The cost of generic alendronate is set according to the October 2009 NHS Drug Tariff price of £1.16 for 28 days supply (i.e. £15.08 per year). The cost of a combined calcium and vitamin-D preparation is set at £50 per year. Therefore, the annual cost of generic alendronate co-prescribed with a calcium and vitamin-D supplement is set at £65.08 per year. The cost for a non-alendronate branded osteoporosis medication co-prescribed with a

calcium and vitamin-D supplement is set at £300 per year. The cost for 5 years treatment in line with NICE Technology Appraisals for 80% of patients with generic alendronate and calcium and vitamin-D is £112,067. The cost for 5 years treatment for the remaining 20% of patients treated with a currently branded drug and calcium and vitamin-D is £64,574. The drug spend assumes 80% compliance, 12% mortality and the availability over the next few years of **generic** risedronate (from 2010), ibandronate (2011) and zoledronate (2012), based on a forecast reduction of 50% overall over four years in the cost of these drugs.

6. **FLS staff costs:** These reflect the proportion (two thirds) of all fractures considered in this cost/benefit study. Fracture Liaison Nurse salary set at £26,800 per year, Lead-Clinician at 1 session per week set at £6,700 per year and clerical support set at £3,350 per year.

7. **Bone density scanning (DXA):** Bone scanning in year 1 is a further £20,690, based on a marginal cost per scan of £50. Based on the age profile and a pragmatic application of NICE TA161 around 20% of hip fracture patients will need a DEXA scan, with a higher proportion (estimated at 80%) for forearm, spine and humerus patients.

Each of the above sources of cost and saving, where appropriate, will be varied by a fixed percentage above and below the base case estimate.

1. Fracture incidence

The incidence of secondary fractures was varied by ± 20% (the base case estimate by site was 56 hips, 17 forearms, 19 spines and 14 humerus).

If secondary fracture incidence was 20% **lower** than the base case, the number of fractures by site over the 5 year period would be 44 hip, 14 forearm, 15 spine and 11 humerus. The **savings** would be £232,566.

If secondary fracture incidence was 20% **higher** than the base case, the number of fractures by site over the 5 year period would be 67 hip, 21 forearm, 23 spine and 17 humerus. The **savings** would be £348,850.

Assuming that the operational costs remained as estimated in the base case (i.e. 234,181), the 20% lower estimate translates to the FLS **costing** £1,615 to operate. The 20% higher estimate translates to the FLS **saving** £114,669.

2. Drug efficacy

The Relative Risk Reduction (RRR) achieved by drug treatment was modelled at 35% and 45% (versus 40% in the base case).

If RRR was 35%, the number of fractures averted by site would be 16 hips, 5 forearms, 5 spines and 4 humerus The **saving** would be £254,370.

If RRR was 45%, the number of fractures averted by site would be 20 hips, 6 forearms, 7 spines and 5 humerus The **saving** would be £327,047.

Assuming that the operational costs remained as estimated in the base case (i.e. 234,181), the 35% RRR estimate translates to the FLS **saving** £20,189 to operate. The 45% RRR estimate translates to the FLS **saving** £92,866.

3. Drug compliance

Drug compliance was modelled at 60% and 100%.

If compliance was 60%, the number of fractures averted by site would be 13 hips, 4 forearms, 5 spines and 3 humerus The **saving** would be £218,031. Assuming the drug spend would be reduced on account of reduced compliance (i.e. patients would not collect 40% of prescriptions), the operational costs would be £190,021. In this scenario, the overall **saving** would be £28,000.

If compliance was 100%, the number of fractures averted by site would be 22 hips, 7 forearms, 8 spines and 6 humerus The **saving** would be £363,385. Assuming the drug spend would be increased on account of increased compliance (i.e. patients would collect 100% of prescriptions), the operational costs would be £278,341. In this scenario, the overall saving would be £85,044.

4. Treatment rates

On account of the treatment rates being aligned to NICE Technology Appraisal guidance, this input to the model was not subject to variation.

5. Drug spend

Four scenarios have been modelled relating to variations in drug spend over the 5 year period.

a) **25% Reduction in total drug spend on alendronate treated patients:** This scenario would result in the drug spend on patients treated with alendronate

and calcium and vitamin-D reduce from £112,067 to £84,050. Total FLS costs would reduce from £234,181 to £206,164.

b) **75% Reduction in spend on currently branded drugs:** This scenario would result in the drug spend on patients treated with currently branded drugs and calcium and vitamin-D reduce from £64,574 to £32,287. Total FLS costs would reduce from £234,181 to £201,894.

c) **Combination of scenarios a and b:** This scenario would result in the total drug spend reduce from £176,641 to £116,337. Total FLS costs would reduce from £234,181 to £173,877

d) **No new generic drugs available as projected:** This scenario would result in the drug spend on patients treated with currently branded drugs and calcium and vitamin-D increase from £64,574 to £129,149. Total FLS costs would increase from £234,181 to £298,756.

Assuming no impact upon the savings estimated in the base case, the most economically favourable scenario above (c) would result in an overall **saving** of £116,831 over 5 years. The least economically favourable scenario (d) would result in FLS **costing** £8,048 over 5 years.

6. and 7. FLS and bone densitometry operating costs

The FLS and bone densitometry (DEXA) scanning costs were varied by ± 20% assuming drug costs remained as in the base case. This variation results in a range of overall 5 year operating costs, including drug spend, from £222,673 to £245,689. Assuming the numbers of fractures averted and associated costs remained the same as for the base case, the overall **savings** delivered by FLS would be in the range £45,019 to £68,035.

Summary

The majority of scenarios explored in the Sensitivity Analysis suggest that implementation of Fracture Liaison Services will be cost saving. Combining several variations in input values to the economic model provides an illustration of a broader range of the potential economic impact of FLS:

Assume 20% lower secondary fracture rate + 35% Relative Risk Reduction + 60% compliance: The number of fractures averted by site would be 9 hip, 3 forearm, 3 spine and 2 humerus. The associated cost saving would be £152,622.

Total FLS operational costs and drug spend over 5 years would be £190,021. In this scenario, operating the **FLS would cost** £37,399.

Assume 20% higher secondary fracture rate + 45% Relative Risk Reduction + 100% compliance: The number of fractures averted by site would be 30 hip, 9 forearm, 10 spine and 7 humerus. The associated cost saving would be £490,570. Total FLS operational costs and drug spend over 5 years would be £278,341. In this scenario, operating the **FLS would save** £212,229.

The Drug Tariff price of generic alendronate will continue to decline and significant reductions in currently branded drug spend will occur on account of new generic entries from 2010 to 2012. Accordingly, the least economically favourable scenario depicted above is likely to become cost-neutral to marginally cost saving, the base case scenario significantly cost saving and the most favourable scenario substantially cost saving.

End notes

1 Falls and fractures: effective interventions in health and social care, Department of Health, 2009.

2 Cumming RG, Salkeld G, Thomas M, Szonyi G. Prospective study of the impact of fear of falling in activities of daily living, SF-36 scores and nursing home admission. *J Gerontology* 2000; 55: 299-305.

3 Close J, Ellis M, Hooper R, Glucksman E, Jackson S, Swift C. Prevention of falls in the elderly trial (PROFET) : a randomised controlled trial. *Lancet* 1999; 353: 93-97.

4 Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living within the community. N Eng J Med 1988; 319: 1701-07.

5 Technical appraisal (TA) 161 *Osteoporosis – secondary prevention including strontium ranelate* NICE 2008 http://guidance.nice.org.uk

6 Clinical guideline 21 *Clinical practice guideline for the assessment and prevention of falls in older people* NICE 2004 http://guidance.nice.org.uk

7 *National audit of the organisation of services for falls and bone health of older people* Royal College of Physicians 2009 http://www.rcplondon.ac.uk

8 Dual energy x-ray absorptiometry (DXA) scans are used to measure bone mineral density.

9 *Implementing and running a fracture liaison service*, Clunie & Stephenson, Journal of Orthopaedic Nursing, (2008) 12: 156-162.

10 *Fracture risk following an osteoporotic fracture*, Johnell, Kanis et al, Osteoporosis International, (2004) 15:175-179.

11 Based on 2009/10 Payment by Results tariff costs HA11-14, and including a Market Forces Factor of 1.082.

12 Bone densitometry @ £50 per scan.

13 Bone densitometry @ £50 per scan.

14 Based on treating 100% of hip, 50% of forearm, 75% of spine and 75% of humerus fracture patients. Assumes 12% mortality. The drug spend assumes availability over the next few years of generic risedronate (from 2010), ibandronate (2011) and zoledronate (2012), based on a forecast reduction of 50% overall over four years in the cost of these drugs.

15 Drug tariff price October 2009 for generic alendronate = £1.16 for 28 day supply = £15.08 per year. High strength Ca/Vit-D costs £50 per year. Combined treatment therefore costs £65.08 per year.

16 Combination treatment of a branded bisphosphonate or Strontium Ranelate plus high strength Ca/Vit-D costs £300 per year.

17 National Hip Fracture Database 2009 and Hospital Episode Statistics 2007/8, DH.

18 *Older People in the United Kingdom*, Age Concern, 2008.

19 Department of Health estimate.

20 Osteoporosis Int 2004;15(S2):S56:P141 Harkness M et al.

21 Osteoporosis Int 2003;14(S4):S53:P55 Fraser M et al.

22 Osteoporosis Int 2006;17(S3):425:P115 Lockwood S et al.

23 Osteoporosis Int 2003;14(S4):S12:OC27 Barton J et al.

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