Effectiveness of Strategies for the Secondary Prevention of Osteoporotic Fractures in Scotland

CEPS: 99/03

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Abbreviations

A&E accident & emergency
ASG audit steering group
BMD bone mineral density
CI confidence interval (95%)
DADS Direct-access DXA service
Depcat deprivation category: Carstairs and Morris index of socioeconomic deprivation
DXA dual-energy X-ray absorptiometry
FLS Fracture Liaison Service
Fx fracture
FxHx fracture history
GGHB Greater Glasgow Health Board (now GGNHSB)
GP general practitioner
HRT hormone replacement therapy
HR hazard ratio
ISD Information Services (of NHS National Services Scotland)
LREC local research ethics committee
MREC multi-centre research ethics committee
NHS National Health Service
NICE National Institute of Clinical Excellence
NOS National Osteoporosis Society
OAU open-access ultrasound
OR odds ratio
PC primary care
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RR  relative risk
RTA  road traffic accident
SC  secondary care
SD  standard deviation
SIGN  Scottish Intercollegiate Guidelines Network
SMR  standardised mortality ratio
VFx  vertebral fracture
WHO  World Health Organisation
1. Introduction

The prime aims of this audit are to review 1) osteoporosis service provision in Scotland in 2000 (and more recently, in 2004) and 2) the effectiveness of different approaches to fracture ‘case-finding’ and targeting of treatments for the secondary prevention of osteoporotic fractures to women over 50yr who have already sustained fractures of wrist or hip or spine. This audit has also reviewed factors that influence the utility of service models that aim to provide osteoporosis assessment for patients identified to be ‘at risk’ by primary care clinicians.

1.1 What is osteoporosis?

Osteoporosis is a systemic skeletal disorder characterized by microarchitectural deterioration of bone and decreased bone mass that is associated with increased bone fragility resulting in susceptibility to fractures. In the absence of fracture, osteoporosis is asymptomatic and clinically silent. Bone mass is measured as ‘bone mineral density’ (BMD) using dual energy X-ray absorptiometry (DXA) and thresholds of BMD that define the presence of osteoporosis have been established by the WHO(1). Around 20% of all postmenopausal women in western countries would meet the WHO criteria for osteoporosis. Fractures, however, are the important and frequent consequence of osteoporosis.

1.2 Why is osteoporosis important?

Osteoporosis and its associated fractures (in particular, hip fractures(2;3)) are common and are a major public health problem because they result in significant morbidity and mortality(4). Furthermore, fractures also carry high financial costs that are primarily explained through the costs demanded by their acute care, although for some fractures such as those at the hip there can be substantial, additional, ongoing social care costs.

On the basis of the requirement for emergency care from A&E or Orthopaedic trauma services, fractures can usefully be categorised into those that occur at non-vertebral and vertebral sites. Non-vertebral fractures typically result in presentation to hospital: hip fractures necessitate inpatient management while for most other non-hip, non-vertebral fractures such as wrist fractures, the majority (~80%) are managed through outpatient services including fracture clinics. Vertebral fractures are quite different (vide infra), often are unrecognised and very rarely result in presentation to hospital at all (<10%)(5) and yet carry significant morbidity and mortality.

This audit addresses the issues relating to the two commonest non-vertebral fracture sites – hip fractures (as the example of a fracture that typically requires
inpatient management), wrist fractures (an example of a fracture site that typically requires outpatient management) and also vertebral fractures because of the challenges these pose, not least because of difficulties in identifying them.

Incidence of Fractures** by Site in Females & Males >50yr in Glasgow in 2002

** excluding RTA

1.2.1 Non-vertebral fractures

Insight into the epidemiology of fractures comes from ongoing work from Glasgow where comprehensive fracture data collection occurs in association with the Fracture Liaison Service (FLS)\(^6\). Data relating to all incident fractures at all skeletal sites (except skull and jaw fractures) in women and men over 50yr are collected, with the exceptions of those fractures that occur in association with a RTA or in a fall from above head height. Fig. 1 (by permission of the authors) shows the annual incidence of fractures by site in Glasgow: fig. 2 shows the crude annual fracture incidence rates per 10,000 of the Glasgow population, by age group and by gender\(^7\).
The systemic nature of osteoporosis means that potentially any skeletal site can be affected and osteoporosis can contribute to fracture risk at any site. Osteoporosis, however, does not account for all fractures (fig. 3); the prevalence of osteoporosis, categorised on the basis of the lower result of DXA scans of lumbar spine and of hip, differs among fractures sites in women (and also in men) with low trauma fractures over 50yr and ranges from ~30% at ankle to ~70% at the hip\(^6;8\). However, the identification of those with osteoporosis is not merely of aetiological relevance, but also identifies a level of BMD that is amenable to intervention, in that this provides the opportunity to target treatment to reduce the future potential non-vertebral and vertebral fracture risk by up to 50\%(66;74).
Prevalence of osteoporosis in 2587 women and men with fractures**
(assessed in the first 2 years of the Fracture Liaison Service)

![Bar chart showing Site of Fracture](image)

** excluding RTA

Comprehensive fracture incidence data are not available for Scotland as a whole (other than perhaps for hip fractures through SMR1 coding), but are available for Glasgow’s population of ~900,000: 4,700 new fractures (excluding those that occur in RTA or in fall from above head height) present each year to A&E or Orthopaedic trauma services each year in women and men over 50yr. Extrapolation of these figures to the whole Scottish population would suggest that about 28,000 women and men over 50yr sustain a low trauma fracture that results in presentation to hospital; of these over 20,000 will occur in women. The commonest low trauma fracture site in women over 50yr that results in hospital presentation is wrist fracture (fig. 1), followed by hip, humerus, ankle, hand and foot and then an assortment of other sites.
1.2.1.1 Non-vertebral fracture and social class

Ongoing work in Glasgow into the relationship between socioeconomic deprivation (expressed as Depcat, that is a 7-point index of socioeconomic deprivation extrapolated from census data, based on postcode of residence – Depcat 1 is the least deprived group, while Depcat 7 represents the most deprived-see section 3.2.4.) and fracture incidence (included here, by permission of the authors) has established for the first time that fracture incidence is highest at all skeletal sites, among the most socioeconomically deprived\(^{(9)}\) (fig. 4); this trend holds true at all ages (fig. 5)\(^{(7)}\).
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Crude Fracture Incidence Rates per 10^4 population by Age Group & by Depcat in Glasgow in 2002

** Figure 5 

1.2.1.2 Non-vertebral fracture mortality and morbidity

Hip fractures are associated with substantial mortality\(^{10-13}\). Most deaths occur in the first 6-12 months after the fracture event\(^{12-13}\); within 10-14 days of the fracture event, 10% of patients with hip fractures have died and the mortality rises to 30-40% by the end of the first year\(^{14}\). Much of the excess mortality is not, however, explained by the fracture or its treatment (which may account for about 14-24% of the mortality), but probably reflects poor underlying health that is further compromised by the occurrence of an osteoporotic fracture\(^{11,15,16,17}\). Excess mortality has been reported after other types of non-vertebral fractures\(^4\), but not following fractures of the wrist\(^4,18\).

Among survivors after fracture, morbidity is greatest after hip fracture; despite costly and lengthy rehabilitation procedures, hip fracture is typically followed by significant compromise to general health and psychological well-being, as well as functional impairment and loss of quality of life that persists for at least one year after fracture\(^{19-21}\).

1.2.2 Vertebral fractures

Although vertebral fracture is believed to be the commonest of osteoporotic fractures, there is no consensus on their radiological definition and nor is there a gold standard to define vertebral fracture. Loss of height of vertebrae is fundamental to the diagnosis of vertebral fracture, although different thresholds (15% to 20% height loss) have been used to define ‘fracture’\(^{22,23}\). Whatever
the definition that is used, the prevalence of vertebral fractures has been reported to increase with age - from around 20% of women of 50-59yr to around 40-60% of women over 80yr\(^{(24-27)}\). Pain is not a prerequisite for the diagnosis of vertebral fracture: as many as one third of vertebral fractures are asymptomatic\(^{(5,28,29)}\). Vertebral fractures that are identified on X-ray but are not associated with pain are termed ‘asymptomatic, morphometric fractures’. Even when symptoms such as back pain are present (‘clinical vertebral fractures’), these symptoms are often ascribed to causes other than vertebral fracture. Such considerations explain why as many as two-thirds of patients with vertebral fractures are not diagnosed\(^{(5)}\).

Neither the prevalence rates nor the incidence rates of vertebral fractures in Scotland are known. ‘Case–finding’ of patients with new or old vertebral fractures is a challenge for services that endeavour to target efforts for the secondary prevention of osteoporotic fractures. However, in this audit the aim is to ascertain what, if any, action was triggered following the identification and reporting of the presence of a vertebral deformity or fracture on a spine x-ray.

**1.2.2.1 Vertebral fracture mortality and morbidity**

Excess mortality (R.R. 1.2 – 2.3) accompanies vertebral fracture whether the fracture is of recent onset (‘incident fracture’)\(^{(30)}\) or pre-existing (‘prevalent’)\(^{(4,15,18,26,30-35)}\). While excess mortality has been reported after asymptomatic morphometric vertebral fracture\(^{(15,26)}\), mortality is higher again, after clinical vertebral fracture\(^{(4,34)}\). Mortality is correlated with the severity and number of vertebral fractures; among those with at least 2 vertebral fractures the observed mortality is 50-100% greater than the excess mortality that is associated with one vertebral fracture event\(^{(26,30)}\).

Fewer than 10% of incident clinical vertebral fractures result in hospital admission\(^{(35)}\) but for those that are admitted the prognosis is poorer; hospitalization after vertebral fracture is more likely for older patients and when there are multiple concurrent medical problems\(^{(36)}\). Not surprisingly, therefore, for those admitted after vertebral fracture the mortality is higher\(^{(38)}\), although as seen with hip fracture, not all of the mortality (perhaps only about 28%) is attributable to the vertebral fracture itself\(^{(35)}\). Among survivors of hospitalization for vertebral fracture there is an increased need also for post-discharge care\(^{(36)}\).

Apart from the increased mortality risk after asymptomatic morphometric and clinical vertebral fractures, osteoporosis-related vertebral fractures have important functional consequences for the majority of women who will experience them\(^{(5)}\); these include back pain\(^{(5,37)}\) as well as physical impairment and disability\(^{(38,39)}\). When more that one vertebral fracture is present, there is a greater adverse impact on quality of life\(^{(40)}\).
1.2.3 Non-vertebral and vertebral fractures are associated with increased risk of further fractures

Of all the patients who are at risk of fracture, those who have already had an osteoporotic fracture are the group who are at highest risk; a fracture is associated with a 2-4 fold higher risk of having a (further) fracture compared to those without previous fracture(41-46).

Increased fracture risk follows non-vertebral fractures at any site and can potentially occur anywhere in the skeleton(45;47).

Increased fracture risk also follows asymptomatic morphometric(42;48;49) or clinical(41;44;50-54) vertebral fractures whether new or old, and these subsequent fractures can occur rapidly(46;55) and can potentially also occur anywhere in the skeleton(33;41;42;45;47;49;50;52-54;56;57). The highest risk of further fractures is, however, seen in patients who have already sustained multiple fractures, especially of vertebrae(56;58) and among those who have been hospitalized following vertebral fracture(45).

1.3 Measurement of BMD in fracture cases allows treatment to be targeted at the key, modifiable risk factor for further fractures.

Factors that determine risk of sustaining a fracture can be categorised into those that define skeletal integrity (of which the most important is the bone mineral density (BMD)) and those that are non-skeletal, and can broadly be considered as factors that determine risk of falling. Some factors such as age or genetic predisposition to fracture risk influence both; the implication of fracture for future fracture risk similarly has its origins in risk that is derived from skeletal and non-skeletal factors.

Measurement of BMD is a powerful predictor of fracture risk(59;60). When BMD measurement is applied indiscriminately for screening of the population it is not regarded as cost effective(60;61). However, the alternative strategy of targeting use of BMD measurement to patients at higher risk (so called ‘case-finding’ strategies) has been recommended by UK(62;63) and Scottish national guidelines(64). Patients who have already had a low-trauma fracture at any skeletal site constitute a group at high risk who, in accordance with these national recommendations, should be offered BMD assessment by axial DXA(64). The key aim of fracture ‘case-finding’ is to offer this group, who are at higher risk of having osteoporosis and at higher risk of having another fracture, the opportunity to undergo DXA scanning to identify those whose BMD is at a level where the associated fracture risk is modifiable with therapeutic intervention; low BMD is the key modifiable skeletal risk factor for fracture that can be used to target treatment to reduce the incidence of non-vertebral and vertebral fractures(64).

While for an individual patient correction of falls risk factors may be crucial in modifying fracture risk, multi-falls risk factor intervention strategies have not in
themselves been shown to reduce fracture incidence (falls risk can be reduced by such strategies, however(65)) and therefore falls intervention services have not been included in this audit.

Several therapeutic options (that function either by preventing breakdown of older bone (‘anti-resorptives’) or by promoting new bone formation (‘anabolic agents’)) are now available that, if used at appropriate levels of BMD(64), can approximately halve the risk of fracture at vertebral (alendronate(22;66), risedronate(67;68), cyclical etidronate(69), raloxifene(70), calcitriol(71), calcitonin(72)) and non-vertebral sites (alendronate(22;66), risedronate(67;68), and teriparatide(73)) including the hip (alendronate(22;66) and risedronate(74)); success in effecting non-vertebral risk reduction, in particular, requires the targeting of treatment, not at just any level of BMD, but at specific thresholds of BMD to enable anti-fracture effects of treatment(66;74).

1.4 The aims of this audit programme

Briefly summarised, the main aims of this audit programme are to assess strategies in Scotland for the secondary prevention of osteoporotic fractures in women over 50yr through:

1) identification of what services exist for this purpose

2) comparison of the effectiveness of different approaches to fracture ‘case-finding’ of women with fractures in the year 2000, of the hip (a fracture site that requires inpatient management), of the wrist (the commonest non-vertebral, non-hip fracture and typical of the majority of non-vertebral fractures in that fracture management is usually provided as an outpatient), and of the spine (where X-ray reporting is central to ‘case-finding’)

3) comparison of the resulting success rates (and determining factors) of these models in offering and achieving assessment and treatment for the secondary prevention of osteoporotic fractures in women who have already had a fracture

4) review of the issues that govern the success of different secondary care osteoporosis service models that have been established for primary care clinicians

5) review the cost implications of implementing models of service that provide effective case-finding for targeting treatment for the secondary prevention of osteoporotic fractures.
2. Service provision for assessment and treatment of osteoporosis

2.1 Aims & objectives

The first aim was to ascertain what was the provision of services for the management of osteoporosis in Scotland in 2000 in secondary & primary care and to establish how these services function with regard to:

a) interaction among secondary care osteoporosis service providers, orthopaedic/A&E fractures services and primary care
b) what referral criteria govern access to such services
c) who performs ‘case-finding’ of patients for assessment and
d) how the necessary treatment regimens (for fracture risk reduction) are initiated after osteoporosis assessment has taken place.

2.2 Methods

The availability and organisation (including funding, staffing and available hardware) of services for the assessment of osteoporosis after fracture in 2000 were ascertained by questionnaires that were sent to Consultants in Public Health at all Scottish Health Boards (appendix 1) and to Medical Directors of all Primary Care and secondary care/Acute Trusts (appendix 2). Ambiguities were clarified by subsequent telephone contact.

2.3 Fracture services - orthopaedics & A&E

Hospitals providing services for acute care of patients with fractures (either through inpatient and/or outpatient care) were ascertained from ISD and are listed in table 1.

2.4. Osteoporosis service providers 2000 (table 1)

Acute fracture care for the 20,000 (non-RTA) fractures that are estimated to occur each year in Scotland in women over 50yr, is provided by 89 centres with A&E/Casualty and Orthopaedic services (table 1). Six of 15 Health Board areas have at least one centre that offers at least one service that is potentially available to assess for osteoporosis in patients who have sustained a fracture.

2.4.1 Tools for assessment of osteoporosis (table 1)

Axial DXA, that is DXA assessment of hip and/or spine, the current ‘gold-standard’ tool for assessment for osteoporosis and for effective targeting of treatment for the secondary prevention of osteoporotic fractures (as endorsed by the SIGN guideline 71 - the management of osteoporosis(65)) is available to
NHS patients at 9 Scottish centres; 5 centres provide full-time NHS-funded DXA services, one centre provides a part-time NHS-funded DXA service and 3 centres provide full-time DXA services, but are funded by joint funding from NHS and research/University funding. Two additional centres have access to DXA either at another hospital in the same Trust, or at another hospital in an adjacent Health Board on the basis of a specific contract or under an historical ‘block contract’. One DXA service is provided from a hospital centre that does not provide acute fracture care. One centre provides assessment for osteoporosis using ultrasound, a modality that is considered inappropriate by the SIGN guideline\(^{(65)}\).

### 2.4.2 Access to assessment of osteoporosis in fracture cases - open/direct-access services (tables 1 & 2)

Of the 10 centres providing ‘assessment for osteoporosis’ either on the basis of DXA or ultrasound, all provide access for assessment to secondary care patients; 9 provide access to patients referred from primary care. Access to osteoporosis assessment for patients from primary care is typically organised on the basis of ‘open/direct-access’ without the need for clinic assessment; access is typically limited to patients who must fulfil at least one referral criterion from more or less restricted lists endorsed by UK guidelines (RCP\(^{(62;63)}\) & SIGN\(^{(65)}\)); all such services potentially provide access for assessment to women who have sustained a fracture, but only the direct-access DXA service (DADS) in Glasgow encourages prioritisation of fracture cases for referral for assessment.

The processes by which DADS interacts with primary care to achieve osteoporosis assessment, identify those patients who require/or will benefit from treatment and how these treatment recommendations are effected are summarised in table 2. Descriptions of the open-access ultrasound (OAU) and DADS service models are based on the current services at Aberdeen Royal Infirmary (DADS), St.John’s Hospital (Livingston) (OAU) and at Glasgow hospitals (Royal Infirmary, Southern General Hospital, Stobhill Hospital & Western Infirmary) (DADS). ‘Case-finding’ of cases who are appropriate for referral is undertaken by primary care. Assessment by DXA or ultrasound is performed without associated consultation at a clinic. A report that collates the scanning findings, typically with risk factor profile (identified from patients’ self-completed questionnaires) and with treatment recommendation written by a clinician with expertise in the management of osteoporosis is forwarded to the referring primary care clinician whose final role is to prescribe the appropriate medication. Some services are very specific with regard to actual drug therapy and dose to be prescribed by primary care (Glasgow DADS); others offer generic treatment recommendations and leave the referring primary care clinician to prescribe the treatment of their choice (Aberdeen DADS & Livingston OAU) from a recommended class of drug therapy.

### 2.4.3. Fracture Liaison Service (table 2)

In 2000, only one Health Board area (Greater Glasgow) had addressed the challenge of effecting secondary prevention of osteoporotic fractures through
provision of a service dedicated to this task (the Fracture Liaison Service (FLS)) that functions within secondary care and integrates with the acute fracture services to identify all new fracture cases (excluding those occurring in RTA or in a fall from above head height), at any skeletal site in women and men over the age of 50yr. The FLS offers the opportunity to undergo assessment for osteoporosis by DXA (or alternatively may start treatment without DXA when indicated) to all appropriate fracture cases whether their fracture care is provided as an inpatient or as an outpatient; the aim is to select and target treatment to those who will benefit most, and to advise primary care clinicians of the patient-specific treatment regimen that has been tailored to the patients’ needs (table 2). The FLS model and its protocols for effecting secondary prevention of fractures have been fully described elsewhere(8).

2.4.4 Secondary care specialist osteoporosis clinics (table 2)

Specialist osteoporosis secondary care clinics are available in 2 health board areas (Grampian and Greater Glasgow); these clinics typically provide another route to DXA assessment for patients.

2.4.5 Organisation and funding of services for the assessment and treatment of osteoporosis after fracture

Only in Glasgow has the Health Board strategically commissioned services for osteoporosis across the entire region. GGHB initially commissioned (1998) DADS for patients identified by primary care clinicians to be provided from 4 city centres. In 1999 the FLS (table 2) was piloted (Western Infirmary) and from 2001-2002, GGHB commissioned roll out of this service to address the need for systematic post-fracture assessment for all fracture cases over 50yr (excluding RTA) who present to all Glasgow’s hospitals that provide acute fracture care. Since 2002, all 4 of Glasgow’s hospitals that provide acute fracture care through A&E and orthopaedic services are linked to the FLS to provide routine post-fracture assessment and treatment, when necessary, for osteoporosis. For most other Health Board regions it appeared that services for osteoporosis had developed sporadically and independently of formal commissioning by Boards, and typically depended upon the availability of clinicians with academic or research interests in osteoporosis.
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<td>■</td>
<td></td>
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<tr>
<td>Highland</td>
<td>Portree Hospital</td>
<td>Skye</td>
<td>■</td>
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<tr>
<td>Highland</td>
<td>Ross Memorial Hospital</td>
<td>Dingwall</td>
<td>■</td>
<td>●</td>
<td>PC,SC</td>
<td>●</td>
<td>F, R</td>
<td></td>
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<tr>
<td>Lanarkshire</td>
<td>Monklands Hospital</td>
<td>Airdrie</td>
<td>■</td>
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<tr>
<td>Lanarkshire</td>
<td>Kello Hospital</td>
<td>Biggar</td>
<td>■</td>
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</tr>
</tbody>
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<th>Covered by Fracture Liaison Service</th>
<th>Specific Secondary Care Osteoporosis Clinic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lanarkshire</td>
<td>Lady Home Hospital</td>
<td>Douglas</td>
<td>▪</td>
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<tr>
<td>Lanarkshire</td>
<td>Hairmyres Hospital</td>
<td>East Kilbride</td>
<td>▪</td>
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<tr>
<td>Lanarkshire</td>
<td>Wishaw General Hospital</td>
<td>Wishaw</td>
<td>▪</td>
<td></td>
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<td></td>
<td></td>
<td>F, R</td>
<td></td>
</tr>
<tr>
<td>Lothian</td>
<td>St John’s Hospital at Howden</td>
<td>Livingston</td>
<td>▪</td>
<td></td>
<td>▪</td>
<td></td>
<td></td>
<td>F, L</td>
<td>□2004</td>
<td></td>
</tr>
<tr>
<td>Lothian</td>
<td>Royal Infirmary of Edinburgh</td>
<td>Edinburgh</td>
<td>▪</td>
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<tr>
<td>Lothian</td>
<td>Western General</td>
<td>Edinburgh</td>
<td>▪</td>
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<td></td>
<td>F, R</td>
<td></td>
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<tr>
<td>Orkney</td>
<td>Balfour Hospital</td>
<td>Kirkwall</td>
<td>▪</td>
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<tr>
<td>Shetland</td>
<td>Gilbert Bain Hospital</td>
<td>Lerwick</td>
<td>▪</td>
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<tr>
<td>Tayside</td>
<td>Ninewells Hospital</td>
<td>Dundee</td>
<td>▪</td>
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<td>▪</td>
<td>▪</td>
<td></td>
<td>F, R</td>
<td>□2002</td>
<td></td>
</tr>
<tr>
<td>Tayside</td>
<td>Perth Royal Infirmary</td>
<td>Perth</td>
<td>▪</td>
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<td></td>
<td></td>
<td>F, R</td>
<td>□2002</td>
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<tr>
<td>Tayside</td>
<td>St Margaret’s Hospital</td>
<td>Auchterarder</td>
<td>▪</td>
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**Other Assessment Tool**
- U/S = Ultrasound

**Who has Access to Scanning Service**
- PC = for use by primary care clinicians
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<th>Specific Secondary Care Osteoporosis Clinic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tayside</td>
<td>Aberfeldy Community Hospital</td>
<td>Aberfeldy</td>
<td>■</td>
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<tr>
<td>Tayside</td>
<td>Irvine Memorial Hospital</td>
<td>Pitlochry</td>
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<tr>
<td>Tayside</td>
<td>Blairgowrie Community Hospital</td>
<td>Blairgowrie</td>
<td>■</td>
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<tr>
<td>Tayside</td>
<td>Arbroath Infirmary</td>
<td>Arbroath</td>
<td>■</td>
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<tr>
<td>Tayside</td>
<td>Brechin Infirmary</td>
<td>Brechin</td>
<td>■</td>
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<tr>
<td>Tayside</td>
<td>Forfar Infirmary</td>
<td>Forfar</td>
<td>■</td>
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<tr>
<td>Tayside</td>
<td>Montrose Royal Infirmary</td>
<td>Montrose</td>
<td>■</td>
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<tr>
<td>Tayside</td>
<td>Stracathro Hospital</td>
<td>Brechin</td>
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<tr>
<td>Tayside</td>
<td>Crieff Community Hospital</td>
<td>Crieff</td>
<td>■</td>
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<th>Specific Secondary Care Osteoporosis Clinic</th>
</tr>
</thead>
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<tr>
<td>Western Isles</td>
<td>St Brendan’s Hospital</td>
<td>Isle of Barra</td>
<td>■</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Western Isles</td>
<td>Western Isles Hospital</td>
<td>Stornoway</td>
<td>■</td>
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<td></td>
</tr>
<tr>
<td>Western Isles</td>
<td>Uist &amp; Barra Hospital</td>
<td>Isle of Benbecula</td>
<td>■</td>
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Table 2: How Different Models of Service for Assessment for Osteoporosis Function

<table>
<thead>
<tr>
<th>Service model</th>
<th>Direct Access DXA Service (DADS)</th>
<th>Open Access Ultrasound Service (OAU)</th>
<th>Fracture Liaison Service (FLS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centres providing service</td>
<td>A, G &amp; W</td>
<td>S</td>
<td>W</td>
</tr>
<tr>
<td>Routinely offers ~all inpatient fracture cases assessment/treatment for osteoporosis?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Routinely offers ~all outpatient fracture cases assessment / treatment for osteoporosis?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Service available to fracture cases for assessment/treatment of osteoporosis?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Is this service responsible for fracture ‘case-finding’?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Who is responsible for fracture ‘case-finding’?</td>
<td>Primary care</td>
<td>Primary care</td>
<td>FLS (secondary care)</td>
</tr>
<tr>
<td>Are orthopaedic or A&amp;E staff required to refer fracture cases for assessment?</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Which fracture cases are eligible?</td>
<td>≥50yr, fracture any site</td>
<td>≥50yr, fracture any site</td>
<td>≥50yr, fracture any site</td>
</tr>
<tr>
<td>Assessment / treatment decisions based on axial DXA?</td>
<td>Yes</td>
<td>No (Heel ultrasound)</td>
<td>Yes</td>
</tr>
<tr>
<td>Service available to fracture cases for assessment / treatment of osteoporosis in hospital providing acute fracture care</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Location of service offering assessment for osteoporosis?</td>
<td>secondary care</td>
<td>secondary care</td>
<td>secondary care</td>
</tr>
<tr>
<td>Does service providing osteoporosis assessment provide GP with result of scan and a specific treatment recommendation?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Does service providing osteoporosis assessment provide GP with result of scan, but not a treatment recommendation?</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
3. Secondary prevention of osteoporotic fractures

The purpose of this section of the audit is to follow the care pathways of patients who have experienced a fracture to ascertain if they were offered assessment for osteoporosis after the fracture and/or whether they received treatment for the secondary prevention of osteoporotic fractures.

3.1 Aims and objectives

‘Case-finding’ of fracture cases poses different and difficult challenges. Non-vertebral fractures of virtually all sites typically result in presentation to A&E departments or to Orthopaedic Units for acute fracture care. Hip fracture cases are managed invariably as inpatients; the majority of non-vertebral, non-hip fractures are managed as outpatients, without inpatient care. Fracture ‘case-finding’ should be achievable irrespective of the patients’ pathways of care, whether as an inpatient or as an outpatient.

While pain and presentation to hospital are consequences of non-vertebral fracture, pain is said to only accompany ~50% of vertebral fractures, and often that pain is ascribed to other causes. Furthermore, less than 10% of vertebral fractures are hospitalized as a consequence of the fracture. While the majority of vertebral fractures elude diagnosis and are typically missed, if an X-ray has been undertaken this will provide incontrovertible evidence of the presence of vertebral fracture.

Having identified the range of services that were available in 2000 this section assesses their effectiveness with regard to: 1) ‘case-finding’ of fracture cases and 2) subsequently assessing them for osteoporosis and targeting treatment (where necessary) for the secondary prevention of osteoporotic fractures. The outcomes after non-vertebral fracture (of hip and of wrist) and vertebral fracture are considered separately, because for each, the pathway of care is quite different.

3.2 Secondary prevention of osteoporotic fractures after hip & wrist fractures: case-finding

3.2.1 Ethics

Although fundamentally an audit programme, the opinion of MREC was sought as to whether this project required ethics committee approval. On MREC’s recommendation their approval was sought and granted in Feb 2002. Appropriate LREC (and subsequent management) approval was obtained from LRECs in the following Health Board areas: Argyll & Clyde, Forth Valley Grampian, Greater Glasgow Lanarkshire, Highland & Lothian.
A large number of primary care practices opted not to participate in this audit. Ethics approval was insufficient to reassure many in primary care who cited concerns that case record review by the audit nurses might breach patient confidentiality. Some primary care practices and secondary care clinicians may have interpreted that ethics approval signified that the project was research rather than an audit programme. The ability to opt not to participate could potentially influence the outcome of the audit by skewing the dataset in favour of those who are more focused on osteoporosis, and who were more likely to arrange osteoporosis assessment in fracture cases via DADS and to prescribe treatments recommended by FLS.

### 3.2.2 Setting/participating centres

Six centres (A, G, H, I, S & W) – see Table 3 were invited to participate in this audit; they were chosen because they provide a range of services from none (centre I) to multiple options (centre W) (tables 2 & 3) and differ strategically in how they addressed the challenges of fracture secondary prevention (tables 2 & 3).
Table 3. Description of services that are available for assessment of osteoporosis and to effect strategies for the secondary prevention of osteoporotic fractures at the 6 participating centres.

<table>
<thead>
<tr>
<th>Centre</th>
<th>A: Aberdeen Royal Infirmary</th>
<th>G: Glasgow Royal Infirmary</th>
<th>H: Hairmyres Hospital E.Kilbride</th>
<th>I: Raigmore Hospital Inverness</th>
<th>S: St. John’s Livingston</th>
<th>W: Western Infirmary Glasgow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialist secondary care bone clinic</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Fracture Liaison Service provided by secondary care</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes 'FLS'</td>
</tr>
<tr>
<td>Open or direct access service provided by secondary care</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Orthopaedic surgeon advises patient of need to attend GP for referral for DXA elsewhere</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Local access to axial DXA</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Access to ultrasound</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

3.2.3 Database

The Audit Steering Group had agreed the detail of the dataset for collection. An ACCESS database was created and customised for use in this audit. The lead audit nurse provided induction and worked closely with the other audit nurses to ensure consistency of data entry.

For the purpose of assessing impact of social class on outcomes after fracture, ‘Depcat scores’ were allocated to each. Depcat(75) is a validated 7-
Effectiveness of Strategies for the 2nd Prevention of Osteoporotic Fractures in Scotland

point scoring system derived from UK National census data (reference census 1991) in which degree of deprivation (from Depcat 1 – most affluent, to Depcat 7 – most deprived) is assigned on the basis of postcode of residence) that has itself been related through census data to a wide range of parameters that provide insight into deprivation.

3.3 Non-vertebral fracture case finding methods – hip and wrist fracture cases

3.3.1 Hip fracture cases (fig. 6)

For year 2000, SMR1 discharge data for hip fracture were gathered at each participating centre. Case ascertainment was verified additionally through gathering hip fracture cases identified by centres that were participating in the Scottish hip fracture audit or through comparison with a list of patients who had attended A&E departments with ‘a hip complaint’.

It is surprising to note that none of the participating centres had an A&E computerised database that was capable of identifying cases who had attended with a fracture (at any skeletal site) whether as an inpatient or as an outpatient.

Where they could be identified, the patients’ primary care clinicians were contacted to invite their participation; participation required that they granted permission for a visit to their practice by the audit nurses to review the relevant case records and to abstract data for entry on the database. A minority of participating primary care practices opted to complete a questionnaire (appendix 3) for each fracture case as an alternative to a practice visit by the audit nurses.

Many hip fracture cases were no longer registered at their original practice; some had died, some had been transferred to residential or nursing home facilities that were outwith the care of the original General Practitioner.

It was agreed by the ASG that, where possible, for the subset of patients whose primary care records could not be accessed either because they had died, or were no longer registered with the original GP (and the current practice could not be identified) or because the primary care clinicians had refused to participate, the secondary care records would be reviewed to ascertain what post-fracture assessment/osteoporosis treatment had been offered.

Thus data were collected from primary care case records for all those patients who were alive after hip fracture, who were traceable (registered with a practice that was identifiable from secondary care records) and where the primary care clinician had agreed to participation. Data were collected from secondary care case records from a proportion of those who had died or
whose practice was not readily traceable or where their primary care clinician had refused to participate.

Mortality after hip fracture was ascertained in the process of attempting to trace the hip fractures cases back to their primary care clinicians. This information was gleaned from primary care and secondary care case records and from notifications of deaths that had been reported to the Health Boards’ archives.
Identification & Processing of Hip Fracture Cases

Identification of hip fracture admissions from SMR1 discharge coding for women = 50yr admitted between 1/1/2000 & 31/12/2000 inclusive
- A / G / H / I / S / W

All A&E attendances with a ‘hip complaint’
- A / G / H / I / S / W

Hip fracture case identification from Scottish hip fracture audit
- A / G / H / I / S / W

Hip fracture cases

Write to hip fracture cases’ GPs requesting their participation

Participating clinicians

Non-participating clinicians & patients not traced back to primary care

Patients no longer registered at practice

Patients now dead & not traced back to primary care

Patients not traced back to primary care

Primary care patient data collection
Subset
GPs opted to complete data collection form
Majority
Data collected by audit nurse during practice visit

Secondary care patient data collection by audit nurse

Figure 6
3.3.2 Wrist fracture cases (fig. 7)

For year 2000, SMR1 discharge data for wrist fracture cases were gathered at each participating centre (however, only about 20% of wrist fracture cases are admitted to hospital). For the majority, wrist fracture case were identified through correlation of lists of patients who had attended A&E departments with ‘a wrist complaint’ with lists of patients who had subsequently attended a fracture clinic; verification of actual fracture cases was on the basis of subsequent review of the A&E attendance cards or of fracture clinic records.

Where they could be identified, the patients’ primary care clinicians were contacted to invite their participation; participation required that they granted permission for a visit to their practice by the audit nurses to review the relevant case records and to abstract data for entry on the database. A minority of participating primary care practices opted to complete a questionnaire for each fracture case as an alternative to a practice visit by the audit nurses (appendix 3).

Relatively few cases were no longer registered at their original practice; some had died, some had been transferred to residential or nursing home facilities outwith the care of the original practices.

It was agreed by the ASG that where possible, for the subset of patients whose primary care records could not be accessed either because they had died, or were no longer registered with the original GP (and the current practice could not be identified) or because the primary care clinicians had refused to participate, the secondary care record would be reviewed to ascertain what post-fracture assessment/osteoporosis treatment had been offered.

Thus data were collected form primary care case records for all those patients who were alive after wrist fracture, who were traceable (registered with a Practice that was identifiable from secondary care records) and where the primary care clinician had agreed to participation. Data were collected from secondary care case records from a proportion of the remainder.

Mortality after wrist fracture was ascertained in the process of attempting to trace the wrist fractures cases back to their primary care clinicians. This information was gleaned from primary care and secondary care case records and from notifications of deaths that had been reported to the Health Boards’ archives.
Identification & Processing of Wrist Fracture Cases

Identification of wrist fracture admissions from SMR1 discharge coding for women = 50yr admitted between 1/1/2000 & 31/12/2000 inclusive
– A / G / H / I / S / W

All A&E attendances between 1/1/2000 & 31/12/2000 inclusive among women = 50yr with a ‘wrist complaint’. This list is then correlated with fracture clinic attendance lists to identify group who probably had a wrist fracture (whether the patient had actually sustained a fracture was confirmed by review of the patients’ clinical records.
– A / G / H / I / S / W

(probable) wrist fracture cases

Write to wrist fracture cases’ GPs requesting their participation

Participating clinicians

Non-participating clinicians & patients not traced back to primary care

Patients no longer registered at practice

Patients now dead & not traced back to primary care

Patients still alive

Patients not traced back to primary care

Primary care patient data collection
Subset
GPs opted to complete data collection form
Majority
Data collected by audit nurse during practice visit

Secondary care patient data collection by audit nurse

Figure 7
Effectiveness of Strategies for the Secondary Prevention of Osteoporotic Fractures in Scotland

Fracture

On treatment for osteoporosis prior to fracture

Yes

Offered assessment for osteoporosis by:
- FLS
- GP (DADS / OAU / GP-clinic)
- Secondary care specialist (other-clinic)

Participation in clinical trial

Review

Treatment continued with / without review

Assessed for osteoporosis

Did not accept offer of assessment or did not attend

Treatment for secondary prevention of osteoporotic fractures is required

No treatment required

Figure 8: Possible outcomes after a ‘fracture case’ has been identified: targeting assessment and/or treatment when it is necessary & is likely to achieve secondary prevention of osteoporotic fractures
3.3.3 Outcomes. Ascertainment of what happened after fracture case-finding: ‘assessment and/or treatment of osteoporosis’

The ultimate goal is to treat patients appropriately with therapeutic agents that are capable of reducing fracture risk. The corollary is not, however, that the aim is simply to ensure that all fracture patients should receive treatment: as treatment, for example, with bisphosphonates does not reduce fracture risk in patients when used at levels of BMD that are higher than/better than the threshold that defines the presence of osteoporosis\(^{(66;74)}\), other than in those who have had a vertebral fracture.

In order to address the complexities (fig. 8) that arise from the many possible paths in the patients’ pathways of care the main end-points that were assessed were: 1) whether the patient was ‘offered assessment &/or treatment for osteoporosis’ and 2) what (if any) treatment they received. The inclusion of ‘offered assessment’ was justifiable as a marker of ‘case-finding’ rather than exclusively relying on ‘what treatment they received’ because an entirely appropriate outcome of ‘assessment’ is that ‘no treatment’ might be recommended if assessment showed that BMD was higher than the threshold than that at which fracture risk will be benefited with treatment. Similarly, if a patient was already on treatment at the time of fracture, having undergone assessment in the recent past, then further assessment of BMD would neither be necessary nor useful.

Thus ‘assessment &/or treatment of osteoporosis’ refers to several scenarios (fig. 8): 1) patient had undergone assessment by DXA in the recent past and was on treatment at the time of fracture, and this treatment was continued after fracture (if assessment was in the distant past, patients may be offered review DXA), 2) the offer of assessment by a FLS, or by primary care through referral via a DADS/OAU or via a secondary care clinic or was invited to take part in a clinical trial of osteoporosis treatment. The treatment outcomes that were recorded on the database included specific anti-osteoporosis drugs (including bisphosphonates – alendronate, risedronate) and other relevant options including HRT, raloxifene, calcium + vitaminD, ‘none’ (where assessment showed a BMD that was above the threshold where treatment was indicated), ‘nil’ if no treatment was recommended / received. ‘DNA’ noted where the patient was offered assessment but did not attend for assessment.

3.3.3.1 Statistical analysis

Survival after fractures of hip, wrist and spine, was compared using Kaplan-Meyer survival plots and Cox’s proportional hazards regression modelling. For each fracture site, the performance of the participating centres (and the different services they offer for osteoporosis assessment &/or treatment) was compared using Chi-square. Multiple logistic regression analysis was used to elucidate factors that were associated with key outcomes (3.3.3.). Statistical analyses were performed on Minitab V13 and SSPS V11.5.
3.4 Hip fracture cases identified

![Diagram of hip fracture cases]

Figure 9: How data relating to the 704 hip fracture cases were obtained: data were obtained from review of primary care records (516) or from review of secondary care records (188 others who were ‘tracked back’ including 38 of the 554 who were still registered, but who had died). The majority of the other 631 hip fracture cases that had been identified had died.

Hip fracture is the most serious osteoporosis-related fracture because of its associated morbidity and mortality that, in part, are explained by the occurrence of hip fractures in older patients who often have multiple co-morbidities. Data were gathered on 704 hip fracture cases among the centres (each centre contributing between 45 (centre H) to 225 (centre A) cases) (table 4).
Effectiveness of Strategies for the 2nd Prevention of Osteoporotic Fractures in Scotland

3.5 Mortality after fracture

Mortality after hip fracture was greater than after vertebral fracture, that in turn was greater than after wrist fracture (figs. 10a & 10b). In the 3 years after hip fracture, the mortality was 2.9 fold greater (HR (95%CI) 2.9 (2.3 to 3.5)) than after wrist fracture; following vertebral fracture, the mortality was 1.5 fold greater (HR (95%CI) 1.5 (1.2 to 1.9)) than following wrist fracture. By the end of 3 years following a fracture, the mortality rates after hip, vertebral and wrist fracture were 41%, 18% and 10% respectively. Survival curves diverge within the first few months reflecting the early mortality seen particularly after hip fracture that largely reflects peri-fracture morbidity and peri- and postoperative complication rates. About 50% of deaths within the first year after hip fracture occur within the first three months. The cohorts that died were typically older than the survivors for each fracture site. Those who died after wrist, hip and spine fracture were respectively 12, 5 and 5 years respectively older than survivors. The survival differences shown in fig.10b persist after correction for age, however.
The age at which the fracture occurred is a significant determinant of mortality (and in part, at least, explains the greater mortality following hip fracture); for each year by which the age of fracture exceeds the age of 76yr mortality is increased by a factor of 1.06 ((95% CI) 1.05 to 1.07). Socioeconomic deprivation (as reflected by Depcat) has no influence on survival after fracture.
3.6. Hip fracture

3.6.1 Hip fracture demography and fracture history

Table 4: Hip fracture cases identified at each centre: demographics – age at time of fracture and their past fracture histories (over the age of 50yr).

<table>
<thead>
<tr>
<th>Hip Fx Patients</th>
<th>W</th>
<th>G</th>
<th>H</th>
<th>S</th>
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<td>N</td>
<td>124</td>
<td>74</td>
<td>45</td>
<td>74</td>
<td>225</td>
<td>159</td>
</tr>
<tr>
<td>Age @ Fx yr</td>
<td>80.5(8.8)</td>
<td>76.5(8.8)</td>
<td>76.1(8.7)</td>
<td>78.4(9.5)</td>
<td>80.9(9.3)</td>
<td>79.3(8.8)</td>
</tr>
<tr>
<td>Past Fx Hx %</td>
<td>52.4</td>
<td>42.7</td>
<td>46.7</td>
<td>46</td>
<td>44.9</td>
<td>39.6</td>
</tr>
<tr>
<td>Past Hip Fx %</td>
<td>14.5</td>
<td>8.1</td>
<td>11.1</td>
<td>9.5</td>
<td>11.6</td>
<td>10.8</td>
</tr>
<tr>
<td>Past nonVFx%</td>
<td>48.4</td>
<td>41.9</td>
<td>46.7</td>
<td>45.9</td>
<td>41.8</td>
<td>35.4</td>
</tr>
<tr>
<td>Past VFx%</td>
<td>9.7</td>
<td>4.1</td>
<td>2.2</td>
<td>1.4</td>
<td>19.1</td>
<td>7</td>
</tr>
</tbody>
</table>

Hip fracture patients were older than the wrist fracture and vertebral fracture cohorts and range from (mean ± SD) 76.1 ± 8.7 to 80.9 ± 9.3 yr (table 4) across participating centres. The occurrence of hip fracture often was preceded by a past history of fracture events over the age of 50; between 39.6% and 52.4% of hip fracture cases had a history of previous fracture (table 4). In between 8.1% and 14.5% of cases at each centre, the past fracture experience included a previous hip fracture (table 4). For 27% the past history comprised one previous fracture event but around 20% of patients had previously experienced two other fractures (fig. 11). Each of these previous fracture events afforded a potential opportunity for targeting intervention that might potentially have reduced the risk of the patient experiencing the index fracture identified through this audit programme.
3.6.2 Assessment and/or treatment for the secondary prevention of osteoporotic fractures after hip fracture

Assessment and/or treatment of osteoporosis following hip fracture differed significantly amongst the centres with rates varying from 16% (centre I) to 97% (centre W) ($\chi^2 = 239.738$, df = 5, p<0.0001). Considering the entire hip fracture cohort, assessment and/or treatment rates after hip fracture were significantly higher where there was a local service (DADS/OAU for primary care, FLS or clinic) and occurred in 44% of such cases, in contrast to 16% where there is no local service ($\chi^2 = 36.565$, df = 1, p<0.0001).
Outcome After Hip Fx by Centre

![Outcome After Hip Fx by Centre](image)

Figure 12: Rates of assessment and/or treatment for the secondary prevention of osteoporotic fracture after hip fracture, by centre.

Assessment and/or treatment rates after hip fracture were highest where there was a FLS and reached 97% where such a service was available (centre W) compared with 25% in the absence of a FLS (centres A,G,H,I & S) ($\chi^2 = 227.053$, df = 1, p<0.0001).

The presence within primary care clinical records of a communication, either a discharge summary or a fracture clinic letter specifically referring to the fracture was noted in 91% of hip fracture cases. This had no impact on rates of assessment and/or treatment for osteoporosis after the hip fracture and in fact assessment rates where a letter was present were just 34% in contrast to 68% in the absence of such communication.

Ninety-three percent of hip fracture cases were referred to a Geriatric Rehabilitation Unit after their acute orthopaedic care. There was a trend towards higher rates of post hip fracture assessment and/or treatment for osteoporosis in those patients managed within Geriatric Units but this did not achieve statistical significance, 38% versus 32% (who did not require rehabilitation) ($\chi^2 = 0.660$, df = 1, p=0.416).

Higher rates of assessment and/or treatment after hip fracture were noted where there was a past history of at least one additional fracture. Forty-six percent of such patients underwent assessment and/or treatment after hip fracture compared to 30% who had no additional past fracture history ($\chi^2 = 20.023$, df = 1, p<0.0001). The high rates of assessment and/or treatment...
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after hip fracture at centre W were achieved through the FLS (fig. 13). In centres where this service does not exist, systems that required case-finding by primary care (DADS/OAU) achieved osteoporosis assessment after hip fracture typically in under 5% (centre G) to 10% (centre S) of cases (fig. 13).

Figure 13: Mechanism by which assessment and/or treatment were achieved after hip fracture, by centre.
3.6.3 Outcome after assessment &/or treatment after hip fracture

Figure 14: Outcome after assessment and/or treatment after hip fracture – did the patients attend and what treatment, if any was recommended?

Treatments recommended after hip fracture (fig. 14) were most commonly calcium with vitamin D (given to between 2% (centre H) and 48% of cases (centre W)) followed by bisphosphonates that were given to between 3% (centre I) and 25% (centre W) of cases. Between 12% and 22% of cases either turned down the opportunity to be assessed or did not attend for assessment. Apart from those who declined or did not attend for assessment, and from those where treatment was not thought to be necessary, after hip fracture, between 2% (centre W) and 92% (centre I) of hip fracture cases received no intervention for the secondary prevention of fractures (fig. 14).
3.6.4 Subsequent fracture experience after hip fracture

Table 5: The clinical vertebral and non-vertebral fracture experience after the occurrence of hip fracture.

<table>
<thead>
<tr>
<th></th>
<th>W</th>
<th>G</th>
<th>H</th>
<th>S</th>
<th>A</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>124</td>
<td>75</td>
<td>45</td>
<td>76</td>
<td>225</td>
<td>158</td>
</tr>
<tr>
<td>Subs FxHx %</td>
<td>13.7</td>
<td>16</td>
<td>18.9</td>
<td>17.1</td>
<td>14.2</td>
<td>25.2</td>
</tr>
<tr>
<td>Subs Hip Fx %</td>
<td>4</td>
<td>5.3</td>
<td>11.1</td>
<td>0</td>
<td>6.2</td>
<td>5.7</td>
</tr>
<tr>
<td>Subs nonVFx %</td>
<td>12.9</td>
<td>14.7</td>
<td>26.7</td>
<td>15.8</td>
<td>12.9</td>
<td>19</td>
</tr>
<tr>
<td>Subs VFx %</td>
<td>1.6</td>
<td>2.7</td>
<td>4.4</td>
<td>1.3</td>
<td>2.7</td>
<td>8.2</td>
</tr>
</tbody>
</table>

Table 5 shows the past fracture experience after the occurrence of the index hip fracture in the (mean ± SD) 1.8 ± 0.6 years of follow-up following the hip fracture until data collection; this follow-up period differed among and within the participating centres. Between 14% and 25% of hip fracture cases sustained at least one further fracture during the time to data collection after the index fracture and in up to 11% that subsequent fracture experience included a further hip fracture event.

3.6.5 Discussion

The achievement of optimal secondary prevention of osteoporotic fractures is a two stage process; the first stage is ‘case-finding’ of the patients with fracture, in this case hip fracture, and the second stage is the subsequent assessment to identify those who will benefit from intervention/treatment. Given that assessment of patients will identify those who will benefit from treatment of osteoporosis, and a group in whom the BMD is above a level that will benefit from treatment (and in whom treatment will not therefore reduce fracture incidence), treatment rates per se should be interpreted with caution. The criterion for judging efficacy of service has been defined as ‘offering assessment and/or treatment where necessary’. Some will be assessed not to require treatment (as it will not benefit the patient); others may receive treatment, for example with calcium & vitamin D, without undergoing prior DXA. Both these scenarios, in addition to those who undergo assessment of
BMD and are deemed to require treatment are regarded as having been offered 'assessment and/or treatment'.

The key success factor in offering patients with hip fractures the opportunity to undergo assessment and/or treatment of osteoporosis was the availability of a FLS (that achieved this in 97% of patients); this was 6X greater than achieved in the absence of any service ($\chi^2 = 239.738$, df = 5, $p<0.0001$). Multiple logistic regression analysis was performed to assess the relationship between the outcome of 'offered assessment and/or treatment of osteoporosis' and other potential explanatory variables including Depcat, centre, age at index hip fracture, whether the fracture required rehabilitation in a geriatric unit, whether the patient had experienced at least one other fracture prior to sustaining the hip fracture. Depcat (OR 0.62 ((95% CI) 0.44 to 0.85) ($p=0.004$)), centre (OR 2.16 ((95% CI) 1.89 to 2.46) ($p<0.0001$), whether the fracture required rehabilitation in a geriatric unit (OR 2.33 ((95% CI) 1.09 to 4.99) ($p=0.03$) whether the patient had experienced at least one other fracture prior to sustaining the hip fracture (OR 2.15 ((95% CI) 1.47 to 3.15) ($p<0.0001$) were significantly associated with the occurrence of the offer of assessment and/or treatment of osteoporosis' after hip fracture. In the regression model, when 'centre' was replaced with 'centre with service' (including those with FLS or DADS/OAU for primary care or with secondary care specialist clinics (that is, centres A, G, S & W)) there was a greater likelihood of post-hip fracture offer of assessment and/or treatment (OR 3.10 ((95% CI) 2.04 to 4.71) ($p<0.0001$) compared to the centres without local services (centres H & I).

Assessment and/or treatment were more likely among the most deprived. This finding contrasts with recent work from Glasgow\(^{(9)}\), and is likely to be a consequence of the observation that the bulk of patients from Depcats 6&7 reside in Glasgow where both centres offered a range of service options that performed relatively well in successfully offering assessment and/or treatment across the spectrum from the affluent to the socioeconomically deprived. Higher assessment/treatment rates were achieved even among the socioeconomically deprived in Glasgow than is routinely achieved elsewhere in Scotland due to differences in the availability of services. Within Glasgow itself, however, it is clear that socioeconomic deprivation is associated with poorer rates of case-finding by the DADS service (dependent upon case-finding by primary care)\(^{(6)}\) but even when case-finding is achieved directly by the FLS (where a dedicated nurse typically would meet with the patient either in the ward or at the fracture clinic) while lower than for the DADS service, there is a higher rate of refusal to undergo assessment for osteoporosis in Depcats 6 & 7\(^{(9)}\).

The key outcome of interest is the achievement of the secondary prevention of osteoporotic fractures. Multiple logistic regression analysis was performed to assess the relationship between the occurrence of at least one further fracture after the index hip fracture (in the time from fracture to data collection) and potential explanatory variables including Depcat, centre, age at index hip fracture, whether assessment and/or treatment took place and whether the patient had experienced at least one other fracture prior to sustaining the index hip fracture. Refracture risk was not associated with assessment and/or
Effectiveness of Strategies for the 2nd Prevention of Osteoporotic Fractures in Scotland

treatment after the index hip fracture. This result should be interpreted with caution, however, because fracture risk will be governed by some factors that were not assessed in this audit, including BMD itself and non-skeletal risk factors for fracture, and many other confounding factors that are not controlled for in an audit (but are in a clinical trial) including differing follow-up periods after hip fracture among centres, the overall relatively small number of patients who actually received treatment and the short time on treatment until data collection (even in the largest intervention trials fracture risk reduction was seen after at least 6 to 12 months on treatment\(^{(22,67,68)}\)).

History of previous fracture (in addition to the index hip fracture) was, however, associated with increased risk of further fracture (OR 2.07((95%CI) 1.36 to 3.15)(p=0.001). ‘Centre’ was associated with reduction in refracture risk (OR 0.84((95%CI) 0.73 to 0.97)(p=0.017)). Stronger associations with reduction in subsequent fracture risk were observed for ‘centres with service’ (OR 0.43((95%CI) 0.27 to 0.68)(P<0.0001) and centre with FLS (OR 0.51 ((95%CI) 0.27 to 0.99)(p=0.045)). If subsequent fracture risk reduction is related to centre and the associated service models, but not necessarily with assessment and/or treatment, this may potentially reflect non-pharmacological interventions such as falls intervention that may also have been provided.

### 3.7 Wrist Fracture

#### 3.7.1 Wrist Fracture cases identified

Figure 15: How data relating to the 919 wrist fracture cases were obtained: data were obtained from review of primary care records (733) or from review of secondary care records (186 others who were ‘tracked back’).
3.7.2 Wrist fracture demography and fracture history

Among the entire wrist fracture cohort, about 34% had previously sustained at least one fracture since the age of 50 (table 6 & fig. 16) and over 12% had sustained at least two other fractures previously (fig. 16). The previous fracture experience of wrist fracture patients at each centre is shown (tables 6 & 7) and past fractures over the age of 50 were reported in 28%-41% of cases; in 1%-5% of cases, depending on centre, that previous fracture experience included a hip fracture. These previous fractures again reflect missed opportunities for earlier intervention to interrupt the natural history of recurrent fractures that characterises osteoporosis.

Table 6: Wrist fracture cases identified at each centre: demographics – age at time of fracture and their past fracture histories (over the age of 50yr)

<table>
<thead>
<tr>
<th>W</th>
<th>G</th>
<th>H</th>
<th>S</th>
<th>A</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>n</strong></td>
<td>235</td>
<td>91</td>
<td>81</td>
<td>167</td>
<td>237</td>
</tr>
<tr>
<td><strong>Age @ Fx yr</strong></td>
<td>70.9(10.6)</td>
<td>68.4(9.9)</td>
<td>68.7(10.9)</td>
<td>68.6(10.5)</td>
<td>69.8(10.2)</td>
</tr>
<tr>
<td>Past Fx Hx %</td>
<td>41.3</td>
<td>31.9</td>
<td>34.6</td>
<td>34.7</td>
<td>28.2</td>
</tr>
<tr>
<td>Past Hip Fx %</td>
<td>4.7</td>
<td>2.2</td>
<td>2.5</td>
<td>4.2</td>
<td>5.1</td>
</tr>
<tr>
<td>Past nonVFx%</td>
<td>39.1</td>
<td>29.7</td>
<td>30.9</td>
<td>34.7</td>
<td>27.4</td>
</tr>
<tr>
<td>Past VFx%</td>
<td>5.5</td>
<td>2.2</td>
<td>3.7</td>
<td>0</td>
<td>11.8</td>
</tr>
</tbody>
</table>
Past Fx (nonVFx & VFx) History in 919 Patients with Wrist Fx

Figure 16: the number of previous clinical vertebral and non-vertebral fractures experienced (after the age of 50yr) by the cases who had sustained a wrist fracture.

3.7.3 Assessment and/or treatment for the secondary prevention of osteoporotic fractures after wrist fracture

Outcome After Wrist Fx by Centre

Figure 17: Rates of assessment and/or treatment for the secondary prevention of osteoporotic fracture after wrist fracture, by centre.
After wrist fracture, there was a significant difference among centres with regard to assessment and/or treatment rates for osteoporosis (fig. 17) and these range from 11% (centre I, that lacked any formal osteoporosis service) to 95% (centre W) ($\chi^2 = 407.323$, df = 5, $p<0.0001$). Among all participating centres, after wrist fracture, the presence of a FLS (centre W) was associated with the achievement of assessment and/or treatment for osteoporosis in 95%, a rate that far exceeded the overall figure of around 21% for the rest of the centres that lacked a FLS, whether or not they had any other service for osteoporosis ($\chi^2 = 401.183$, df = 1, $p<0.0001$).

Assessment and/or treatment after wrist fracture was more likely if there was a local service (including DADS for primary care, FLS or clinic) and occurred in 45% of patients with such local services (centres A,G,S & W) in contrast to assessment rates of around 17% in the absence of such services (centre H & I) ($\chi^2 = 50.271$, df = 1, $p<0.0001$).

Assessment and/or treatment for osteoporosis was not more likely if the patient was hospitalized following wrist fracture. Thirty-three percent of those whose wrist fracture resulted in inpatient management were assessed compared to 42% who are managed entirely as outpatients ($\chi^2 = 5.529$, df = 1, $p=0.019$).

Eighty-eight percent of the wrist fracture cohort had a letter within primary care clinical records relating to the fracture or an associated admission with fracture for those who were inpatients. Assessment and/or treatment for osteoporosis was, however, not more likely in those where such a communication was present within the patient’s clinical records. Thirty-seven percent of those with letters underwent subsequent assessment and/or treatment compared to 54% of those without such a letter.

After wrist fracture, assessment and/or treatment is more likely in those with a past history of additional fractures. Forty-eight percent with additional past fracture history (beyond the index wrist fracture) underwent assessment and/or treatment for osteoporosis in comparison with 35% without a previous history of additional fracture ($\chi^2 = 14.848$, df = 1, $p<0.0001$).

The greater the past fracture experience, the more likely it was that subsequent osteoporosis assessment and/or treatment would happen: 58% of patients with two or more additional past fractures (beyond the index wrist fracture) underwent assessment, in contrast to 43% where there was one additional past fracture or 35% where there were no additional past fractures ($\chi^2 = 21.591$, df = 2, $p<0.0001$).

### 3.7.4 Outcome after assessment and/or treatment after wrist fracture

The FLS accounted for 84% of ‘assessed and/or treated’ group at centre W (fig. 18), while DADS/OAU explained between 3% (centre W) and 10% (centre
S). The other mechanisms that achieved assessment and/or treatment after wrist fracture are shown in fig. 18.

Thirty-two percent of wrist fracture patients at centre W, following assessment, were prescribed bisphosphonates, about 15% calcium with vitamin D and (consistent with practice at that time) HRT 7% and raloxifene 2% (fig. 19). In about 9% following assessment, it was confirmed that there was no requirement of role for any drug therapy (fig. 19). Treatment rates were consistently higher for all treatment categories at centre W than at any other centre. Each centre experienced a rate of refusal to undergo or attend for assessment. About 29% of wrist fracture patients despite being identified and offered the opportunity at centre W either declined or did not attend for that assessment. In the other centres, 70-90% were neither formally identified nor were offered osteoporosis assessment or treatment.

**Outcome After Wrist Fx by Centre:**

<table>
<thead>
<tr>
<th>Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>ONS/FLS</td>
</tr>
<tr>
<td>DADS/OAU</td>
</tr>
<tr>
<td>GP-clinic</td>
</tr>
<tr>
<td>Other-clinic</td>
</tr>
<tr>
<td>Prior Rx</td>
</tr>
<tr>
<td>Trial</td>
</tr>
<tr>
<td>Subs-Assess</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

![Figure 18: Mechanism by which assessment and/or treatment were achieved after wrist fracture, by centre.](image-url)
3.7.5 Subsequent fracture experience after wrist fracture

In the time period from index wrist fracture to data collection, 6-17% of wrist fracture patients sustained a further fracture that included the occurrence of hip fracture in 1-7% of cases. The subsequent fracture experience of these patients is shown in table 7. What is clear is that the occurrence of fracture is associated with a high risk of further fracture that includes fracture sites with considerable potential morbidity and mortality and that further fracture experience can occur soon after the first fracture and supports the need for a systematic approach to targeting strategies for the secondary prevention of osteoporotic fractures as soon as possible after the index fracture event.
Table 7: The clinical vertebral and non-vertebral fracture experience after the occurrence of wrist fracture. Time to data collection presented as mean (SD) for each centre.

<table>
<thead>
<tr>
<th></th>
<th>W</th>
<th>G</th>
<th>H</th>
<th>S</th>
<th>A</th>
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<td>81</td>
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<td>Time (yr) to Data Collection</td>
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<tr>
<td></td>
<td>1.6(0.4)</td>
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<td>2.6(0.6)</td>
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<td>1.8(0.4)</td>
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<tr>
<td>Subs FxHx %</td>
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<td>17.3</td>
<td>7.8</td>
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<td>13</td>
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<tr>
<td>Subs Hip Fx %</td>
<td>2.6</td>
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<td>2.5</td>
<td>1.8</td>
<td>0.8</td>
<td>1.9</td>
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<tr>
<td>Subs nonVFx %</td>
<td>11.8</td>
<td>12.1</td>
<td>17.3</td>
<td>6.6</td>
<td>5.1</td>
<td>8.3</td>
</tr>
<tr>
<td>Subs VFx %</td>
<td>0.4</td>
<td>1.0</td>
<td>2.5</td>
<td>1.8</td>
<td>1.3</td>
<td>4.6</td>
</tr>
</tbody>
</table>

3.7.6 Discussion

The key success factor in offering patients with wrist fractures the opportunity to undergo assessment and/or treatment of osteoporosis was the availability of a FLS (that achieved this in 95% of patients); this was ~9X greater than achieved in the absence of any service ($\chi^2 = 239.738$, df = 5, $p<0.0001$).

Multiple logistic regression analysis was performed to assess the relationship between the outcome of ‘assessment and/or treatment of osteoporosis’ and potential explanatory variables including Depcat, centre, age at index wrist fracture, whether the fracture required inpatient management, whether the primary care records contained a letter from secondary care indicating the patient had attended with this fracture and whether the patient had experienced at least one other fracture prior to sustaining the wrist fracture. Depcat (OR 0.7((95%CI) 0.53 to 0.93)(p=0.013)), centre (OR 2.44 ((95%CI) 2.15 to 2.76)(p<0.0001)), the requirement for inpatient fracture management (OR 0.67((95%CI) 0.45 to1.00)(p=0.049)) and past history of at least one other fracture (OR 1.7((95%CI) 1.19 to 2.42)(p=0.003)) are independently associated with achieving the offer of assessment and/or treatment of osteoporosis. In the regression model, when ‘centre’ was replaced with ‘centre with service’ (including those with FLS or DADS for primary care or with secondary care specialist clinics (that is, centres A, G, S & W)) there was a greater likelihood of post-hip fracture offer of assessment and/or treatment (OR 3.88 ((95%CI) 2.51 to 5.98)(p<0.0001) compared to the centres without local services (centres H & I).
Assessment and/or treatment was more likely among the most deprived. This finding contrasts with recent work from Glasgow (see 3.6.5.), and is likely to be a consequence of the observation that the bulk of patients from Depcats 6&7 reside in Glasgow where both centres offered a range of service options that performed relatively well in successfully offering assessment and/or treatment across the spectrum from most deprived to least deprived.

Surprisingly wrist fracture patients who were managed as inpatients were 33% less likely to undergo assessment and/or treatment for osteoporosis than those who were managed entirely as outpatients (p=0.049).

The key outcome of interest is the achievement of the secondary prevention of osteoporotic fractures. This audit does not permit evaluation of that outcome. Multiple logistic regression analysis was performed to assess the relationship between the occurrence of at least one further fracture after the index wrist fracture (in the time from fracture to data collection) and potential explanatory variables including Depcat, centre with service*, age at index wrist fracture, whether assessment and/or treatment took place and whether the patient had experienced at least one other fracture prior to sustaining the index wrist fracture. Of these ‘centre with service’ was associated with reduction in re-fracture risk (OR 0.44 ((95%CI) 0.26 to 0.75)(p=0.002)) but paradoxically among those who had undergone assessment and/or treatment re-fracture risk appeared higher (OR 2.27((95% CI) 1.42 to 3.61). These results should be interpreted with caution, however, because fracture risk will be governed by many factors that were not assessed in this audit, including BMD itself, time on treatment (at the time of data collection would patients have received treatment long enough to effect fracture reduction), and non-skeletal determinants of fracture risk (discussed further in section 3.6.5.)

3.8 Hip and wrist fractures and social class

The distribution by Depcat of the fracture cohort identified at each centre is shown in fig. 20 – for patients with hip fracture, and for patients with wrist fracture in fig. 21. Thus virtually all of the fracture patients in the most deprived Depcats – 6 & 7, were managed at the Glasgow centres W & G.
Significant differences were noted amongst the different Depcat groupings with regard to assessment and/or treatment rates after hip fracture. Sixty-three percent of patients from Depcats 6 and 7 underwent assessment compared to 41% among Depcats 1 and 2 ($\chi^2 = 33.127$, df = 2, p<0.0001).

After wrist fracture, assessment was more likely to occur in the most deprived in the community (67% from Depcats 6 and 7 versus 38% amongst the most affluent, Depcats 1 and 2) ($\chi^2 = 60.146$, df = 2, p<0.0001).
Despite local data from Glasgow showing an adverse association between socioeconomic deprivation and assessment and/or treatment rates\(^6\;^9\), that demographic disadvantage is eclipsed by the greater inequalities of health care delivery that have been identified; the Glasgow services – FLS & DADS perform relatively well even in the face of social disadvantage.

### 3.9 Secondary prevention after vertebral fractures

Radiology departments have a potentially crucial role in facilitating the ’case-finding’ and recognition that a vertebral fracture event has occurred. The purpose of this component of the audit was to assess what happens when a vertebral fracture has been reported to be present on a spine X-ray.

#### 3.9.1 Vertebral fracture case finding methods

The process that led to identification of the cohort of vertebral fracture cases is summarised in fig. 22. Reports from all X-rays of thoracic and lumbar spine relating to women of 50yr or older that were performed in 2000 were reviewed manually (or with the aid of X-ray report archive search (centre S)) to identify those that included terms that indicated (agreed by the ASG) the presence of a vertebral fracture; the terms that were sought were “fracture”, “collapse”, “compression”, “wedging”, “height loss” and any other terminology suggesting fracture, grouped under “other”.

---

**Figure 21**

![Wrist Fx & Depcat graph](image-url)

% of each centre’s Wrist Fx population in each depcat

---

**Effectiveness of Strategies for the 21st Prevention of Osteoporotic Fractures in Scotland**
The clinicians who requested the X-rays were identified (whether from primary care or from secondary care) and were contacted to invite their participation; participation required that they granted permission for the audit nurses to review the relevant case records and to abstract data for entry on the database. A minority of participating primary care practices and secondary care clinicians opted to complete a questionnaire for each fracture case as an alternative to a visit by the audit nurses (appendix 3).

Relatively few cases were no longer registered at their original practice; some had died, some had been transferred to residential or nursing home facilities outwith the care of the original practices. It was agreed by the ASG that where possible, for the subset of patients whose primary care records could not be accessed either because they had died, or were no longer registered with the original GP (and the current practice could not be identified) or because the primary care clinicians had refused to participate, the secondary care record would be reviewed to ascertain what post-fracture assessment/osteoporosis treatment had been offered.

Thus data were collected from primary care and secondary care case records for all those patients who were alive after vertebral fracture, who were traceable (registered with a practice that was identifiable from secondary care records) and where the primary care or secondary care clinicians had agreed to participation. For some primary care patients’ data were collected, where possible, from secondary care case records.

Mortality after vertebral fracture was ascertained in the process of attempting to trace the fracture cases back to their primary care or secondary care clinicians. This information was gleaned from primary care and secondary care case records and from notifications of deaths that had been reported to the Health Boards’ archives.
Identification & Processing of Vertebral Fracture Cases

Identification of all thoracic and lumbar spine X-ray reports from women \( \geq 50 \)yr taken between Jan 2000-Dec 2000 (incl)
- A / G / H / I / S / W

Manual search for agreed key phrases* indicative of vertebral fracture
- A / G / H / I / S / W
Computerised search for agreed key phrases* indicative of vertebral fracture
- A / G / H / I / S / W

Vertebral fracture cases

Identification of origin (primary care or secondary care) of X-ray request & of requesting clinician

Primary care cases
Secondary care cases

Write to clinicians requesting their participation

Participating clinicians

Non-participating clinicians & patients not traced

Primary care cases
Secondary care cases

Patient no longer registered at practice
Patients now dead & not traced
Patient still alive

Patients not traced back to primary care

Primary care patient data collection
Subset
GPs opted to complete data collection form
Majority
Data collected by audit nurse during practice visit

Secondary care patient data collection by audit nurse

Figure 22
3.9.2 Vertebral fracture cases identified

**443 Vertebral Fx – Primary Care**
- GP refused to participate
  - Yes
    - Registered
      - Yes: 0
      - No: 10
  - No
    - Registered
      - Yes: 429
      - No: 4

Tracked back to secondary care: 14

**831 Vertebral Fx – Secondary Care**

Figure 23: How data relating to the 1274 vertebral fracture cases were obtained: 443 were cases identified from X-rays requested by primary care (14 of whom were tracked only via secondary care records) and 831 were identified from X-rays requested by secondary care clinicians.

443 vertebral fracture cases were identified from review of spine X-rays requested by primary care clinicians (numbers at each centre range from 37 to 136). 831 vertebral fracture cases were identified from review of spine X-rays requested by secondary care clinicians. The outcomes for those patients identified to have vertebral fracture on X-rays requested by primary care clinicians are considered separately from outcomes for patients identified to have vertebral fracture on X-rays requested by secondary care clinicians.
3.10 Vertebral fractures - primary care

3.10.1 Vertebral fracture demography and fracture history – for vertebral fractures identified in primary care

Table 8: Vertebral fracture cases identified by primary care at each centre: demographics – age at time of fracture and their past fracture histories (over the age of 50yr)

<table>
<thead>
<tr>
<th></th>
<th>W</th>
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<th>H</th>
<th>S</th>
<th>A</th>
<th>I</th>
</tr>
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<tbody>
<tr>
<td>N</td>
<td>61</td>
<td>45</td>
<td>37</td>
<td>69</td>
<td>136</td>
<td>95</td>
</tr>
<tr>
<td>Age @ Fx yr</td>
<td>75(9)</td>
<td>72.1(8.6)</td>
<td>72.4(8.6)</td>
<td>70.5(10.2)</td>
<td>76.3(10)</td>
<td>73.7(9.1)</td>
</tr>
<tr>
<td>Past Fx Hx %</td>
<td>45.9</td>
<td>53.3</td>
<td>46</td>
<td>30.4</td>
<td>52.9</td>
<td>62.1</td>
</tr>
<tr>
<td>Past Hip Fx %</td>
<td>3.3</td>
<td>0</td>
<td>5.4</td>
<td>1.4</td>
<td>10.3</td>
<td>15.8</td>
</tr>
<tr>
<td>Past nonVFx%</td>
<td>36.1</td>
<td>37.8</td>
<td>29.7</td>
<td>27.5</td>
<td>33.1</td>
<td>45.3</td>
</tr>
<tr>
<td>Past VFx%</td>
<td>13.1</td>
<td>22.2</td>
<td>16.2</td>
<td>4.3</td>
<td>31.6</td>
<td>16.8</td>
</tr>
</tbody>
</table>

The average age of patients with vertebral fractures identified on X-rays requested by primary care ranged from 71-76yr across participating centres. Past experience of fracture (ascertained from primary care case record review) over the age of 50, was commoner than among wrist fracture patients and ranged from 30 to 62%. Past hip fracture experience varied widely and was noted in up to 16%. Past vertebral fracture history was noted in 4-32% of cases among participating centres. Overall about 50% of the vertebral fracture patients have previously experienced at least one additional fracture – a potential opportunity for assessment and intervention, that was typically neglected.
3.10.2 Assessment and/or treatment for the secondary prevention of osteoporotic fractures after vertebral fracture, for vertebral fractures identified by primary care

Outcome After VFx-Primary Care by Centre

Figure 24: Rates of assessment and/or treatment for the secondary prevention of osteoporotic fracture after vertebral fracture for those vertebral fractures identified in primary care, by centre.

Assessment and/or treatment for the secondary prevention of osteoporotic fracture occurred in about 47% (centre I) to about 84% (centre G) of primary care vertebral fracture cases (fig. 24). The mechanism by which assessment and/or treatment was achieved is shown in fig. 25.
The mechanism by which primary care clinicians achieved assessment of osteoporosis or treatment for the secondary prevention of fractures was primarily through links with secondary care services. Almost all patients who were assessed and/or treated at centre A achieved this through open access DXA services that were accessible by primary care while at Glasgow centres G and W, where a DADS service exists, assessment was usually achieved by primary care through referral to specialist Bone Metabolism clinics in respectively 40% and 34% of cases while access to DXA through the DADS accounted for an additional 27-34% of assessed cases respectively at these centres. At centres H, S and I, virtually all vertebral fracture patients that were assessed and/or treated achieved this through referral to secondary care clinics. Highest rates of assessment and/or treatment were achieved at Glasgow centres G and W where the combination of access to specialist clinics and access to DADS accounted for the vast majority of those who underwent assessment and/or treatment for osteoporosis. These services may also have contributed to the management of the 8-11% of case who were on treatment at the time of their fracture.
3.10.3 Outcome after assessment and/or treatment after vertebral fracture, identified in primary care

![Rx Prescribed After Vertebral Fx Primary Care](image)

Figure 26: Outcome after assessment and/or treatment after vertebral fracture, identified in primary care – did the patients attend and what treatment, if any, was recommended?

Treatment decisions resulting from ascertainment of vertebral fracture on X-ray are shown in fig. 26. Among those who are assessed and/or treated, bisphosphonates were prescribed in 41 to 57% of cases. Other interventions used included calcium and vitamin D in about 8 to 18%, and occasionally HRT (upto 5%) and raloxifene (upto 3%). No treatment for secondary prevention was prescribed in 32 to 49% of cases (however, in a proportion of these treatment would have been deemed unnecessary on the basis that BMD may have exceeded a threshold at which treatment might be expected to effect a useful reduction in fracture risk).
3.10.4 Subsequent fracture experience after vertebral fracture, for vertebral fracture cases identified in primary care

Table 9: The clinical vertebral and non-vertebral fracture experience after identification of vertebral fracture, among cases identified in primary care.

**Vertebral Fx Patients – Primary Care: Outcomes**

<table>
<thead>
<tr>
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<th>S</th>
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<th>I</th>
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<tr>
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<td>61</td>
<td>45</td>
<td>37</td>
<td>69</td>
<td>136</td>
<td>95</td>
</tr>
<tr>
<td>Time (yr) to Data Collection</td>
<td>61</td>
<td>44</td>
<td>37</td>
<td>68</td>
<td>135</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>1.6(0.4)</td>
<td>1.6(0.4)</td>
<td>2.8(0.3)</td>
<td>2.1(0.3)</td>
<td>2(0.5)</td>
<td>3.2(0.4)</td>
</tr>
<tr>
<td>Subs FxHx %</td>
<td>16.9</td>
<td>15.6</td>
<td>24.3</td>
<td>7.3</td>
<td>16.9</td>
<td>23.2</td>
</tr>
<tr>
<td>Subs Hip Fx %</td>
<td>3.3</td>
<td>4.4</td>
<td>5.4</td>
<td>0</td>
<td>4.4</td>
<td>15.8</td>
</tr>
<tr>
<td>Subs nonVFx %</td>
<td>8.2</td>
<td>11.1</td>
<td>18.9</td>
<td>5.8</td>
<td>13.2</td>
<td>13.7</td>
</tr>
<tr>
<td>Subs VFx %</td>
<td>9.8</td>
<td>4.4</td>
<td>5.4</td>
<td>1.4</td>
<td>4.4</td>
<td>4</td>
</tr>
</tbody>
</table>

Rates of further fracture after vertebral fracture are particularly high and were invariably higher than after wrist fracture and occurred in up to 24% of cases in the brief period from index vertebral fracture to the time of data collection (that ranged from 1.8 ± 0.5 to 3.1 ± 0.6 years(table 9)).
3.11 Vertebral fractures - secondary care

3.11.1 Vertebral fracture demography and fracture history – for vertebral fractures identified in secondary care

Table 10: Vertebral fracture cases identified by secondary care at each centre: demographics – age at time of fracture and their past fracture histories (over the age of 50yr)

<table>
<thead>
<tr>
<th></th>
<th>W</th>
<th>G</th>
<th>H</th>
<th>S</th>
<th>A</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>165</td>
<td>172</td>
<td>68</td>
<td>76</td>
<td>219</td>
<td>131</td>
</tr>
<tr>
<td>Age @ Fx yr</td>
<td>75.8(9.9)</td>
<td>72.9(10.1)</td>
<td>76.5(9.1)</td>
<td>76.6(10.9)</td>
<td>74.4(11.5)</td>
<td>76.8(11.7)</td>
</tr>
<tr>
<td>Past Fx Hx %</td>
<td>52.1</td>
<td>46.5</td>
<td>30.9</td>
<td>48.7</td>
<td>60.3</td>
<td>42.8</td>
</tr>
<tr>
<td>Past Hip Fx %</td>
<td>9.1</td>
<td>7</td>
<td>11.8</td>
<td>11.8</td>
<td>9.1</td>
<td>7.6</td>
</tr>
<tr>
<td>Past nonVFx %</td>
<td>38.8</td>
<td>32.6</td>
<td>23.5</td>
<td>42.1</td>
<td>41.1</td>
<td>36.6</td>
</tr>
<tr>
<td>Past VFx%</td>
<td>21.8</td>
<td>21.5</td>
<td>10.3</td>
<td>11.8</td>
<td>35.6</td>
<td>13.7</td>
</tr>
</tbody>
</table>

Past experience of fracture (ascertained from secondary care case record review) over the age of 50, was commoner than among wrist fracture patients and ranged from 31 to 60% (table 10). Past hip fracture experience varied widely and was noted in up to 12%. Past vertebral fracture history was noted in between 10 and 36% of cases among participating centres.

Once again, about half of the vertebral fracture cohort has a past history of at least one other fracture that occurred after the age of 50yr; for the vast majority, the potential opportunity this presented to intervene to reduce future fracture risk was entirely neglected.
3.11.2 Assessment and/or treatment for the secondary prevention of osteoporotic fractures after vertebral fracture, for vertebral fractures identified by secondary care

**Outcome After VFx-Secondary Care by Centre**

![Bar chart showing rates of assessment and/or treatment for secondary prevention of osteoporotic fracture after vertebral fracture for those vertebral fractures identified in secondary care, by centre.](chart.png)

Figure 27: Rates of assessment and/or treatment for the secondary prevention of osteoporotic fracture after vertebral fracture for those vertebral fractures identified in secondary care, by centre.

Assessment and/or treatment for the secondary prevention of osteoporotic fractures after vertebral fracture occurred in about 25%-69% of cases (fig. 27). It should be noted that in centres G and W, specific bone metabolism clinics are held. At centre G, at the time of the audit there was an automatic policy of performing spine X-rays on patients who were undergoing osteoporosis assessment and this accounted for over half of the secondary care vertebral fracture cases at this centre (figs. 28 & 29).
Figure 28: Mechanism by which assessment and/or treatment was achieved after vertebral fracture, for vertebral fractures identified in secondary care, by centre.

It should be noted that in contrast to hip and wrist fractures, the FLS model is involved in no more than 4% of the vertebral fracture cases which is largely a reflection that the remit of this service was to deal with fracture cases presenting to A&E and orthopaedic fracture services and in practice few patients present to hospital on account of acute vertebral fracture; those that did would have been identified and offered assessment by the FLS. The majority of assessments of the vertebral fracture patients that did take place outside centre G were arranged by a diverse spectrum of secondary care clinicians from assorted medical and surgical specialties (grouped as ‘other’ in figs. 28 & 29).
3.11.3 Outcome after assessment and/or treatment after vertebral fracture, identified in secondary care

Of patients identified to have vertebral fracture from secondary care X-ray requests, between 37% and 86% of such patients subsequently received no drug therapy (fig. 30). The most commonly used intervention was bisphosphonate therapy; this was recommended in 12% (centre I) to 43% (centre G) of cases. Calcium and vitamin D were prescribed as only treatment in between 2% and 17% of patients across centres.
Figure 30: Outcome after assessment and/or treatment after vertebral fracture, identified in secondary care – did the patients attend and what treatment, if any was recommended?

3.11.4 Subsequent fracture experience after vertebral fracture, for vertebral fracture cases identified in secondary care

In the 1.6 to 3.1 years of follow-up from the date that the vertebral fracture had been identified on the spinal X-ray until the data had been collected, between 11 and 25% of secondary care vertebral fracture patients had experienced at least one further fracture; that subsequent fracture experience included the occurrence of a hip fracture in between 4 and 8% of cases, depending on centre.
Effectiveness of Strategies for the 2° Prevention of Osteoporotic Fractures in Scotland

Table 11: The clinical vertebral and non-vertebral fracture experience after identification of vertebral fracture, among cases identified in secondary care.

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>W</th>
<th>G</th>
<th>H</th>
<th>S</th>
<th>A</th>
<th>I</th>
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<tr>
<td>N</td>
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<td>172</td>
<td>68</td>
<td>76</td>
<td>219</td>
<td>131</td>
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<tr>
<td>Time (yr) to Data Collection</td>
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<td>52</td>
<td>146</td>
<td>236</td>
<td>128</td>
</tr>
<tr>
<td></td>
<td>1.6(0.4)</td>
<td>1.6(0.4)</td>
<td>2.6(0.6)</td>
<td>2.2(0.4)</td>
<td>1.8(0.4)</td>
<td>3.1(0.5)</td>
</tr>
<tr>
<td>Subs FxHx %</td>
<td>13.9</td>
<td>10.5</td>
<td>16.2</td>
<td>11.8</td>
<td>13.7</td>
<td>25.2</td>
</tr>
<tr>
<td>Subs Hip Fx %</td>
<td>7.9</td>
<td>4.7</td>
<td>4.4</td>
<td>5.3</td>
<td>4.6</td>
<td>7.6</td>
</tr>
<tr>
<td>Subs nonVFx %</td>
<td>13.7</td>
<td>9.3</td>
<td>11.8</td>
<td>11.8</td>
<td>11.9</td>
<td>19.1</td>
</tr>
<tr>
<td>Subs VFx %</td>
<td>3.6</td>
<td>1.2</td>
<td>4.4</td>
<td>1.3</td>
<td>1.8</td>
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</tr>
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</table>

3.12 Past and future fracture experience associated with vertebral fracture

In sections 3.10.1 and 3.11.1 the past fracture history experienced by vertebral fracture patients, by site of fracture, is described. Fig. 31 shows this past fracture experience (for the primary care and secondary care cohorts together) by number of fractures that had occurred: 29% had accumulated one other previous fracture, while 21% had had at least 2 other fractures, since the age of 50yr.
Past Fx (nonVFx & VFx) History in 1048 Patients with Vertebral Fx

![Bar chart showing the number of previous clinical vertebral and non-vertebral fractures experienced (after the age of 50yr) by the vertebral fracture cases (considering all vertebral fracture cases whether identified in primary or secondary care).]

Figure 31: The number of previous clinical vertebral and non-vertebral fractures experienced (after the age of 50yr) by the vertebral fracture cases (considering all vertebral fracture cases whether identified in primary or secondary care).

Fig. 32 shows the fracture experience (as the numbers of fractures sustained by patients) after the identification of the index vertebral fracture. About 16% of vertebral fracture cases sustained at least one other fracture in the time from fracture to data collection; ~3% had sustained 2 or more other fractures during this period.

Among all vertebral fracture patients, the risk of sustaining a further fracture in the follow-up period from the time of original fracture to data collection was no less among those who had undergone assessment (17%) than those who had not (14%) \( \chi^2 = 2.949, df = 1, p=0.086 \). However, this should be interpreted with caution (see discussion in section 3.6.5).
Subsequent Fx (nonVFx & VFx) History in 1048 Patients with Vertebral Fx

Figure 32: The number of subsequent clinical vertebral and non-vertebral fractures experienced (after the age of 50yr) by the cases who had sustained a vertebral fracture (considering all vertebral fracture cases whether identified in primary or secondary care).

In order to elucidate factors that contribute to risk of further fracture after vertebral fracture, multiple logistic regression analysis was performed to assess the relationship between possible determinants including Depcat, whether the original X-ray had been requested by primary or secondary care, centre, whether the patient had experienced at least one other fracture prior to sustaining the vertebral fracture, whether the X-ray showed one or two or more vertebral fractures, the age at the time of the index vertebral fracture and whether assessment and/or treatment were achieved. Only the presence two or more vertebral fractures on the original X-ray report (versus the report of the presence of a single vertebral fracture) was associated with higher risk of subsequent fractures (OR 1.77 ((95%CI) 1.28 to 2.47)(p=0.001)).
3.13 Comparison of assessment and/or treatment rates by primary care and secondary care after vertebral fracture cases have been identified on X-rays requested.

Assessed &/or Rx After Vertebral Fx
Primary Care v Secondary Care

Figure 33a: Rates of assessment and/or treatment for the secondary prevention of osteoporotic fracture by primary care (PC) and secondary care (SC) after vertebral fracture.

Patients identified to have vertebral fractures on X-rays requested by primary care clinicians are more likely to undergo subsequent osteoporosis assessment and/or treatment than patients with vertebral fractures identified within secondary care (fig. 33a). Overall, 70% of cases with fractures identified on X-rays identified by primary care underwent subsequent assessment and/or treatment compared with 52% from secondary care X-rays ($\chi^2 = 39.185$, df = 1, p<0.0001). Higher assessment and/or treatment rates were consistently seen among cases identified by primary care than among cases identified by secondary care at each centre; this is despite the routine use of spine X-rays in the evaluation of patients undergoing secondary care clinic assessment at centre G (a practice that would inflate the assessment and/or treatment rates after vertebral fracture at that centre, and therefore also in the secondary care cohort as a whole).
Figure 33b: Treatment rates for the secondary prevention of osteoporotic fracture by primary care (PC) and secondary care (SC) after vertebral fracture.

Actual treatment rates among patients with vertebral fractures identified within primary care were 7 to 44% higher than among patients with vertebral fractures identified within secondary care at 4 centres (A, H, S, & W) (fig. 33b). However, 1 to 4% higher treatment rates were seen among vertebral fracture cases identified within secondary care at centres G & I.
3.14 Vertebral fractures and social class

Vertebral Fx & Depcat
% of each centre’s Vertebral Fx population in each depcat

Figure 34: Distribution by Depcat of vertebral fracture cases identified within primary care and secondary care, by centre.

As seen for hip and vertebral fractures, the vast majority of patients from Depcats 6 & 7 (the most deprived) are found within Glasgow centres G & W (fig. 34). Across all centres, and in contrast to the findings for wrist and hip fracture cases, among patients with vertebral fractures identified on X-rays requested by primary and secondary care clinicians, Depcat is not associated with differential rates of assessment and/or treatment ($\chi^2 = 7.349$, df = 6, $p=0.29$).

3.15 Discussion

Multiple logistic regression analysis was performed to assess the relationship between the outcome of ‘offered assessment and/or treatment of osteoporosis’ after vertebral fracture and potential explanatory variables including Depcat, the inclusion of the term ‘fracture’ in the original X-ray report (discussed further in sections 3.14.1 to 3.14.3), whether the original X-ray had been requested by Primary or secondary care, whether the patient had experienced at least one other fracture prior to sustaining the vertebral fracture, whether the X-ray showed one or two or more vertebral fractures, centre and the age at the time of the index vertebral fracture.

Inclusion of the term ‘fracture’ in the original X-ray report (OR 1.57 ((95%CI 1.12 to 2.12)(p=0.009)) (see below – section 3.16.2.), whether the original X-
Effectiveness of Strategies for the Prevention of Osteoporotic Fractures in Scotland

A X-ray had been requested by secondary care (v primary care) (OR 0.39 ((95% CI) 0.3 to 0.51) (p<0.0001)), whether the patient had experienced at least one other fracture prior to sustaining the vertebral fracture (OR 1.91 ((95% CI) 1.49 to 2.46) (p<0.0001)), whether the X-ray showed one or two or more vertebral fractures (OR 1.95 ((95% CI) 1.49 to 2.55) (p<0.0001)), centre (OR 1.28 ((95% CI) 1.18 to 1.39) (p<0.0001)) are independently associated with ‘assessment and/or treatment of osteoporosis’ after vertebral fracture.

The analysis was repeated and ‘centre’ was replaced by ‘centre with service’ or not (see below), and in a further analysis by ‘centre with FLS’ or not (see below).

<table>
<thead>
<tr>
<th>Predictor</th>
<th>p</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centre</td>
<td>&lt;0.0001</td>
<td>1.28</td>
<td>1.18 to 1.39</td>
</tr>
<tr>
<td>Centre with service*</td>
<td>&lt;0.0001</td>
<td>2.56</td>
<td>1.89 to 3.48</td>
</tr>
<tr>
<td>Centre with FLS**</td>
<td>0.04</td>
<td>1.39</td>
<td>1.01 to 1.93</td>
</tr>
</tbody>
</table>

*Centre with service includes those with FLS or DADS for primary care or with secondary care specialist clinics (centres A, G, S, W).

**Centre with FLS = centre W

It can be seen that the availability of a local service (whether DADS/OAU or FLS or secondary care clinic) almost trebles the chance of ‘assessment and/or treatment of osteoporosis’ after vertebral fracture. Because the FLS aims and achieves ‘case-finding’ of fracture cases that present to inpatient and outpatient orthopaedic fracture services – and these are not stages in the typical vertebral fracture patients’ pathway of care, the presence of a FLS (centre W) has a substantially lower impact on vertebral fracture assessment and/or treatment than occurs after non-vertebral fracture.

Considering all vertebral fracture subjects, subsequent assessment and/or treatment are more likely if there is a locally available osteoporosis service (whether DADS, FLS, or clinic) (81%) than where there is no local service (19%) (χ² = 41.256, df = 1, p<0.0001). The rates of assessment and/or treatment after vertebral fracture consequently differed significantly among the different Trusts with rates ranging from 43% (centres H and I) to 72% (G) (χ² = 54.613, df = 5, p<0.0001).
3.16 Vertebral fracture ‘case-finding’ issues

3.16.1 Vertebral fracture terminology and treatment outcome

The crucial role that Radiology departments have is in facilitating the ‘case-finding’ and recognition that a vertebral fracture event has occurred in the expectation that this should trigger appropriate intervention for the secondary prevention of fractures. It has previously been shown that routinely reported spine X-rays often fail to mention the presence of vertebral fracture, but even when a vertebral fracture has been reported the requesting clinician may fail to respond to this finding by initiating therapy or recommending further assessment\(^{(76)}\).

The purpose of this component of the audit was to assess current radiological practice in reporting vertebral fractures and the potential impact of this reporting on triggering intervention (including assessment, if required) for the secondary prevention of osteoporotic fractures among the clinicians who requested the spine X-rays.

The routine radiology reports relating to all the cases with vertebral deformity/fracture that had been included in section 3.9.2 were analysed. All descriptive phrases/terms cited in those reports were collated. Consensus was reached among the ASG regarding core vertebral fracture descriptors and an arbitrary prioritization was agreed such that reports including multiple core descriptive terms were recorded only once, even if the original X-ray report contained more than one term. All associated adjectives and qualifying terms were also noted. The purpose was to ascertain whether terminology used routinely by radiology departments to convey the presence of vertebral fracture influenced the response among clinicians receiving the X-ray reports.

The agreed core terms that were regarded to be synonymous with, and indicative of, vertebral fracture were “fracture”, “collapse”, “compression”, “wedging”, “height loss” and any other terminology suggesting fracture was grouped under “other”. This order reflected the arbitrary ranking that was agreed by the ASG. For example, if an X-ray report included mention of “fracture” but also “wedging” and “height loss”, that X-ray report would be classified as including “fracture” but not the other terms. Other adjectives that were commonly used reflected the perception of: 1) duration of the presence of fracture (“old” or “long-standing”), 2) fracture severity when minor (“mild”, “minor”, “partial”, “some”, “slight”, “early”, “reduction”, “early partial”, “limited”, “minimal”, “a degree”, “30%”, “some evidence of”), 3) fracture severity when more severe (“moderate”, “marked”, “significant”, “40%”, “50%”, “60%”, “70%”) and 4) anatomical patterns of fracture (“anterior”, “biconcave”, “end-plate”, “posterior”). Vertebral fracture reports were collated. Vertebral fracture core terminology and its influence in triggering assessment and/or treatment of osteoporosis is shown in fig. 35.
Vertebral Fracture Terminology & Outcome

Figure 35: Assessment and/or treatment rates in relation to terminology indicating the presence of vertebral fracture that was used in the original X-ray report.

Inclusion of explicit reference to the term “fracture” on spine X-ray report is associated with significantly greater rates of subsequent assessment and/or treatment for osteoporosis whether the X-ray was requested from primary care or secondary care (fig. 36). The rates of assessment are respectively 65% versus 57% (χ² = 4.483, df = 1, p=0.034).
Impact of VFx Terminology & Outcome: inclusion of ‘fracture’ & association with assessment & or Rx

Chi-square: 4.483, DF=1: p = 0.034

![Bar chart showing assessment and/or treatment rates with or without explicit use of the term 'fracture'.]

Figure 36: Assessment and/or treatment rates were higher if there was explicit use of the term ‘fracture’ in the X-ray report.

Table 12 shows that explicit reference to the presence of ‘fracture’ or ‘collapse’ on spine X-ray reports is associated with significantly higher rates of assessment and/or treatment than those whose X-ray reports do not include these terms. Inclusion of the terms ‘compression’/‘depression’, ‘wedging’ and ‘height loss’ are not associated with higher rates of intervention. Thus the terminology used by Radiologists who report the presence of vertebral fractures on spine X-rays can crucially influence the response that is triggered in the clinicians who referred these patients for their spine X-rays.
Effectiveness of Strategies for the 2° Prevention of Osteoporotic Fractures in Scotland

Table 12

Impact of Terminology Used to Denote Vertebral Fracture & its Impact on Outcome

<table>
<thead>
<tr>
<th>Term</th>
<th>n</th>
<th>% with term - assessed or treated</th>
<th>% w/o term - assessed or treated</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fracture</td>
<td>206</td>
<td>65%</td>
<td>57%</td>
<td>0.03</td>
</tr>
<tr>
<td>Collapse</td>
<td>394</td>
<td>66%</td>
<td>54%</td>
<td>0.0001</td>
</tr>
<tr>
<td>Compression/Depression</td>
<td>113</td>
<td>63%</td>
<td>57%</td>
<td>0.23</td>
</tr>
<tr>
<td>Wedging</td>
<td>220</td>
<td>54%</td>
<td>59%</td>
<td>0.16</td>
</tr>
<tr>
<td>Height loss</td>
<td>327</td>
<td>45%</td>
<td>62%</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

Impact of VFx Terminology & Outcome: single v multiple VFx & association with assessment & or Rx

Chi-square: 19.545; DF=1: p = 0.0001

Figure 37: Assessment and/or treatment rates were higher if multiple vertebral fractures (versus single) were noted in the X-ray report

For all vertebral fracture subjects, when the X-ray report indicated the presence of multiple vertebral fractures, subsequent assessment and/or treatment for osteoporosis was more likely (67%) than in patients whose X-ray
report referred to the presence of a single, vertebral fracture (54%)(χ² = 19.545 df = 1, p=0.0001) (fig. 37).

The impact of other descriptive terminology on ‘assessment and/or treatment rates’ that were seen when the core fracture term was present are seen in figs. 38 to 41.

**Impact of VFx Terminology & Outcome:**
association with assessment & or Rx of ‘fracture’ + other qualifier

![Graph showing assessment and/or treatment rates](image)

Figure 38: Assessment and/or treatment rates when there was explicit reporting of the presence of a ‘fracture’ and the influence on outcome when other descriptive terms are included.
Impact of VFx Terminology & Outcome: association with assessment & or Rx of ‘collapse’ + other qualifier

Figure 39: Assessment and/or treatment rates when there was explicit reporting of the presence of a ‘collapse’ and the influence on outcome when other descriptive terms are included.

Impact of VFx Terminology & Outcome: association with assessment & or Rx of ‘compression’ + other qualifier

Figure 40: Assessment and/or treatment rates when there was explicit reporting of the presence of a ‘compression’ and the influence on outcome when other descriptive terms are included.
Impact of VFx Terminology & Outcome: association with assessment & or Rx of ‘wedging’ + other qualifier

Figure 41: Assessment and/or treatment rates when there was explicit reporting of the presence of ‘wedging’ and the influence on outcome when other descriptive terms are included.

Impact of VFx Terminology & Outcome: association with assessment & or Rx of ‘height loss’ + other qualifier

Figure 42: Assessment and/or treatment rates when there was explicit reporting of the presence of ‘height loss’ and the influence on outcome when other descriptive terms are included.
3.16.2 Discussion - vertebral fracture reporting

A number of other issues relating to the reporting of vertebral fractures merit consideration. Currently, the UK lacks a universal, standardized reporting system that defines what constitutes a vertebral fracture. In one North American study, experts who reviewed spine views from a series of 934 lateral chest X-rays identified almost twice as many ‘moderate’ to ‘severe’ vertebral fractures and about one third more ‘severe’ fractures than the radiologist who issued the original report(76). Typically, however, even where a ‘moderate’ or ‘severe’ vertebral fracture had been reported to be present this was only reflected in about 17% of the affected patients’ clinical management records or discharge summaries; when at least one ‘severe’ vertebral fracture had been identified on the original X-ray report, only in 24% was this reflected in the clinical records or discharge summaries(76). The presence of multiple fractures made little difference. It is perhaps not surprising that only 18% of patients with an X-ray that was reported to show the presence of at least one vertebral fracture, received any form of treatment for osteoporosis or fracture reduction (including calcium and vitamin D).

This audit has assessed the response to the reporting of vertebral fractures (noted to be present in routinely reported X-rays taken in 6 radiology departments in Scotland) by the clinicians who requested the X-ray (from both primary care and secondary care). The importance of X-ray reporting of vertebral fracture as the only effective current means to achieve ‘case-finding’ of vertebral fracture cases has already been emphasized (because of the diverse presentations of vertebral fracture, they often are asymptomatic). It is clear that the vocabulary used routinely in reporting spine X-rays is diverse (3.14.2); we accepted 6 ‘core’ terms to be indicative of fracture. Even within one hospital, when core fracture terminology is coupled with other descriptive terms, 26 different phrases were used to denote the presence of vertebral fractures of one sort or another. Terminology determines the response in clinicians who receive the X-ray report (figs. 35 - 42); this is perhaps most clearly seen in fig. 36, where explicit reference to the presence of a vertebral ‘fracture’ (as opposed to ‘collapse’, ‘height loss’ and all other core terms) resulted in significantly greater (~8%) assessment and/or treatment rates.

There are several possible solutions to the problems that have been identified in effectively communicating the presence of a vertebral fracture on an X-ray. The most objective way to define the presence of vertebral fracture is to perform quantitative morphometry; this was introduced because visual assessment of radiographs alone was considered not to be reproducible enough for clinical and epidemiologic studies of vertebral fracture. Several morphometric definitions of vertebral fracture have been described, and have been used in clinical trials(77), but these are time consuming, are impractical in routine clinical practice and can perform suboptimally when used in isolation without reference to the radiological appearance (specifically the pattern of deformity) of the vertebra.

The alternative, and more practical approach that might be more readily applicable to routine radiological reporting practice is to adopt a standardized
and time-efficient system that recognises different patterns of vertebral fracture and grades their severity. Currently, tools that could achieve this goal are available; the semiquantitative (SQ) assessment devised by Genant et al. (78) provides a simple protocol for reporting vertebral fractures on lateral spine X-rays. Three patterns of vertebral fracture are recognized in this scoring system – ‘wedge’ or ‘biconcave’ or ‘crush’ fractures; when present these fractures are graded on visual inspection and without direct vertebral measurement into 4 grades according to the severity of the deformity (‘normal’/grade 0, ‘mild’/grade 1 comprising 20-25% reduction in height, ‘moderate’/grade 2 comprising 25-40% reduction in height, and ‘severe’/grade 3 comprising > 40% reduction in height. This SQ approach has been demonstrated to have excellent intraobserver and interobserver reproducibility (78-80).

It would appear from this report that specific reference to the presence of a vertebral ‘fracture’, whatever the pattern or grade, should be the crucial inclusion in any revised reporting protocol for vertebral fractures.
4. Factors influencing utilisation of services for osteoporosis by primary care: access, geography, prioritisation and social class

4.1 Factors influencing utilisation of services for osteoporosis in Glasgow

4.1.1 The response of primary care clinicians to risk factors for osteoporosis and for fracture: prioritisation/outcomes with and without access to a direct-access DXA service

Much of the emphasis on osteoporosis management in the UK has hitherto focused on the primary prevention of osteoporosis and of fracture: the corollary is that patients with fractures have not been regarded as a priority group for identification and assessment, despite their inherent much higher risk of fracture (which is the important clinical consequence of osteoporosis). To explore the actual response of primary care clinicians to three established and recognized risk factors, (1) early menopause (where the potential benefit of intervention would be the primary prevention of osteoporosis and of fracture - although most patients will, in fact, receive treatment for relief of menopause-related symptoms), (2) corticosteroid use (where the potential benefit would be the primary prevention of osteoporosis and of fractures), and (3) fracture (potential benefit would be the secondary prevention of osteoporotic fractures), 15 primary care practices were visited to assess what were the assessment and/or treatment rates among patients identified from primary care with these three risk factors.

4.1.2 Methods

This component of the study was conducted in association with MREC and LREC approval through Acute and Primary Care Trusts. Appropriate G-Pass/Vision codes for the risk factors in question were identified.

General practitioners who participated in the other sections of this audit programme were approached and were selected on the basis of their representation of a range of distributions of deprivation category within their patient populations and on the basis of having either G-Pass or Vision patient record databases.

Fifteen practices situated within 20 miles of the Western Infirmary were approached and 10 agreed to participate. In order to assess the impact on response to risk factors of not having local access to DXA assessment services, 7 general practices that were located more than 20 miles from Glasgow were approached, of which 5 agreed to participate.

Search criteria – fracture patients: women ≥50 years with “fracture of lower limb”, “fractures of upper limb” or “vertebral fractures” were sought.
Early menopause: women with premature menopause under age 45 (read code C1631) and women who had undergone hysterectomy under the age of 45 (read code 7E045) were sought. Current or past use of glucocorticoid: males or females over 15yrs on a dose of prednisolone of $\geq$7.5mg per day for three months were sought. The Audit Nurse visited the practice and personally undertook the database search using the appropriate criteria to ensure standardization of data collection.

4.1.3 Results

Table 13 shows the distribution of patients with fractures (hip, other non-vertebral and vertebral), early menopause and current/past corticosteroid users. It is clear that there is enormous variability in the numbers of patients fulfilling each of these criteria from one practice to another. This might indicate a true difference in the prevalence of such risk factors or might, more likely, indicate variable recording of the information in the primary care databases. It should be noted that these practices were selected on the basis that they were computerised. None of the criteria that are being searched for is currently a target/priority area that has been specified in the new GP contract, furthermore.
Table 13: Cases with risk factors for osteoporosis (past history of fracture, past or current use of steroids or early menopause) who were identified from search of general practice databases (15 practices) within 20 miles radius of Glasgow (urban practices with local access to DADS) or greater than 20 miles from Glasgow (rural practices, with no local access to DADS).

<table>
<thead>
<tr>
<th>Practice</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>O</th>
<th>P</th>
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</thead>
<tbody>
<tr>
<td>n</td>
<td>70</td>
<td>70</td>
<td>273</td>
<td>426</td>
<td>179</td>
<td>126</td>
<td>240</td>
<td>374</td>
<td>221</td>
<td>410</td>
<td>366</td>
<td>280</td>
<td>124</td>
<td>71</td>
<td>288</td>
<td>234</td>
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<tr>
<td>%</td>
<td>1.9</td>
<td>1.9</td>
<td>7.3</td>
<td>11.4</td>
<td>4.8</td>
<td>3.4</td>
<td>6.4</td>
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<td>10.9</td>
<td>9.8</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td>Y</td>
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<td>Y</td>
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<td>Y</td>
<td>Y</td>
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<td>N</td>
<td>N</td>
<td>N</td>
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<td>N</td>
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<tr>
<td>Total Fx</td>
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<td>29</td>
<td>171</td>
<td>261</td>
<td>160</td>
<td>81</td>
<td>147</td>
<td>253</td>
<td>130</td>
<td>300</td>
<td>116</td>
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<td>48</td>
<td>50</td>
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<td>43</td>
<td>22</td>
<td>27</td>
<td>4</td>
<td>3</td>
<td>39</td>
<td>18</td>
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<tr>
<td>Other non-vertebral Fx</td>
<td>22</td>
<td>12</td>
<td>145</td>
<td>227</td>
<td>142</td>
<td>66</td>
<td>112</td>
<td>202</td>
<td>109</td>
<td>254</td>
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<td>241</td>
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<td>4</td>
<td>2</td>
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<td>3</td>
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<td>12</td>
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<td>8</td>
<td>7</td>
<td>9</td>
<td>5</td>
<td>11</td>
<td>14</td>
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<td>7</td>
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<td>11</td>
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<tr>
<td>Current steroid use</td>
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<td>6</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>10</td>
<td>8</td>
<td>3</td>
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<td>Past steroid use</td>
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<td>6</td>
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<td>7</td>
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<td>39</td>
<td>94</td>
<td>153</td>
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<td>34</td>
<td>76</td>
<td>104</td>
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<td>99</td>
<td>231</td>
<td>0</td>
<td>65</td>
<td>11</td>
<td>86</td>
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<tr>
<td>Actual cases</td>
<td>65</td>
<td>69</td>
<td>273</td>
<td>421</td>
<td>179</td>
<td>120</td>
<td>234</td>
<td>371</td>
<td>219</td>
<td>406</td>
<td>355</td>
<td>280</td>
<td>117</td>
<td>71</td>
<td>288</td>
<td>230</td>
</tr>
</tbody>
</table>
Table 14: Cases with past history of fracture, who were identified from search of general practice databases (15 practices) – showing age at which fracture occurred and current age of patient

<table>
<thead>
<tr>
<th>Fracture site</th>
<th>Hip</th>
<th>Other non-vertebral site</th>
<th>Vertebral</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>366</td>
<td>1991</td>
<td>40</td>
</tr>
<tr>
<td>Age (mean) at fracture</td>
<td>73.4</td>
<td>64.3</td>
<td>67.8</td>
</tr>
<tr>
<td>Current age (mean)</td>
<td>79.5</td>
<td>73.8</td>
<td>77.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How long ago was Fracture (years)</th>
<th>0 to 5</th>
<th>6 to 10</th>
<th>11 to 15</th>
<th>16 to 20</th>
<th>20+</th>
<th>0 to 5</th>
<th>6 to 10</th>
<th>11 to 15</th>
<th>16 to 20</th>
<th>20+</th>
<th>0 to 5</th>
<th>6 to 10</th>
<th>11 to 15</th>
<th>16 to 20</th>
<th>20+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of fractures</td>
<td>217</td>
<td>79</td>
<td>35</td>
<td>17</td>
<td>15</td>
<td>672</td>
<td>542</td>
<td>382</td>
<td>217</td>
<td>164</td>
<td>11</td>
<td>11</td>
<td>8</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Assessed&amp;/or Treated (n)</td>
<td>149</td>
<td>44</td>
<td>19</td>
<td>11</td>
<td>6</td>
<td>328</td>
<td>164</td>
<td>92</td>
<td>57</td>
<td>45</td>
<td>11</td>
<td>8</td>
<td>5</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Age at fracture</td>
<td>50-59</td>
<td>60-69</td>
<td>70-79</td>
<td>80+</td>
<td>50-59</td>
<td>60-69</td>
<td>70-79</td>
<td>80+</td>
<td>50-59</td>
<td>60-69</td>
<td>70-79</td>
<td>80+</td>
<td>8</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>Number</td>
<td>41</td>
<td>78</td>
<td>132</td>
<td>113</td>
<td>698</td>
<td>684</td>
<td>429</td>
<td>148</td>
<td>8</td>
<td>15</td>
<td>12</td>
<td>10</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessed&amp;/or Treated (n)</td>
<td>24</td>
<td>47</td>
<td>79</td>
<td>80</td>
<td>220</td>
<td>227</td>
<td>178</td>
<td>61</td>
<td>7</td>
<td>12</td>
<td>10</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 15: Cases with risk factors for osteoporosis (past history of fracture, past or current use of steroids or early menopause) who were identified from search of general practice databases (15 practices) within 20 miles radius of Glasgow (urban practices with local access to DADS) or greater than 20 miles from Glasgow (rural practices, with no local access to DADS), indicating their Depcat and whether they underwent assessment and/or treatment for osteoporosis.

<table>
<thead>
<tr>
<th>Fx site</th>
<th>Urban (All Fx n=1885)</th>
<th>Rural (All Fx n=511)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Assessed&amp;/or treated</td>
<td>831 (44.1%)</td>
</tr>
<tr>
<td>n</td>
<td>314</td>
<td>1544</td>
</tr>
<tr>
<td>Assessed&amp;/or treated</td>
<td>209 (66.6%)</td>
<td>600 (38.9%)</td>
</tr>
<tr>
<td>Depcat</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>n</td>
<td>305</td>
<td>144</td>
</tr>
<tr>
<td>Assessed&amp;/or treated</td>
<td>141</td>
<td>88</td>
</tr>
<tr>
<td>Steroid users n=91</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>Early menopause n=884</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>n</td>
<td>117</td>
<td>35</td>
</tr>
<tr>
<td>Assessed&amp;/or treated</td>
<td>88</td>
<td>30</td>
</tr>
</tbody>
</table>
It is, however, interesting to note that around 68% of patients with early menopause had undergone some form of assessment and/or treatment and that this figure was not affected by having local availability of a DADS service. For those practices within a 20 mile radius who were eligible to refer patients to DADS, 67% of cases with early menopause had either been assessed and/or were receiving treatment whilst that for more distant practices without local access around 72% of patients with early menopause had undergone assessment and/or treatment. Early menopause, however, is a circumstance which could prompt intervention (for example with HRT) without the necessity to perform DXA scanning or some other form of osteoporosis assessment and the majority of these cases were “treated” without undergoing assessment first whether within or outwith Glasgow.

Virtually all patients who were current or past users of steroid therapy had undergone assessment and/or treatment for osteoporosis.

There was marked variability in the number of fracture patients identified among the multiple participating practices - again, almost certainly reflecting differences in recording data to the primary care databases. However, for those patients who were identified from GP patient database search with hip fracture, 67% of those occurring within Glasgow with local access to DXA underwent assessment and/or treatment in contrast to 40% for those practices that didn’t have local access to DXA. Corresponding figures for “other non-vertebral fractures” were 39% for those with local access to DXA versus 21% for those without and for the few vertebral fracture cases identified from primary care database searches, 82% of those from practices with access to DADS had undergone assessment with a similar percentage (85%), ending up with assessment and/or treatment from those practices without local access to a DADS service.

Vertebral fractures, particularly when multiple, merit intervention for the secondary prevention of fractures and that can be achieved without prior DXA scanning. Current national guidelines recommend (under appropriate circumstances) use of antiresorptive therapies in patients who have previously received, or are currently receiving, steroids and do not necessarily recommend prior DXA – and most patients with early menopause can undergo treatment (at that time HRT would have been the preferred option) without necessarily doing prior DXA. It is clear where there is no need for prior DXA that there are high rates of what has been termed “assessment and/or treatment” but that in practice reflects the use of treatments, without DXA assessment.

However, for non-vertebral patients who are intrinsically at higher risk of fracture because of that previous fracture, treatment rates are lower than for those where treatment can be started without DXA; nevertheless treatment rates are at least 50% higher in patients where there is local access to DXA.

It thus appears that patients who are at highest risk, by virtue of the requirement for DXA, are being under-assessed and/or under-treated in the absence of local DXA compared to other risk factors that inherently carry
much lower risk of fracture such as ‘early menopause’. The availability of DXA significantly impacts on greater rates of assessment. Gaining access to DXA requires participation of primary care in ‘case-finding’ and in referral, a variable that renders such systems/processes intrinsically less robust than the FLS-type model that was demonstrated to be much more effective in section 3; the FLS model performs ‘case-finding’ of fracture cases at the time of their presentation to the acute fracture services and does not require primary care to have any role in ‘case-finding’.

4.1.4 Discussion

It is clear that delivery of optimal secondary prevention after fracture requires effective ‘case-finding’ or identification and subsequent assessment (ideally including axial DXA) to target treatment to those where it is likely to confer benefit.

The work of section 3 has established that highest rates of assessment and/or treatment are seen where ‘case-finding’ strategies (for new or ‘incident’ fractures presenting to A&E/orthopaedic inpatient or outpatient fracture services) are directly linked to the services providing acute fracture care – for example, via the FLS model.

Where ‘case-finding’ is performed by primary care, and subsequent post-fracture assessment requires referral to a DADS service, assessment and/or treatment is achieved less frequently, but much more so than where there is no service. However, the DADS service models fulfil an additional role, in providing the opportunity for assessment of patients who sustained a fracture in previous years (a group who are at the same degree of increased risk of further fractures as those with new or incident fractures). Table 14 shows that the DADS service model facilitates osteoporosis assessment for those who sustained a fracture up to 20 years previously. Assessment after fracture is ‘never too late’ and treatment of a women who is now over 80yr, who previously has had a fracture (over the age of 50yr), provided her BMD is at a level where treatment can benefit fracture risk is likely to effect greater absolute fracture risk reduction than many who nevertheless also merit treatment but are 20yrs younger.

It is clear from the national audit data presented here, that access to DXA crucially influences treatment rates for the secondary prevention of fractures. Even location of a practice just 20 miles from Glasgow impacts dramatically on assessment/treatment after non-vertebral fracture; this is a consequence of restriction of access to DADS for patients within specific Health Board areas and the unwillingness of adjacent Health Boards either to fund their own service or to contract with service providers to make this service more widely available.

DADS services may offer primary care clinicians access to DXA assessment for indications other than fracture. For some risk factors for osteoporosis and/or for fracture – such as patients who are receiving or who have previously received glucocorticoid therapy at a dose that could be detrimental
to the skeleton - treatment does not necessarily require assessment with DXA. Rates of assessment and/or treatment for osteoporosis for patients with this indication are high whether there is local access to DADS or not. For patients with early menopause who are much younger than the typical cohort with a fracture, and where the issue is primarily prevention of osteoporosis (because their absolute fracture risk over the next 5 years is very low, primarily because they are much younger) treatment rates are around 68% whether or not there is local access to DADS. It is not possible to identify the proportion of those with early menopause who have been treated with the aim of preventing osteoporosis, but many will have received HRT for the exclusive purpose of menopausal symptoms. Whatever the actual requirement for treatment, early menopause appears to attract higher prioritisation for assessment/treatment than patients with fracture (who are at highest risk of fracture of all patients) by primary care.

Increasing the availability of DXA to primary care clinicians is a prerequisite for improving delivery of strategies for the secondary prevention of osteoporotic fractures. It is clear, however, that optimal targeting of this resource to achieve greatest benefit to patients is to ensure prioritisation of access to those at greatest risk, not of osteoporosis per se, but at greatest risk of fractures. It is essential to establish, in association with primary care clinicians, appropriate prioritisation of indications for DXA assessment. DADS-service models do allow restriction of access to DXA for patients who fulfil at least one appropriate referral criterion, of which those who have previously sustained a fracture are the group at highest risk of further fractures. Providing greater access to DXA for high risk patients is essential, but this will only achieve its goal if patients who have previously sustained a fracture can also be identified from primary care computerised record systems; currently fracture data may or may not be logged. There is no central directive to encourage, endorse, or facilitate the recording of fracture history – a key event that should trigger the process of assessment for osteoporosis in the expectation that directing treatment to those with osteoporosis should halve their future fracture experience.

4.1.5 The primary care perspective on osteoporosis, fractures, the direct-access DXA service & the Fracture Liaison Service

Osteoporosis and its associated fractures are a major public health problem. Secondary prevention of osteoporotic fractures will only be achieved through engagement of primary care and by making available to primary care clinicians access to the appropriate resources. In order to gauge opinion of primary care clinicians in Glasgow about their perception of the importance of osteoporosis and fracture management as well as their perspectives on the DADS and FLS service models, a questionnaire was compiled (appendix 4) and was sent to 474 general practitioners in Glasgow: 218 replied (46%). In order to assess potential opportunities to involve other members of the primary care team in addressing the challenges posed by osteoporosis and fractures, a questionnaire (appendix 5) was distributed also to 165 practice nurses, of whom 97 responded (59%).
Primary care clinicians

*How high a priority is the management of osteoporosis in primary care?*

![Bar chart showing priority levels](chart.png)

**Figure 43**

Among the 218 responders (that is 46% of GPs who were sent the questionnaire), 98% graded this as a “medium”/“high” or “very high” priority (fig. 43). Sixty-two percent rated osteoporosis management as a “high” or a “very high” priority. Consistent with that response was the grading of their perception of the importance within their practice of the prevention of osteoporotic fracture: 95% ranked this as “quite important” (38.6%) or “very important” (56%) (fig. 44). Eighty-seven percent of primary care respondents graded the FLS as “quite useful” (30%) or “very useful” (57%) (fig. 45).
How Important in Your Practice is Prevention of Osteoporotic Fracture?  
Survey of North Glasgow GPs (n=207)

Primary care perspectives on the Fracture Liaison Service

How Useful is the Fracture Liaison Service?  
Survey of North Glasgow GPs (n=207)
Table 16: Primary care perspectives on the Fracture Liaison Service, and their respond to treatment recommendations from this service.

<table>
<thead>
<tr>
<th></th>
<th>Not answered</th>
<th>Not useful</th>
<th>Quite useful</th>
<th>Very useful</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>How useful is the final report issued by the FLS?</strong></td>
<td>10.7%</td>
<td>1%</td>
<td>32%</td>
<td>56.3%</td>
</tr>
<tr>
<td><strong>How often do you tend to use the treatment regimens that are recommended by the FLS?</strong></td>
<td>8.3%</td>
<td>0%</td>
<td>16%</td>
<td>75.7%</td>
</tr>
<tr>
<td><strong>If a patient is started on calcium/vitaminD in hospital do you routinely continue this?</strong></td>
<td>4.3%</td>
<td>4.3%</td>
<td>91.3%</td>
<td></td>
</tr>
<tr>
<td><strong>If patient doesn't report any problems with treatment does anyone in practice routinely check compliance with treatment for osteoporosis?</strong></td>
<td>5.3%</td>
<td>48.8%</td>
<td>45.9%</td>
<td></td>
</tr>
</tbody>
</table>

Table 16 shows that 88% of primary care clinicians (who responded) find the contents of the FLS report either “quite” or “very useful”; 76% indicate that they “always” use the explicit treatment regimens recommended by the FLS and 16% indicate that they do so “sometimes”. If patients are started on calcium/vitamin D within the hospital as part of discharge treatment, 91% indicate that they would routinely continue this.

Given that osteoporosis therapies are required potentially life-long, but certainly typically for a minimum of five years, and the adherence/compliance of patients to treatment can be an issue, GPs were asked whether, in the
absence of a patient-initiated consultation about medication problems, there is a routine check of compliance with medication for osteoporosis. Forty-six percent indicate that there is and 49% indicate that there is no routine process for checking compliance with these therapies.

**Direct access DXA service**

General Practitioners were asked to estimate the use of DADS since it was established (end 1998). Fifty-six percent estimated that their use had exceeded 50 referrals, 35% indicated that they had referred between 10 and 50 patients and 7% indicated that they had referred less than 10 patients during that time (figure 46).

Eighty-five percent of general practitioners rated DADS as “very useful” and 13% as “quite useful” (fig. 47).

Eighty-seven percent reported that they “always” implement treatment regimens recommended by DADS and 12% indicated that they did so “sometimes” (fig. 48).

![Figure 46](image-url)
How Useful is DADS?
Survey of North Glasgow GPs (n=219)

Figure 47

How Often Do You Implement the Treatment Regimens that are Recommended by DADS?
Survey of North Glasgow GPs (n=218)

Figure 48
Osteoporosis and nursing practice within primary care

In order to assess potential opportunities that might exist within primary care for the assessment of osteoporosis, practice nurses were contacted to assess their perspective and current or potential roles. Practice nurses were also asked to rate the priority given to the management of osteoporosis in their nursing practice. Of the 95 respondents, 22% rated osteoporosis management “low” priority, 60% “medium” priority and 18% “high” priority.

How High a Priority is Management of Osteoporosis in your Nursing Practice?
Survey of North Glasgow GP Practice Nurses (n=95)

Table 17 identifies potential educational needs that would need to be considered if practice nurses took on a greater role in osteoporosis management within primary care. While 83% “feel comfortable discussing osteoporosis risk factors with patients”, 68% “did not feel comfortable discussing osteoporosis assessment and measurement with patients” and 54% “did not feel comfortable discussing treatment options for osteoporosis with patients”. Seventy-two percent indicated that there were no practice-based protocols for osteoporosis management within their primary care practices and 94% indicated that there was no specific osteoporosis clinic within the practice. Eighty-two percent of practice nurses had not attended an educational meeting dealing with osteoporosis within the last twelve months.
Table 17: Practice nurses and their perspectives on issues relating to their potential role in the management of osteoporosis.

<table>
<thead>
<tr>
<th></th>
<th>Not answered</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you feel comfortable discussing osteoporosis risk factors with patients?</td>
<td>0</td>
<td>16.8%</td>
<td>83.2%</td>
</tr>
<tr>
<td>Do you feel comfortable discussing osteoporosis assessment &amp; measurement with patients?</td>
<td>2.1%</td>
<td>67.7%</td>
<td>30.1%</td>
</tr>
<tr>
<td>Do you feel comfortable discussing treatment options for osteoporosis with patients?</td>
<td>3.2%</td>
<td>53.7%</td>
<td>43.2%</td>
</tr>
<tr>
<td>Do you have practice-based protocols for osteoporosis management?</td>
<td>5.3%</td>
<td>71.6%</td>
<td>23.2%</td>
</tr>
<tr>
<td>Do you have a specific osteoporosis clinic in your practice?</td>
<td>2.1%</td>
<td>93.7%</td>
<td>4.2%</td>
</tr>
<tr>
<td>Have you attended a specific meeting or educational update on osteoporosis in the last year?</td>
<td>0</td>
<td>82.1%</td>
<td>17.9%</td>
</tr>
</tbody>
</table>
Which Nurse-led Clinics Do You Have in your Practice?
Survey of North Glasgow GP Practice Nurses (n=95)

Figure 50

Table 18

How Often Would You Discuss Osteoporosis with Women Attending the Following Clinics in Your Practice?
Survey of North Glasgow GP Practice Nurses (n=95)

<table>
<thead>
<tr>
<th></th>
<th>Well-Woman</th>
<th>HRT</th>
<th>Over 75yr Check</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>3.9%</td>
<td>3.9%</td>
<td>6.7%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Occasionally</td>
<td>36.4%</td>
<td>21.6%</td>
<td>31.7%</td>
<td>40.9%</td>
</tr>
<tr>
<td>Often</td>
<td>31.1%</td>
<td>39.2%</td>
<td>43.3%</td>
<td>40.9%</td>
</tr>
<tr>
<td>Always</td>
<td>24.7%</td>
<td>35.3%</td>
<td>13.3%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Not Answered</td>
<td>3.9%</td>
<td>0</td>
<td>5%</td>
<td>9.1%</td>
</tr>
</tbody>
</table>
All reported, however, that within their primary care practices there was at least one, but often several, clinics that would provide an opportunity to take on a greater role in osteoporosis management in women. Fig. 50 indicates that 38% of the Practice Nurses reported that their practice runs a “Well Woman Clinic”, 18% have an HRT Clinic, and 29% have an “over 75 year clinic”. Osteoporosis is a theme that occasionally arises in each of these clinic settings but clearly there is potential to routinely schedule clinic time even with an existing clinic framework to specifically deal with issues relating to osteoporosis and specifically to identify opportunities for the secondary prevention of osteoporotic fractures after a previous fracture has occurred. There would be value in using these existing resources as opportunities to provide ‘case-finding’ for those patients whose past history of fracture has not been recorded on the practice database.

4.2 Factors influencing utilisation of services for osteoporosis in Aberdeen

The approach to this question was by necessity of time and geography, different for the Aberdeen centre. The research nurse was employed only 0.8 WTE and had a very large region to cover which alone necessitated 1,100 miles travelling to carry out Grampian’s contribution to the audit alone. Further, it became clear during the work acquiring data on the outcome after hip, wrist and vertebral fractures that it would not be possible to have sufficient GP practices in city centre and rural areas allowing access to their computerised GP records to enable searches of their patient database to be concluded.

4.2.1 The use by primary care clinicians of the direct-access DXA service and the effect on outcomes - Aberdeen

It was decided to use the same basic questionnaire that was used in the Glasgow audit to follow up the effects of referral on treatment patterns in those who had been referred for a DXA scan between April 2001 and March 2002. Of the total 92 general practices in Grampian, 19 refused to take part in the follow-up, 20 did not reply, 2 practices did not refer any patients and 51 agreed to participate of whom 22 were city centre and 29 rural.

4.2.2 Methods and results

All patients referred by their general practitioners for a DADS scan between April 2001 and March 2002 were examined by interrogating the DXA scanner database at the Osteoporosis Research Unit, Woolmanhill Hospital, Aberdeen. Information was collected on past fractures, the reason for referral, treatment at the time of referral, results of the DXA scan and treatment advice given. Information collected from the GP records of participating practices included treatments taken since the scan. There were 573 referrals of women aged over 50 during the period of the audit. As can be seen from fig. 51, 56% came from participating practices and 35% from
practices who were unwilling to be involved, with the remainder from those practices who failed to respond to the invitation and reminder.

**Patients Referred for DXA**
**Apr'01- Mar'02:**
**Practice Participation**

![Pie chart showing practice participation](image1)

<table>
<thead>
<tr>
<th>Non participating</th>
<th>35%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participating</td>
<td>56%</td>
</tr>
<tr>
<td>Non responders</td>
<td>9%</td>
</tr>
</tbody>
</table>

Figure 51

There were no significant differences between the age and deprivation categories of the patients from the 3 types of practices (fig. 52).

**AGE & DEPCAT Scores of GP Practice Patients**

![Bar chart showing age and depcat scores](image2)

![Bar chart showing age and depcat scores](image2)

<table>
<thead>
<tr>
<th>GP Practice Response</th>
<th>Age</th>
<th>Depcat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non participating</td>
<td>2.6</td>
<td>0.0</td>
</tr>
<tr>
<td>Non responders</td>
<td>2.9</td>
<td>0.0</td>
</tr>
<tr>
<td>Participating</td>
<td>2.9</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Figure 52
The results of the index DXA scan according to the WHO criteria are shown for participating and the total population in table 19. There was no significant difference between the two groups ($\chi^2 = 0.6679$, $P>0.7$)

Table 19: Results of DXA scans in 2001/2 by participating or total population

<table>
<thead>
<tr>
<th>Participating GPs</th>
<th>Total Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>82</td>
</tr>
<tr>
<td>Osteopenia</td>
<td>138</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>103</td>
</tr>
</tbody>
</table>

The outcome of assessment for 322 patients was audited from participating GP practices. The reasons for assessment as agreed with NHS Grampian are shown in Table 20. Several women had more than one reason for assessment.

Table 20: Reasons for index DXA assessment 2001/2

<table>
<thead>
<tr>
<th>Assessment of Treatment</th>
<th>188</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low trauma #</td>
<td>115</td>
</tr>
<tr>
<td>Early Menopause or prolonged amenorrhoea</td>
<td>85</td>
</tr>
<tr>
<td>Radiological osteopenia</td>
<td>64</td>
</tr>
<tr>
<td>Previous glucocorticoid user</td>
<td>44</td>
</tr>
<tr>
<td>Maternal Hip #</td>
<td>33</td>
</tr>
<tr>
<td>Current glucocorticoid user</td>
<td>27</td>
</tr>
<tr>
<td>Surgical Menopause &lt;45</td>
<td>19</td>
</tr>
<tr>
<td>Vertebral deformity or kyphosis</td>
<td>10</td>
</tr>
<tr>
<td>Malabsorption</td>
<td>8</td>
</tr>
<tr>
<td>BMI&lt;19 or Anorexia Nervosa</td>
<td>7</td>
</tr>
<tr>
<td>Prolonged immobilisation</td>
<td>3</td>
</tr>
<tr>
<td>Thyrotoxicosis or hyperparathyroidism</td>
<td>3</td>
</tr>
</tbody>
</table>
The effects of treatment advice, if any, for osteopenic women and the resultant treatments are shown in fig. 53. As can be noted, the advice from the DXA centre differed substantially from the treatment prescribed, ($\chi^2=15.06, p=0.0046$) with drug therapy not invariably being started or continued but more importantly drug therapy, including raloxifene, alendronate and HRT, being prescribed in those not requiring treatment.
In women found to be osteoporotic (T score< -2.5 at either spine or proximal femur) treatment was advised in all 103 cases although data were missing in two such patients. As can be seen from fig. 54, there was no significant difference between the treatment advice given and that prescribed, although it will be noted that 16% of patients advised to receive treatment were not prescribed medication. One-two years after the advice was given, 69% of patients were still receiving the same or an alternative medication.

186 patients from 22 city practices were audited compared with 136 from 29 rural practices (>15 miles from Aberdeen city centre). The patients from city practices were significantly older (64.0 ± 9.0yr) than from the rural practices (61.9 ± 9.4yr, p=0.043) but did not differ significantly in Depcat scores.

As can be seen from fig. 55, there was a significant difference in the reasons for referral from city and rural GPs ($\chi^2 = 22.79$, p=0.0067) with rural GPs more likely to refer after the finding of radiological osteopenia and for assessment of treatment but less likely to refer after the finding of vertebral deformity or kyphosis. There was no difference in the proportion of patients diagnosed as being normal, osteopenic or osteoporotic from the two communities and similarly the chances of receiving or continuing treatment after assessment were no different.
To determine if there was a difference in the deprivation category between referrals for DXA and that of the base population for Grampian, a crude assessment was made comparing the Depcat scores of the fracture cases compared to the scores of patients referred to the DADS from the participating general practices. As can be seen in fig. 56 there were no significant differences or apparent trends.
Depcat Scores in Fracture Cases and Direct Access DXA Referrals

![Depcat Scores in Fracture Cases and Direct Access DXA Referrals](image)

Figure 56

4.2.3 The primary care perspective on osteoporosis, fractures, and the direct-access DXA service in Aberdeen

We approached all 91 practices in Grampian to complete a slightly modified version of the questionnaire used in Glasgow (as shown in appendix 4). Two practices responded to indicate that their participation would be unhelpful (one was the practice serving the University Health Service and the other was the practice for a local community for largely young people based on the teachings of Rudolf Steiner) and of the others, 48 responded with a completed questionnaire (55%). Of the remaining practices, 20 did not reply (22%), 3 returned the questionnaire uncompleted and 18 refused to participate (20%). The responding practices had represented a cross-section of practices with between 1 and 13 partners. The practices varied in size from 500 to 17,451 patients.

Primary care clinicians

How high a priority is the management of osteoporosis in primary care?

Of the 49 responses, only 21 (42%) graded osteoporosis as a "high" or “very high” priority, while 26 (53%) felt it was a medium priority (fig. 57).
Effectiveness of Strategies for the 2nd Prevention of Osteoporotic Fractures in Scotland

How high a priority is osteoporosis management in your practice
Survey of Grampian GP Practices (n=49)

![Figure 57](image)

**Direct-access DXA service**

General practices were asked to estimate the use of the Aberdeen based DADS since it was established. Twenty-nine percent estimated that their use had exceeded 50 referrals, 35% indicated that they had referred between 10 and 50 patients and 20% indicated that they had referred less than 10 patients during that time (fig. 58).

How often have you used the Direct Access DXA Service
Survey of Grampian GP Practices (n=49)

![Figure 58](image)
Ninety percent of practices found the service either useful or very useful (fig. 59) although interestingly only 69% stated that they always implemented the treatment regimes advised (fig. 60).
Sixty-four percent of responding practices felt the report was slow or too slow in arriving although it is likely that this represents the waiting time for the scan which at the time of audit could have been as long as 18 months, rather than the time when the report arrived after the scan which is typically less than 1 week. Only 23 out of the 49 practices logged the results on to their practice database.

Of the 49 responding practices 22 would have preferred a specific referral form, which is not the policy in Grampian, and hence it is not currently used. Only 10 of the 49 were unhappy with the layout of the report of the scan. Of these 10, several felt that more guidance on the treatments to be used would have been valuable, and this could have value as only 12 of the practices reported having protocols for the management of osteoporosis. None of the 10 practices who were unhappy with the layout of the report had practice protocols for the management of osteoporosis. No Grampian practices had specific osteoporosis clinics and only 18 of the 49 practices reported that members of their staff had been to specific osteoporosis meetings. On the more positive side only 8 of the 49 practices did not have osteoporosis educational leaflets available for patients to take away.

In summary GP practices in Grampian generally take osteoporosis seriously but further education may well be required. It does not appear that management of osteoporosis is a high priority for most general practitioners in the North East of Scotland.
5. Osteoporosis service providers 2004

To update osteoporosis service provision in Scotland in January 2004, a questionnaire (appendix 2) was completed by lead clinicians or their support staff, over the telephone. As of January 2004, 10 of 15 Health Board areas have at least one centre that offers at least one service (within that same Health Board area) that is potentially available to assess for osteoporosis in patients who have sustained a fracture.

Tools for Assessment of Osteoporosis (tables 1 & 3)

As of January 2004, axial DXA is available to NHS patients at 13 Scottish centres; 9 centres provide full-time NHS-funded DXA services, 2 centres provide a part-time NHS-funded DXA service and two centres provide full-time DXA services, but are funded by joint funding from NHS and research/University funding. Two additional centres have access to DXA either at another hospital in the same Trust, or at another hospital in an adjacent Health Board on the basis of a specific contract or under an historical ‘block contract’. One DXA service is provided from a hospital centre that does not provide acute fracture care. Two centres provide assessment for osteoporosis using ultrasound, a modality that is not endorsed by the SIGN guideline 71(64).

Access to Assessment of Osteoporosis in Fracture Cases

Open/direct-access services (tables 1 & 2)

Of the 15 centres providing ‘assessment for osteoporosis’ either on the basis of DXA or ultrasound that were functioning by January 2004, all provide access for assessment to secondary care patients; 14 provide DADS to patients referred from primary care.

Fracture Liaison Service (table 2)

By January 2004, 10 centres in 6 Health board areas have introduced services analogous to the FLS to provide systematic assessment for the secondary prevention of osteoporotic fractures to those presenting with new fractures.

Secondary Care Specialist Osteoporosis Clinics (table 2)

As of January 2004, specialist osteoporosis secondary care clinics are available in 3 Health Board areas (Grampian, Greater Glasgow and Lothian).
### Table 21: Provision and use of DXA facilities in Scotland in 2004

<table>
<thead>
<tr>
<th>Health Board</th>
<th>Location of DXA service</th>
<th>DXA scans / yr</th>
<th>Population served</th>
<th>DXA Scans Per 1000</th>
<th>Waiting time for DXA</th>
<th>Full-time DXA service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argyll &amp; Clyde</td>
<td>Royal Alexandra Hospital</td>
<td>700**</td>
<td>430K</td>
<td>0.002</td>
<td>12/52</td>
<td>N**</td>
</tr>
<tr>
<td>Ayrshire &amp; Arran</td>
<td>Irvine Central Hospital</td>
<td>1300</td>
<td>375K</td>
<td>0.004</td>
<td>8/52</td>
<td>Y</td>
</tr>
<tr>
<td>Dumfries &amp; Galloway</td>
<td>Dumfries &amp; Galloway Royal Infirmary</td>
<td>1400</td>
<td>180K</td>
<td>0.008</td>
<td>12/52</td>
<td>N</td>
</tr>
<tr>
<td>Fife</td>
<td>Victoria Hospital</td>
<td>2800</td>
<td>350K</td>
<td>0.008</td>
<td>10-12/52***</td>
<td>Y</td>
</tr>
<tr>
<td>Grampian</td>
<td>Aberdeen Royal Infirmary</td>
<td>4000</td>
<td>550K</td>
<td>0.007</td>
<td>24/52</td>
<td>Y</td>
</tr>
<tr>
<td>Greater Glasgow</td>
<td>Glasgow Royal Infirmary</td>
<td>4500</td>
<td>300K</td>
<td>0.017</td>
<td>4/52</td>
<td>Y</td>
</tr>
<tr>
<td>Greater Glasgow</td>
<td>Stobhill Hospital</td>
<td>2000</td>
<td>200K</td>
<td></td>
<td>8-10/52</td>
<td>N</td>
</tr>
<tr>
<td>Greater Glasgow</td>
<td>Southern General Hospital</td>
<td>4500</td>
<td>300K</td>
<td></td>
<td>6-20/52***</td>
<td>Y</td>
</tr>
<tr>
<td>Greater Glasgow</td>
<td>Western Infirmary/ Gartnavel General</td>
<td>4500</td>
<td>250K</td>
<td></td>
<td>4-6/52***</td>
<td>Y</td>
</tr>
<tr>
<td>Highland</td>
<td>Ross Memorial Hospital</td>
<td>750</td>
<td>225K</td>
<td>0.003</td>
<td>1 yr</td>
<td>N</td>
</tr>
<tr>
<td>Lanarkshire</td>
<td>Wishaw General Hospital</td>
<td>3700</td>
<td>560K</td>
<td>0.007</td>
<td>12/52</td>
<td>Y</td>
</tr>
<tr>
<td>Lothian</td>
<td>St John's Hospital At Howden</td>
<td>600*</td>
<td>200K</td>
<td>0.003</td>
<td>6/52</td>
<td>N*</td>
</tr>
<tr>
<td>Lothian</td>
<td>Western General Hospital</td>
<td>3000</td>
<td>800K</td>
<td>0.004</td>
<td>16/52</td>
<td>Y</td>
</tr>
<tr>
<td>Tayside</td>
<td>Ninewells Hospital</td>
<td>1400</td>
<td>380K</td>
<td>0.004</td>
<td>6/52</td>
<td>Y</td>
</tr>
<tr>
<td>Tayside</td>
<td>Perth Royal Infirmary</td>
<td>1200</td>
<td>250K</td>
<td>0.004</td>
<td>6/52</td>
<td>N</td>
</tr>
</tbody>
</table>

Notes:
* = DXA scans available through contractual arrangement with DXA provider in same HB area
** = DXA scans available through contractual arrangement with DXA provider in adjacent HB area
*** = different waiting lists for different services (i.e. DADS & FLS) using DXA
Discussion

DXA is currently the ‘gold standard’ hardware for the diagnosis of osteoporosis, but perhaps more importantly for fracture risk stratification and for targeting treatment to those whose fracture risk can be usefully modified by antiresorptive therapy. Currently ~35,000 DXA scans are performed annually in Scotland (table 21); DXA scanning capacity is determined by the type of scanner (fan-beam DXA scanners have at least twice the capacity of pencil-beam machines), by contractual constraints (4 DXA providers are funded only for a limited number of sessions) and by local operational issues (e.g. availability of holiday cover for the DXA technician). Table 21 shows that where DXA scanning facilities are available – they are often only available part-time, produce remarkably variable throughput of scans and may have lengthy waiting lists. Addressing the variations in functioning of existing DXA services offers potential to improve service with relatively minor cost implications.

Access to DXA is typically restricted to those cases who have an indication (‘case-finding’ strategy) recognised as carrying higher risk (either of osteoporosis itself or of fracture) as endorsed by UK national guidelines. Some services (e.g. the Glasgow DADS) choose to restrict access further to prioritize resources to those perceived to be at greatest risk. All DXA providers offer access to secondary care referrals, and all but one to primary care referrals, through DADS that require patients to have an agreed criterion that merits DXA assessment. Ten services currently operate a FLS – dedicated to fracture ‘case-finding’ and to providing DXA assessment (where appropriate); the FLS ensures that patients who are at the highest overall relative and absolute fracture risks are prioritized for identification and management.

It is possible to extrapolate from the experience of the incidence of new non-vertebral fracture cases assessed by FLS in Glasgow, and from the vertebral fractures identified through the ‘case-finding’ undertaken by this audit programme to model the number of DXA scans that would be required to address the needs of the Scottish population for the secondary prevention of osteoporotic fractures (appendix 6). Approximately 41,190 DXA scans per annum would be required to offer appropriate assessment to the majority of new vertebral and non-vertebral fracture cases, and to a proportion of those with previous fractures.
6. Discussion – secondary prevention of osteoporotic fractures

The importance of the occurrence of a fracture to the victim and to the NHS in Scotland is apparent. Around 28,000 women or men of 50yr or older present with non-vertebral fractures (excluding fractures occurring within the context of road traffic accident) of which ~20,000 occur in women each year in Scotland (section 1.2.1.): about 50% are hospitalized as a consequence\(^6\). The commonest non-vertebral fracture presentation is with wrist fracture followed by fractures of hip, humerus, ankle and an assortment of other fractures. Overall, however, vertebral fractures are said to be the commonest fractures of all\(^{28}\). As discussed, the additional impact of vertebral fractures on our population and on the NHS is difficult to assess because they seldom result in presentation to hospital because around one third are painless and in the remainder the consequent pain is often ascribed to other causes. However, whether the fracture occurred at a non-vertebral site or at the spine (whether painful or not), fractures are associated with increased mortality (2.9 fold higher after hip fracture (section 3.5.), 1.5 fold higher after vertebral fracture (section 3.5.) – both compared to mortality after wrist fracture). However, the occurrence of a fracture can impact also dramatically on quality of life; the extent and severity of fracture-related morbidity are not reviewed here but the one key aspect of post-fracture morbidity that is considered is the importance of fracture as a risk fracture (in itself) for further fracture. The prevalence of past fracture history (over the age of 50) in the fracture cohorts that were audited was up to 50% in patients with hip fracture (section 3.6.1.), up to 60% of patients with vertebral fractures (sections 3.10.1. and 3.11.1.) and up to 41% of wrist fractures (section 3.7.2.); even more dramatic is the magnitude and speed with which further fractures occur after the occurrence of a fracture. Even more worrying is the number of fractures that had been sustained previously; 20% of the hip fracture cohort (section 3.6.1.), 12% of the wrist fracture cohort (section 3.7.2.) and 21% of the vertebral fracture cohort (section 3.12.) had experienced two or more fractures prior to the index fracture, since they were 50. All of these were potential opportunities to intervene earlier.

Intervention with drug therapies has been shown to reduce subsequent non-vertebral and vertebral fracture risk – but requires prior measurement of BMD by axial DXA. The real cost of a DXA scan is around one tenth of the annual cost of treatment with bisphosphonate therapy (currently, the first choice agents\(^{65}\)) and therefore in real terms DXA is a relatively cheap resource\(^{65}\) that should be used to ensure that the patient has a level of BMD (and associated fracture risk) that would benefit from treatment. Different thresholds of BMD have been shown to be appropriate for targeting treatment in the absence of vertebral fracture and therefore applied to non-vertebral fracture groups (T-score \(<-2.5\)) in the presence of one vertebral fracture (T-score \(<-1.6\)). Where multiple vertebral fractures are present, treatment may be administered without prior DXA. The opportunity to be assessed for osteoporosis and for treatment to reduce further fracture risk is as relevant to
patients who present with new fractures ("incident fractures") as it is for those who have sustained their fracture in the past ("prevalent fractures"). Effective secondary prevention of osteoporotic fractures requires 'case-finding' of the fracture cases and subsequent assessment by axial DXA (a strategy that applies to all with non-vertebral fracture and also to those with a single vertebral fracture).

The challenge of ‘case-finding’ of fractures that occur at all skeletal sites does not have a single solution. New non-vertebral fractures do all present to acute fracture services; orthopaedic surgeons perceive their role to be to facilitate access for fracture cases to services designed to achieve case finding with the aim of providing osteoporosis assessment and/or treatment rather than effecting this themselves\(^{81}\). New vertebral fractures are recognisable on spinal X-rays – but their use is at best sporadic (and is actively discouraged in the investigation of patients with back pain). Patients with previous or "prevalent" fractures, whether at non-vertebral or vertebral sites, are potentially identifiable in primary care if computerised records contain data relating to past fracture history, robustly and consistently; however, currently there is neither necessity nor incentive to record these data. Whose responsibility is ‘case-finding’ of fracture cases? ‘Case-finding’ must be integrated with access to axial DXA and knowledge of its role and interpretation and should happen at the most logical step in the fracture patients’ pathways of care. For patients who have sustained a fracture in the past, the prevalent fracture group, primary care clinicians would be best placed to achieve fracture ‘case-finding’ but can only do so if fracture history has been recorded or alternatively may do so opportunistically if this history is sought during consultation for other reasons. Ninety-five to 98% of primary care clinicians in Aberdeen/Grampian & Glasgow rank management of osteoporosis as a “medium” to “very high” priority, and 95% regard prevention of osteoporotic fractures as “quite” or “very” important (sections 4.1.5. & 4.2.3.). In section 4.1.3., aside from the wide variation in numbers of fracture cases recorded in a series of primary care databases, where fracture history was recorded, the assessment and/or treatment rates among patients with past fracture history were consistently higher where their role in ‘case-finding’ was linked to access to axial DXA (67% of hip fracture patients underwent assessment and/or treatment where GPs had local access to DXA versus 40% with no local access and 39% of patients with non-hip and non-vertebral fractures underwent assessment and/or treatment where GPs had local access to DXA services compared to 21% in the absence of such services).

Primary care ‘case-finding’ with associated assessment and/or treatment for patients with early menopause or patients on corticosteroid therapy is higher at around 67% and around 100% (respectively) suggesting that fracture secondary prevention after non-vertebral fracture may be perceived to be less important. Interestingly, assessment and/or treatment rates for patients with previous vertebral fracture are higher at around 82-85% irrespective of whether there is access to DXA, consistent with the evidence-based practice of treating such patients (who strictly should have had multiple vertebral fractures for this to be appropriate and to be consistent with guidelines\(^{65}\)) without prior DXA.
The main focus of this audit, however, has been on the outcome after a new or recent fracture. In the absence of access to a service for primary care or, for that matter, secondary care clinicians, that provides access to assessment for osteoporosis, assessment and/or treatment for osteoporosis is achieved in around 11% of wrist fracture cases (section 3.7.3) and around 16% of hip fracture cases (section 3.6.2). Where ‘case-finding’ is typically performed by primary care clinicians and where there is access to DADS/OAU, secondary care clinics (or FLS), assessment and/or treatment after hip fracture occurs three times more often (OR 3.1 (2.042 to 4.71) (Section 3.6.5) and around four times more often after wrist fracture (OR 3.88 (2.31 to 5.98) (section 3.7.6) than is seen in the absence of such services. However, when ‘case-finding’ links with osteoporosis assessment and is achieved by personnel dedicated to ‘case-finding’ within orthopaedic inpatient wards and fracture clinics (the FLS), after hip fracture and after wrist fracture, the offer of assessment and/or treatment for fracture secondary prevention occurs almost always, and substantially more often than is seen in centres without this service. Other factors that favourably influenced rates of assessment after non-vertebral fracture (hip and wrist fractures) were the presence of a past history of at least one other fracture (1.7 times to 2.15 times more likely to undergo assessment and/or treatment for osteoporosis), and if rehabilitation had occurred after hip fracture in a geriatric or other rehabilitation facility (2.3 times more likely to undergo assessment and/or treatment). The FLS service model appears also to address some of the inherent disadvantages of socioeconomic deprivation, by consistently at least offering assessment after fracture to all fracture cases but it is appropriate to acknowledge that patients from Depcats 6 and 7 are, nevertheless, more likely to refuse that offer to undergo assessment for osteoporosis.

Overall, after recent non-vertebral fracture, the highest rates of assessment and/or treatment for osteoporosis were achieved by the FLS model – a model that assumes responsibility for ‘case-finding’ and for assessment and that functions alongside and integrates with the orthopaedic inpatient and outpatient fracture services. This ensures timeous post-fracture assessment and obviates the need to depend upon primary care clinicians to undertake ‘case-finding’. The FLS is regarded as “quite” or “very useful” by 80% of Glasgow GPs (who responded to the questionnaire). While treatment rates after non-vertebral fracture could be misleading as “blind treatment” of all would be both costly and for many quite ineffective at reducing fracture rates (if treatment happened to be used in patients whose BMD was higher than the threshold which fracture risk can be effectively reduced), after FLS assessment up to 9% of wrist fracture cases were deemed not to actually require treatment. FLS allows selection not only of optimal therapy tailored to patients’ individual needs but also allows selection of those patients who are unlikely to benefit from treatment (typically because their BMD is too high). Around 48% of hip fracture cases are recommended calcium with vitamin D, 25% bisphosphonate therapy (section 3.6.3) and after wrist fracture the corresponding figures were ~15% for calcium and vitamin D, 32% bisphosphonate therapy, 7% HRT and 2% raloxifene (section 3.7.4). Despite the success of the FLS in ‘case-finding’ and in offering assessment and/or treatment, there is a finite refusal rate among patients (between 22-29% either
The FLS model out-performs, by far, rates for 'case-finding' and appropriate recommendation for use of osteoporosis treatment than are achieved with other models for assessment after non-vertebral fracture primarily because it integrates with acute fracture services to which these patients present for their fracture care. The FLS does not address the challenge of vertebral fracture 'case-finding': vertebral fractures seldom present to acute fracture services (as previously discussed). Fracture secondary prevention after vertebral fracture differs from that required after non-vertebral fractures in that, at least for patients with multiple vertebral fractures, treatment is appropriate without prior DXA assessment\(^{65}\). After a single vertebral fracture event, ideally treatment should be targeted at the basis of axial DXA, but the level of BMD at which treatment may be started is higher than after non-vertebral fracture (T-score \(<-1.6\))\(^{22;65}\).

Assessment and/or treatment rates in patients with vertebral fracture range from 47-84% among centres for those vertebral fractures identified by primary care. The poorest performance is substantially better than the poorest rates achieved after non-vertebral fracture. Depending on the centre, these rates are achieved through a combination of referral to secondary care clinics and via secondary care DADS/OAU services provided for primary care.

Overall, a number of factors were associated with two-fold higher rates of assessment and/or treatment for osteoporosis after vertebral fracture (section 3.15). These factors included whether the X-ray was requested by primary care or secondary care clinicians (primary care clinicians were twice as likely to achieve assessment and/or treatment), past history of at least one other fracture and the presence of multiple vertebral fractures. The importance of radiology reporting of vertebral fractures is highlighted by the fact that explicit reference to the presence of a “fracture” in the X-ray report resulted in 8% higher assessment and/or treatment rates than reports containing other synonyms (including “compression”, “wedging”, “height loss”). Access to local services (DADS/OAU or FLS or secondary care clinic) was associated with around three-fold higher assessment and/or treatment rates (OR 2.56(1.89 to 3.48). Two to 17% were treated with calcium and vitamin D while 12-43% were treated with bisphosphonates as a consequence (sections 3.10.3 & 3.11.3.). However, it should be noted that a substantial number (between 37 and 86%) received no medication for the secondary prevention of osteoporotic fractures.

Within Scotland in 2004, the NHS has an example of a model of service (FLS) that achieves rates of assessment and/or treatment after new or incident non-vertebral fractures that are unparalleled elsewhere in the world. Unfortunately, outside Glasgow (within which there is a multi-site FLS that ensures that all orthopaedic fracture inpatients and outpatient fracture-clinic patients over 50yr with fractures are routinely offered assessment and/or treatment for the secondary prevention of fractures) assessment and/or treatment rates are poor but are similar to the those reported from elsewhere.
Effectiveness of Strategies for the 2nd Prevention of Osteoporotic Fractures in Scotland

in the UK (82), in the rest of Europe (83) and further afield (84-86). After fragility fractures including vertebral, Colles' (85) or hip fractures, rates of initiation of treatment for future fracture risk reduction have been reported in 5% (83), 17% (85), under 32% (87), 30-38% (88) and 39% (82,83,85,87). Elsewhere in the world, treatment rates are also low even if the fracture resulted in hospitalization (83,88).

Typically, in Scotland, albeit not in Glasgow, it appears that the occurrence of a fracture is not currently a trigger for routine assessment of osteoporosis nor for starting treatment for the secondary prevention of osteoporotic fractures. Secondary prevention of new non-vertebral fractures can be optimally addressed by creating FLS service models in each Health Board area; already Grampian, Tayside and Dumfries and Galloway have introduced similar programmes. FLS development requires access to axial DXA, preferably within the same Health Board region or by contractual agreement if spare capacity exists in other Health Board areas that do provide axial DXA.

Secondary prevention for patients with a past fracture history requires (i) initiatives (perhaps incentives) to promote collation and recording of past fracture experience in primary care patient databases and (ii) access to services such as DADS service models that can facilitate the role of primary care in tackling the burden of secondary prevention of osteoporotic fractures. Structuring DADS around limited (agreed but mandatory) criteria for referral could ensure that DXA is not used indiscriminately but rather that its use is restricted to priority areas such as for the secondary prevention of osteoporotic fractures.

Where there is access to appropriate services (DADS) and secondary care osteoporosis clinics, primary care can achieve impressive rates of assessment and/or treatment after vertebral fracture – but there are currently marked geographical differences that need to be resolved to achieve an equitable level of service throughout Scotland.

It is also clear that vertebral fracture cases identified within secondary care are assessed and/or treated less often than those identified within primary care. This probably reflects the need for wider education regarding the importance of secondary prevention of osteoporotic fractures within secondary care and also probably reflects that the focus of service development (limited though it has been) has been on how best to address the needs of primary care. It is clear that tailoring of DADS service models to address better the needs of secondary care clinicians is essential.

It is clear, also, that radiology reporting has a crucial role in triggering awareness of the need for assessment and/or treatment after the occurrence of a vertebral fracture. Adoption throughout Scotland of a standardised vocabulary for reporting vertebral fractures within the X-ray departments with explicit use of the term “fracture” when a fracture is present, perhaps using a semi-quantitative grading system such as that described by Genant and Woo (78) would facilitate assessment and/or treatment for the secondary prevention of fractures after a vertebral fracture has been noted.
7. Economic perspectives

A new paradigm for the secondary prevention of fractures after non-vertebral and vertebral fractures is proposed (fig. 61). This model builds on the current examples of ‘best practice’ that are available within Scotland (the FLS) that addresses secondary prevention in all new cases with non-vertebral fracture. Although currently those providing FLS assess all $\geq 50$yr, it would be legitimate to revise upwards the age at which the FLS assesses patients to $\geq 60$yr (recognising the important implication this has for increasing the future potential fracture risk, and thus lowering the proportion of those who will not need treatment). This would create capacity for a novel service that would extend the role of the FLS to integrate with Radiology Departments to prospectively provide assessment for osteoporosis and treatment, where necessary, for patients whose spine X-rays are reported to show one or more vertebral fractures. Primary care needs access to DXA and existing DADS models are successful, particularly in providing the tool for assessment of vertebral fractures that have been identified on spine X-rays; with appropriate initiatives patients with past non-vertebral fractures could be identified and assessed also via DADS.
ALL WOMEN AGE 60yr OR OVER WITH FRACTURE

SECONDARY CARE

NEW

VERTEBRAL

IDENTIFIED FROM CURRENT SPINE X-RAY REPORTING

NON-VERTEBRAL

IDENTIFIED IN ORTHOPAEDIC WARDS & FRACTURE OUTPATIENT CLINICS

FRACTURE LIAISON SERVICE including AXIAL DXA (when appropriate)

IDENTIFICATION OF THOSE REQUIRING TREATMENT & WHERE APPROPRIATE, SELECTION OF OPTIMAL REGIMEN TARGETED ON BASIS OF BMD + FRACTURE RISK

PRIMARY CARE

PREVIOUS

VERTEBRAL

IDENTIFIED FROM PRIMARY CARE CLINICAL RECORDS

NON-VERTEBRAL

IDENTIFIED IN ORTHOPAEDIC WARDS & FRACTURE OUTPATIENT CLINICS

DIRECT ACCESS DXA SERVICE

1 2 or more

PRIMARY CARE CLINICIANS PRESCRIBE TREATMENT RECOMMENDED FOR SECONDARY PREVENTION OF FRACTURES

Figure 61: A new paradigm for the secondary prevention of osteoporotic fractures.

Modelling cost-benefit is beyond the scope of this audit and, in any case, is currently under consideration by NICE.

The estimated costs of providing FLS/DADS & additional DXA scanning capacity (for secondary care specialist referrals) for a population of 600,000 are ~£170,000 to ~£192,000 (recurring) plus an additional non-recurring cost
of ~£65,000 for fan-beam DXA + vertebral morphometry capability. For this investment all new non-vertebral fractures, all new vertebral fractures and a steady stream of patients with previous vertebral and non-vertebral fractures (identifiable within primary care) would undergo assessment and treatment would be recommended where necessary. The cost estimates do not include treatment costs: currently annual treatment with alendronate or risedronate (the first choice bisphosphonates) are ~£300 per patient /yr. Currently ~25-30% of patients processed by the FLS are recommended bisphosphonate therapy. Annual treatment costs with calcium & vitamin D are an additional ~£70 per yr and would typically be used in association with bisphosphonate therapy, but more often, independently.

Current models of FLS and DADS not only assess patients after fracture, but make explicit treatment recommendations tailored to patients’ needs, and only employ treatment when it is likely to reduce future fracture risk. Thus expertise in osteoporosis management, delivered by nurse specialists within secondary care, is effected through explicit treatment recommendations for implementation by primary care.
Effectiveness of Strategies for the 2nd Prevention of Osteoporotic Fractures in Scotland

Table 22: costs of providing FLS & DADS for a population of 600,000.

<table>
<thead>
<tr>
<th>Component</th>
<th>FLS</th>
<th>DADS</th>
<th>Estimated annual cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Recurring</td>
</tr>
<tr>
<td>Consultant*</td>
<td>~ 3 sessions/week – leadership, supervision + DXA/DADS reporting</td>
<td>~£23K</td>
<td></td>
</tr>
<tr>
<td>Clinical Assistant</td>
<td>DADS reporting 2 sessions/week</td>
<td>~£10K</td>
<td></td>
</tr>
<tr>
<td>‘G’ Grade Nurse Specialist</td>
<td>2 WTE 18 sessions FLS + 2 sessions DADS/week</td>
<td>~£65K</td>
<td></td>
</tr>
<tr>
<td>DXA Radiographer</td>
<td>2WTE</td>
<td></td>
<td>~£54K</td>
</tr>
<tr>
<td>Clerical Support</td>
<td>1 WTE clerical + 1 WTE secretary***</td>
<td>~ £15K</td>
<td>~£19K</td>
</tr>
<tr>
<td>Fan-Beam Axial DXA Scanner**</td>
<td>Scanning capacity with fan-beam machine ≥5000 scans per yr****</td>
<td>~£6K maintenance etc.</td>
<td>~£40-86K av. ~£65K</td>
</tr>
</tbody>
</table>

Notes:
* Consultant supervision, leadership and participation. Speciality as per locally available expertise – options typically could be Endocrinology, Rheumatology, Care of the elderly or Orthopaedics.
** SIGN guideline 71 recommends fan-beam DXA with facility for vertebral morphometry currently ~£65K.
*** Use of a database to generate letter for FLS and DADS could replace requirement for secretarial input
**** Estimate of capacity allows for 1900 FLS scans/yr + 2000 DADS scans/yr + minimum of 1100 scans/yr for secondary care use

Costs estimated from current service provision in North Glasgow Hospitals University NHS Trust – where FLS operates on 2 sites (Western Infirmary & Royal Infirmary) & where DADS operates on both sites.

Although currently Bone metabolism clinics are available at both sites – the running costs are excluded from the following review.

Catchment population: ~600,000
FLS patients processed: ~3,300 of which ~1900 undergo DXA
DADS patients processed: ~ 2,000 of which ~700 are in fracture patients

DXA scan use not considered here – DXAs performed in association with Bone metabolism clinics, and use by secondary care clinicians esp. respiratory, gastroenterology primarily for patients receiving steroid therapy.
8. NOS perspective

Background

The National Osteoporosis Society (NOS) is the only national (UK) charity dedicated to improving the diagnosis, prevention and treatment of this fragile bone disease. The NOS campaigns to ensure that all people with or at risk of osteoporosis receive appropriate advice and treatment to enable them to avoid broken bones and enjoy a better quality of life. The NOS provides information and support for people with osteoporosis and their carers by promoting education for the public and health professionals, by lobbying government and health organisations, and by encouraging fundraising for support services and research into osteoporosis prevention and treatment. Currently there is one member of staff who has been employed as Development Manager since 1998 by the Charity in Scotland. There are 15 support groups that are sustained by volunteers throughout all mainland health board areas, with a telephone support network established in Orkney, Shetland and the Western Isles.

The Development Manager, coordinates the activities of support groups and volunteers, and liaises with key health professionals and other agencies to further the aims of the Charity. On-going work includes:

- “Are you at risk?” - educational meetings throughout Scotland for the public, to raise awareness of osteoporosis, of risk of fractures, but also of how to help prevent the disease and promote good bone health throughout all age groups.
- Organisation of national educational meetings and local study days for health professionals, working in partnership with service providers.
- Informing members of the Scottish Parliament about osteoporosis, key issues for Scotland and national and local service provision.

Patients’ Concerns

The NOS was very pleased to be able to contribute to the development of SIGN 71, the national clinical guideline on management of osteoporosis. Patients’ concerns regarding osteoporosis were identified through contact with patients themselves and via the published literature. A review of the literature highlighted issues that are of concern to people suffering from, or concerned about their risk of suffering from, osteoporosis. Similar issues, reflecting patients’ concerns were also identified from calls received by the NOS helpline managed by a team of nurse advisors; “am I at risk of developing osteoporosis?” “do I need a bone scan?” “what can I do to help myself?” “are there any risks with my medication”? “How can I manage this pain?” (SIGN 71). The NOS Development Manager for Scotland can report that these issues continue to be of concern.
Information, Support, Access to Services

On a day to day basis, there are telephone enquiries to the office in Scotland requesting information about the disease and treatments that have been described, what support is available for them and what clinical services can be accessed locally. For example, without local access to axial DXA, advertising of other methods of scanning by private operators results in confusion for patients due to misinformation and even misdiagnosis. They ask the NOS for help.

Management of Pain

In particular, there are numerous requests for help, with complaints of lack of adequate pain management by GPs, following vertebral fractures. Many callers report being afraid to leave their home due to fear of falling, and further vertebral fractures, as the pain is so severe and lasts so long. They feel abandoned.

Helpline Issues

The NOS operates a helpline, taking nearly 6000 calls from January to June 2004. The majority of calls were from women over the age of 50. Over 3000 calls were requests for more information about treatments. Other predominant concerns were for general information about the disease, management of pain, access to and information about diagnostic tests, lifestyle measures and osteopaenia. They feel anxious and need their questions answered.

Comment

Osteoporosis is a chronic disease, affecting predominantly the older population. “Adding Life to Years” (Scottish Executive,2001) reports that Scotland’s population is changing, and the numbers of people over the age of 65 are expected to increase from 787,000 in 2001 to 1.2 million by year 2031. Surely, adequate osteoporosis services via Primary and secondary care should now be provided in all health board areas to: 1) identify those most at risk, 2) diagnose and treat where necessary, 3) inform and support and 4) to empower each individual patient to manage their condition - before there is even more of a burden on health and social services, as well as on patients themselves. Surely also, national and local health promotion messages should include promotion of factors influencing the development and maintenance of bone health throughout all age groups?

Clearly there are considerable gaps in services that are available to identify, manage and support patients with the disease. Undoubtedly the development of the nurse specialist role both in primary and secondary care would be of great benefit in addressing some of the issues highlighted above. The NOS looks forward to working with others to improve osteoporosis services for people in Scotland.
9. Conclusions and Key Recommendations

- Approximately 20,000 women over 50yr present to acute fracture services in Scotland each year with new low trauma fractures at non-vertebral sites. The true additional burden from new vertebral fractures is unknown.

- Non-vertebral and vertebral fractures are a substantial drain on NHS resources.

- About half of the index cases of hip, wrist and vertebral fracture had previously had at least one other fracture over the age of 50yr- and the opportunity to reduce the risk of the index fracture occurring had been neglected.

  **A patient with a fracture is at high risk of having further fractures.**

- Non-vertebral and vertebral fractures are associated with considerable morbidity that includes increased risk of further fractures: a fracture at any skeletal site is associated with greatly increased risk of having other fractures – often soon after the original fracture. About 17-25% of the index hip, wrist and vertebral fracture cases had another fracture in the ~1.8yr after the index fracture.

  **The occurrence of a new fracture (any site) should prompt early assessment for the secondary prevention of fractures because of the high risk of early, further fracture.**

- The occurrence of a fracture at any site presents an opportunity for assessment for osteoporosis with a view to targeting those patients with osteoporosis with appropriate treatment to halve their risk of experiencing further fractures at vertebral and non-vertebral sites (including hip fractures).

  Identification of osteoporosis in patients who have had a fracture requires access to axial DXA.

  **Patients who fracture in Scotland require access to axial DXA – as this is the key tool for targeting treatment for the secondary prevention of fracture. Approximately 41,190 DXA scans per annum are required in Scotland to address the fracture secondary prevention needs of women and men ≥ 60yr.**

- There is marked regional variation within Scotland in rates of offering the opportunity for assessment for osteoporosis or for treatment for the secondary prevention of osteoporotic fractures after fractures as a consequence of inequity of service provision.
Effectiveness of Strategies for the 2nd Prevention of Osteoporotic Fractures in Scotland

• The Fracture Liaison Service model is uniquely effective in addressing the fracture secondary prevention needs of patients after non-vertebral fracture and achieves substantially higher rates (~95% to 97%) of offering assessment and/or treatment than other service models including those offering direct access to DXA for primary care clinicians.

The Fracture Liaison Service model, effected by Nurse Specialists, should be deployed throughout Scotland as the systematic solution to the challenge of how to achieve the secondary prevention of osteoporotic fractures.

• Direct-access DXA service (DADS) models for primary care serve the fracture secondary prevention needs of two groups of patients – those with vertebral fractures identified on spine X-rays requested by GPs and for patients with previous non-vertebral fractures (provided their past fracture history has been logged in primary care clinical records).

DADS have a complementary role to the FLS and should be developed throughout Scotland to address the need to provide patients with previous fractures who can be identified in primary care, with the opportunity to be considered for treatment for the secondary prevention of fractures.

• Fracture secondary prevention after the identification of vertebral fractures on X-rays identified by secondary care clinicians is achieved less often than in primary care.

The FLS service model should be adapted to link with Radiology Departments to provide assessment for fracture secondary prevention to patients whose spine X-rays are reported to show vertebral fractures.

• The terminology used by Radiologists to describe the presence of vertebral fractures plays a pivotal role in triggering intervention for the secondary prevention of fractures after vertebral fracture by the clinicians who request spine X-rays; currently Radiologists use confusing and diverse terminology that may hinder appreciation that a vertebral fracture has occurred.

Radiologists in Scotland should adopt a universal, simplified scheme to report vertebral fracture such as the semi-quantitative assessment devised by Genant & Wu; however, we recommend that when a fracture is perceived to be present, there should be specific and explicit inclusion of the term ‘fracture’ in all X-ray reports.

• Primary care clinicians accord management of osteoporosis and prevention of osteoporotic fractures relatively high priority in their clinical practice. ‘Case-finding’ of patients with previous fractures in the community, by primary care clinicians is feasible but requires past fracture history to be recorded in primary care patient databases.
Routine recording of past fracture history (over the age of 50yr) on primary care database should be encouraged.

There is potential for practice nurses to gain a greater role in fracture ‘case-finding’ and in the delivery of strategies for fracture secondary prevention in the primary care, after their training needs have been addressed.
10. Action required and recommendations for the future: summary of main outcomes/results including implications for NHS Scotland

The secondary prevention of osteoporotic fractures after non-vertebral and vertebral fractures is a healthcare priority. Currently, typically, post-fracture care ends with the healing of the fracture. A fracture, however, is not an endpoint but should be viewed as the beginning of new phase of clinical management (where appropriate) for fracture secondary prevention. The paradigm outlined in fig. 61 proposes refinement of existing models, and existing expertise from within Scotland can be drawn on to facilitate the rollout of this strategy that should be available to all of 60yrs or older after fracture. However, optimal secondary prevention of fractures after new fractures requires access to DXA via a FLS (that achieves both ‘case-finding’ and post-fracture osteoporosis assessment and achieves this through links with the acute fracture services) and for those who have had a fracture previously, via a DADS service (where ‘case-finding’ is achieved within primary care, who then refer for DXA assessment). The more geographically remote areas in Scotland may not justify permanent service access but their DXA needs (via FLS or DADS service configuration) could be achieved through making DXA available through mobile units (examples of which have been in use in England).

A new paradigm for secondary prevention of osteoporotic fractures proposes a novel refinement to the existing FLS model – that is to integrate with Radiology Departments to offer analogous post-fracture assessment and/or treatment to that currently offered after non-vertebral fracture. The full implications of this (from the perspective of numbers, in the context of revised Radiology reporting protocols for vertebral fractures) require early audit at beacon sites.

There is inequality in the provision of services for osteoporosis and assessment throughout Scotland. A FLS and DADS facility allows all patients who have sustained fractures to be offered and receive appropriate therapies to prevent osteoporotic fractures in the future. The primary recommendation of this audit is that all health board regions in Scotland should be compelled to introduce such services without delay. This, accompanied by increased education of medical and paramedical staff and improved reporting and recording of fractures, will enable targeted therapy to be given to reduce the burden of future fractures in Scotland.

Brief details of any further work planned

The follow-up period after post-fracture assessment and treatment was too short in this report to detect an effect of therapy introduction on fracture rates, at least as determined by multiple regression analysis. It is recommended that a further audit be commissioned after introduction of further FLSs to
determine the relative rates of fractures in centres where patients over the age of 50 with fractures have only recently been identified and treated compared to the established centres. Research is also recommended as to the most effective methods of vertebral fracture identification to enable therapeutic intervention and a reduction of future morbidity and excess mortality.
11. Dissemination

Preliminary data were presented at the Ninth Bath Conference on Osteoporosis 23-26 June, 2003, Bath, UK. Two abstracts (appendix 7) summarising key final outcomes have been submitted to Tenth National Osteoporosis Society Conference on Osteoporosis, Harrogate, UK, 29 Nov-2 Dec, 2004. It is proposed that 2 clinical papers describing outcomes after non-vertebral and after vertebral fractures will be submitted to peer-review journals. The data merit dissemination through a meeting specifically convened for this purpose but will be presented at the October 2004 SIGN guideline implementation meeting. The possible dissemination though appropriate web sites will be considered.
12. Reference List


13. Acknowledgements

The authors would like to acknowledge the commitment and diligence of the nurses who undertook this audit project. Led by Ms Kay Forbes (Glasgow) who had a key role in developing the database and in ensuring training and quality control in its use, the audit nurse team included Ms Rosie Reid (Aberdeen) and two additional nurses Ms Kathleen Duncan (Hairmyres Hospital) and Ms Fiona McGhie (Raigmore Hospital). Mr Robert Currens, Clinical audit Facilitator, North Glasgow Hospitals University NHS Trust, helped create the audit database. Ms Dorothy Rooney provided substantial secretarial assistance to KF & ARMcL throughout and helped with the preparation of the final manuscript.

The authors are grateful to: 1) all the clinicians in primary care and within secondary care who did agree to participate in this project and who permitted review of their clinical records, 2) the Radiologists in the 6 participating centres for their help in gaining access to X-ray reports, 3) staff in the clinical coding departments of participating hospitals, 4) staff involved in the Scottish Hip Fracture audit, 5) staff in ISD, 6) clinicians in primary care and Trust Chief Executives, Medical Directors & Consultants in Public Health who returned completed questionnaires. The authors wish to record their thanks to Dr Donald Farquhar for his cooperation in facilitating the work of this project at St. John’s Hospital in Livingston.
14. Appendices

Appendix 1: Questionnaire re availability and organisation (including funding, staffing and available hardware) of services for the assessment of osteoporosis after fracture for completion by Consultants in Public Health at Health Boards.

Appendix 2: Questionnaire re availability and organisation (including funding, staffing and available hardware) of services for the assessment of osteoporosis after fracture for completion by Medical Directors of all primary care and secondary care / acute Trusts.

Appendix 3: Questionnaire for completion of primary care clinicians who opted to perform case-record review themselves rather than by audit nurse.

Appendices 4a & 4b: Questionnaire for completion by primary care clinicians in Glasgow regarding their perspectives on osteoporosis, of DADS (4a) and of the FLS (4b).

Appendix 5: Questionnaire for completion by Practice Nurses regarding their perspectives on osteoporosis.


Appendix 7: Abstracts submitted to Tenth National Osteoporosis Society Conference on Osteoporosis, Harrogate, UK, 29 Nov-2 Dec, 2004
HEALTH BOARD QUESTIONNAIRE

This questionnaire should be completed for the following year:
1st January 2000 - 31st December 2000

Q1.) Did your Health Board area provide a service that routinely assessed patients who had a fracture to assess them for osteoporosis to decide whether they should receive treatment to reduce the risk of having future fractures?

Yes □  No □ (If no please proceed to Q7)

Q2.)

<table>
<thead>
<tr>
<th>PRIMARY CARE</th>
<th>SECONDARY CARE</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where is this service based?</td>
<td></td>
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<tr>
<td>Who provides this service?</td>
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<tr>
<td>Month service was commenced</td>
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<tr>
<td>If during 2000</td>
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<tr>
<td>Lead Clinician</td>
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</tbody>
</table>

Q3.) Did your Health Board commission that service?

Yes □  No □

Q4.) Which patients with fractures are eligible for this service? (please describe eg age of patient, gender, # site etc

____________________________________________________________________________________

____________________________________________________________________________________

Q5.) Who is providing the funding for this service and is it permanent?

<table>
<thead>
<tr>
<th>NHS</th>
<th>INDUSTRY</th>
</tr>
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<tbody>
<tr>
<td>Permanent □</td>
<td>Permanent □</td>
</tr>
<tr>
<td>Pilot □</td>
<td>Pilot □</td>
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<tr>
<td>OTHER (please specify)</td>
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</table>

Q6.) What areas of this service are the Health Board funding? (please tick below all that apply)

Dexa Scan - Hip/Spine  □  Ultrasound Heel/Wrist/Other  □
Dexa Scan - Forearm  □  CT Spine - for assessment of bone mineral density  □
Dexa Scan - Calcaneum  □  CT Forearm  □
Xray - Digital Radiogrametry  □  Bone Markers - Blood Urine  □
Other (please specify) □
<table>
<thead>
<tr>
<th>STAFFING</th>
<th>GRADE</th>
<th>NO OF SESSIONS PER WEEK</th>
<th>NO OF STAFF</th>
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</thead>
<tbody>
<tr>
<td>Clinician</td>
<td>Consultant</td>
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<td></td>
<td>Staff Grade</td>
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<td>Middle Grade</td>
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<tr>
<td></td>
<td>Other</td>
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</tr>
<tr>
<td>Radiologist</td>
<td>Consultant</td>
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<td></td>
<td>Other</td>
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</tr>
<tr>
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<tr>
<td>Technician</td>
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<tr>
<td>Clerical</td>
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</tbody>
</table>

Q7.) Did your Health Board area provide a clinic, DEXA or other bone densitometry scanning or liaison service that does not specifically target all fracture patients, but to which fracture patients can be referred? (If the answer to Q1 was no and the answer to this question is yes, please go back and answer Q2-6)

Yes □  No □

Q8.) Did your Health Board, Health Implementation Programme for the year 2000, include strategies to reduce incidence of Osteoporosis and/or Osteoporotic Fracture?

Yes □  No □

Q9.) Did your Health Board in the year 2000 commission a scoping group or working party to consider whether Osteoporosis should be addressed by future Health Implementation Programmes?

Yes □  No □

Q10.) Has your Health Board commenced any Osteoporosis Service since 31st December 2000?

Yes □  If yes please describe the service and its aim  No □

Q11.) Has your Health Board made significant changes an existing Osteoporosis service since 31st December 2000? (eg changed referral criteria)

Yes □  If yes please describe what changes to the service have been made  No □

Thank you for taking the time to complete this questionnaire
Effectiveness of Strategies for Secondary Prevention of Osteoporotic Fractures in Scotland
A Scottish Office CEPS / CRAG funded audit project

TRUST QUESTIONNAIRE

This questionnaire should be completed for the following year:-
1st January 2000 - 31st December 2000

Q1.) Did your Hospital/Trust provide a service that routinely offered assessment of patients who had a fracture to assess them for osteoporosis and to decide whether they should receive treatment to reduce the risk of having future fractures?

Yes □ (If yes please go to Q3) No □ (If no please proceed to Q2)

Q2.) Did your Trust/Hospital provide a service for assessment (and possibly treatment) of osteoporosis to which patients with fractures can be referred? 

Yes □ No □

Q3a.) Who is the lead clinician for this service?

b.) Where is this service based?

c.) When did the Trust/Hospital set up this service? (please provide year and month in year below)

Q4.) Was this service established in accordance with:-

Health Implementation Programme
Trust Implementation Programme

Yes □ No □

Q5.) Who is the provider of this service? (please tick all that apply)

Primary Care □ Secondary Care □ Orthopaedics □ Rheumatology □ Endocrinology □
Bone Metabolism □ Gynaecology □ Non - NHS Private □ Other please specify □

Q6.) What areas of this service are the Health Board funding? (please tick all that apply)

<table>
<thead>
<tr>
<th>STAFFING</th>
<th>GRADE</th>
<th>NO OF SESSIONS per week</th>
<th>NO OF STAFF</th>
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<tbody>
<tr>
<td>Clinician</td>
<td>Consultant</td>
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<td>Staff Grade</td>
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<td>Training Grade</td>
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<td></td>
<td>Other</td>
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<tr>
<td>Nurse</td>
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<td>Technician</td>
<td>Mlsso □</td>
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<td></td>
<td>Radiographer □</td>
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<tr>
<td>Clerical</td>
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</tbody>
</table>
Q7.) What technology is available for assessment of Osteoporosis Risk? (please tick all that apply)

<table>
<thead>
<tr>
<th>Technology</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dexa Scan - Hip/Spine</td>
<td></td>
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<tr>
<td>Dexa Scan - Forearm</td>
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<td>Dexa Scan - Calcaneum</td>
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<td>Xray - Digital Radiogrametry</td>
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<td>Ultrasound Heel/Wrist/Other</td>
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<tr>
<td>CT Spine - for assessment of bone mineral densit</td>
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<tr>
<td>CT Forearm</td>
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<tr>
<td>Bone Markers - Blood Urine</td>
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</tbody>
</table>

Q8.) What is the basis of funding for this service and is it permanent? (tick all that are appropriate)

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Staffing</th>
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<tbody>
<tr>
<td>NHS Permanent Yes</td>
<td>NHS Permanent Yes</td>
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<tr>
<td>Industry Permanent Yes</td>
<td>Industry Permanent Yes</td>
</tr>
<tr>
<td>Research Permanent Yes</td>
<td>Research Permanent Yes</td>
</tr>
</tbody>
</table>

Q9.) Who refers patients with fractures to this service?

- Gp
- Practice Nurse
- Health Visitor
- A&E nursing staff
- A&E medical staff
- Orthopaedic medical staff
- Fracture Clinic nursing staff
- Orthopaedic/Dedicated fracture liaison nurse
- Self Referral
- Occupational Therapy
- Other (please specify)

Q10.) Please confirm which Risk Factors are in your criteria for access to your service? (please tick all that apply)

<table>
<thead>
<tr>
<th>Menstrual History</th>
<th>Endocrine</th>
<th>Chronic Disease/Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Menopause/Ovarian Failure/Hysterectomy &lt;45</td>
<td>Thyrotoxicosis</td>
<td>Malabsorption Syndrome</td>
</tr>
<tr>
<td>Secondary Amenorrhea &gt;6months</td>
<td>Cushings Syndrome</td>
<td>Chronic Liver Disease</td>
</tr>
<tr>
<td>Primary Amenorrhea/late menarche &gt;16yr</td>
<td>Hyperprolactinaemia</td>
<td>Inflammatory Bowel Disease</td>
</tr>
<tr>
<td>Perimenopausal</td>
<td>Hyperparathyroidism</td>
<td>Rheumatoid Disease</td>
</tr>
<tr>
<td>Use of depo-provera</td>
<td></td>
<td>Previous renal/liver transplant</td>
</tr>
<tr>
<td>Fracture History</td>
<td></td>
<td>Partial/total gastrectomy</td>
</tr>
<tr>
<td>Past history of fragility fractures</td>
<td></td>
<td>Myeloma</td>
</tr>
<tr>
<td>Family History</td>
<td></td>
<td>Low BMI</td>
</tr>
<tr>
<td>Family history of Osteoporosis</td>
<td></td>
<td>Osteopenia on X-ray</td>
</tr>
<tr>
<td>History of maternal hip fracture</td>
<td></td>
<td>Other (please describe)</td>
</tr>
</tbody>
</table>
Q11.) Does access to this service require: - (please tick all that apply)

- Patients to have had a fracture
- Patients to have the above risk factors for osteoporosis, other than
- No specific criteria to be fulfilled

Q12.) Does the Trust have a strategy/protocol to ensure that all fracture patients are either assessed or treated for osteoporosis with the aim of achieving secondary prevention of fractures?

Yes ☐ No ☐

Q13.) Does your Trust provide a Falls Prevention Programme?

Yes ☐ No ☐

Q14.) Who provides this programme? (please state in the space below)

__________________________________________

Q15.) Has your Trust commenced any Osteoporosis Service since 31st December 2000?

Yes ☐ No ☐

b.) If YES, please describe service and its aim:-

__________________________________________

__________________________________________

__________________________________________

Q16.) Has your Trust changed its Osteoporosis Services since 31st December 2000?

Yes ☐ No ☐

b.) If YES, please provide what changes to the service have been made:-

__________________________________________

__________________________________________

THANK YOU FOR TAKING THE TIME TO COMPLETE THIS QUESTIONNAIRE
Effectiveness of Strategies for Secondary Prevention of Osteoporotic Fractures in Scotland. A CEPS / CRAG Funded Audit Project

Osteoporosis Audit in Women Aged 50 Years and Over

PRIVATE AND CONFIDENTIAL

<table>
<thead>
<tr>
<th>NAME</th>
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<td>DATE of BIRTH</td>
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<td>GP NAME</td>
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<td>GP ADDRESS</td>
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<td>CRN NUMBER</td>
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<td>PRACTICE CODE</td>
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<tr>
<td>FRACTURE SITE</td>
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<td>FRACTURE DATE</td>
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<tr>
<td>HOSPITAL ATTENDED</td>
<td></td>
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<tr>
<td>ATTENDANCE DATE</td>
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</tbody>
</table>

IS THE PATIENT DECEASED?  
☐ YES  ☐ NO  
IF YES, DO NOT CONTINUE

IS THE PATIENT STILL REGISTERED AT YOUR PRACTICE?  
☐ YES  ☐ NO  
IF NO, DO NOT CONTINUE
Patient attended for spine X-Ray on

Did you receive a copy of the report?  YES  NO
Did you interpret the report as suggestive of osteoporotic collapse / fracture?  YES  NO
Did this fracture trigger an assessment for osteoporosis (eg. DEXA or other service)?  YES  NO
Please provide date of assessment

Who arranged this assessment (please tick):

- Orthopaedic doctor
- A&E doctor
- Specialist nurse
- Practice nurse
- GP
- Patient
- Dedicated osteoporosis assessment service
- Other
Did the patient attend for assessment?  YES  NO

What investigations were used to assess whether the patient had osteoporosis (tick all that apply):

- **DEXA**  Spine  NO  Forearm  NO  Hip  NO  Calcaneum (heel)  NO
- **ULTRASOUND**  Heel  NO  Wrist  NO  Other  NO
- **XRAY**  Hip  NO  Wrist  NO  Vertbral  NO  Digital radiogrametry  NO
- **BONE MARKERS**  Blood tests  NO  Urine tests  NO  None  NO

Who provided this service (please tick):

- Hospital
- Clinical trial / research
- Private scanning facility
- Other
- General practice

Are assessment results available?  YES  NO

What was the outcome
- Osteopenia
- Osteoporosis
- Normal

Has the patient had an assessment for osteoporosis prior to this fracture?  YES  NO
### Treatment

<table>
<thead>
<tr>
<th>Question</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was patient on osteoporosis treatment prior to this fracture?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Were they taking this treatment at time of fracture?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was treatment commenced as a result of this fracture?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was treatment changed as a result of this fracture?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### What treatment was recommended (tick all that apply): -

- **BISPHOSPHONATES**
  - D锦ronel / Etridronate
  - Fosamax / Alendronate
  - Actonel / Risedronate
  - SERM (Raloxifene)
  - HRT
  - Calcium
  - Calcium & Vitamin D

<table>
<thead>
<tr>
<th>Question</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did general practice prescribe treatment?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was calcium and / or calcium and vitamin D commenced in secondary care?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Date treatment commenced:**

**Date last prescribed issued:**

### If no treatment prescribed please explain why :-

- Patient declined
- Side effects
- Non-compliance
- Other

### If treatment was stopped, why was it:-

- Patient declined
- Side effects
- Non-Compliance
- Other

<table>
<thead>
<tr>
<th>Question</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was the patient participating in a clinical trial at the time of the fracture?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If the initial fracture did not trigger assessment has patient subsequently been assessed for osteoporosis?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**What triggered the subsequent assessment?**

**Date form completed:**

---

Thank you for taking time to complete this form.
Effectiveness of Strategies for Secondary Prevention of Osteoporotic Fractures in Scotland  
*a Scottish Office CEPS / NHS Quality Improvement Scotland*  
Previously CRAG funded audit project

APPENDIX 4A

The Direct Access DEXA Service was set up in 1998 in Glasgow. In conjunction with the above audit, we would be grateful if you would take a few minutes to complete the following questions: (please tick the relevant box) -

<table>
<thead>
<tr>
<th>How often has your practice used the DADS service since it was set up?</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;50 times</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How high a priority is Osteoporosis Management in your practice?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How useful is the DADS service?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not useful</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Is the time from referral to receiving the report?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Fast</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you find the layout of the referral form user-friendly?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
</tr>
</tbody>
</table>

Would you like other criteria to be added to the list of criteria for eligibility for referral? The present referral criteria has been enclosed for your information (Form 1).

| Yes  | No |

If Yes, what would you like to be included?

Do you find the layout of the returned report clear and concise? An example copy has been enclosed (Form 2).

| Yes  | No |

If No, how would you want it to be changed?

<table>
<thead>
<tr>
<th>Do you implement the treatment recommendations?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always</td>
</tr>
</tbody>
</table>

Do you log the assessment findings on your GP computer system?

| Yes  | No |

Please feel free to enter any other comments you wish to make.

Thank you for taking the time to complete this form.

«Title» «Family_Name» «Practice_ID»
Effectiveness of Strategies for Secondary Prevention of Osteoporotic Fractures in Scotland

*Scottish Office CEPS / NHS Quality Improvement Scotland*

*Previously CRAG funded audit project*

**APPENDIX 4B**

**ACCEPTABILITY QUESTIONNAIRE – ORTHOPAEDIC FRACTURE LIAISON SERVICE**

The Bone Metabolism/Orthopaedic Liaison Service started at Glasgow Royal Infirmary in January 2002.

In conjunction with the CEPS/NHS Quality Improvement Scotland audit, we would like you to take a few minutes to complete the following questions: (please tick the relevant box) –

<table>
<thead>
<tr>
<th></th>
<th>How useful is the Orthopaedic Fracture Liaison Service?</th>
<th>Not useful</th>
<th>Quite useful</th>
<th>Very useful</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>This service aims to provide patients with a treatment recommendation to reduce their future risk of osteoporotic fracture. How important in your clinical practice is prevention of osteoporotic fracture?</td>
<td>Not important</td>
<td>Quite important</td>
<td>Very important</td>
</tr>
<tr>
<td>2.</td>
<td>How useful is the final report that you receive from the O/FLS?</td>
<td>Not useful</td>
<td>Quite useful</td>
<td>Very useful</td>
</tr>
<tr>
<td>3.</td>
<td>Is there any additional information that you would like included in the report?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>How often do you tend to use the treatment regimens that are recommended?</td>
<td>Never</td>
<td>Sometimes</td>
<td>Always</td>
</tr>
<tr>
<td>5.</td>
<td>After taking Rx for osteoporosis, if the patient doesn't report any problems would you or someone else in the practice routinely arrange to meet with the patient to review compliance with the treatment?</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If you do, when would you do this?</td>
<td>Monthly</td>
<td>Other – please state</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Some fracture in-patients are commenced directly on to Calcium and/or vitamin D. Do you routinely continue this?</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Do you have suggestions as to how this service can be improved?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thank you for taking the time to complete this form.

«Title» «Initials» «Surname» «Practice_Code»
## QUESTION 3:

**PLEASE CIRCLE CORRECT ANSWER**

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you feel comfortable discussing osteoporosis risk factors with patients?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Assessment/measurement of osteoporosis with patients</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Treatment options for osteoporosis with patients</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>How high a priority is osteoporosis management in your nursing practice?</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Do you have practice based management protocols for osteoporosis?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>If yes:</td>
<td>Used in practice only</td>
<td>Policy used within LHCC</td>
</tr>
<tr>
<td>Which of the following nurse-led clinics do you have?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Well Women</td>
<td>HRT</td>
<td>Other (please specify):</td>
</tr>
<tr>
<td>HRT</td>
<td>Never</td>
<td>Occasionally</td>
</tr>
<tr>
<td>Well Women</td>
<td>Never</td>
<td>Occasionally</td>
</tr>
<tr>
<td>Over 75yrs check</td>
<td>Never</td>
<td>Occasionally</td>
</tr>
<tr>
<td>Other</td>
<td>Never</td>
<td>Occasionally</td>
</tr>
<tr>
<td>Of women attending these clinics, would you discuss osteoporosis prevention or treatment?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is a specific osteoporosis clinic present in your practice?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>If yes, what is the monthly uptake?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are you aware of any other professionals involved in osteoporosis care in your practice?</td>
<td>Social Worker</td>
<td>Health Visitor</td>
</tr>
<tr>
<td>Have you attended a specific meeting or educational update on osteoporosis in the past year?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Do you have osteoporosis leaflets/documentation within your practice that patients can take away?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Are you aware who provides this documentation?</td>
<td>National Osteoporosis Society</td>
<td>Pharmaceutical Company</td>
</tr>
</tbody>
</table>

Practice Nurse to:
Appendix 6

Estimation of DXA requirement for fracture secondary prevention in Scotland

While CEPS 99/03 has exclusively addressed the issue of secondary prevention of osteoporotic fractures in women, men are also at risk of osteoporosis.

It is possible to extrapolate from data accumulated by the FLS at the Western Infirmary, Glasgow to the entire population of Scotland. Fractures in patients Bold = actual figures; * denotes estimated figures.

<table>
<thead>
<tr>
<th>Fractures</th>
<th>New or ‘incident’ fractures</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-vertebral fractures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Western Infirmary Glasgow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Estimated for Scotland</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age 50yr or over</td>
<td>1400</td>
<td>28300*</td>
<td>350*</td>
<td>7080*</td>
</tr>
<tr>
<td></td>
<td>1100 female</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>300 male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age 60yr or over</td>
<td>1200</td>
<td>24300*</td>
<td>320*</td>
<td>6400*</td>
</tr>
<tr>
<td>Previous or 'prevalent' fractures in last 5 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age 50yr or over</td>
<td>7000*</td>
<td>141500*</td>
<td>1750*</td>
<td>35400*</td>
</tr>
<tr>
<td>Age 60yr or over</td>
<td>6000*</td>
<td>121500*</td>
<td>1600*</td>
<td>32000*</td>
</tr>
</tbody>
</table>

≥ 50yr and ≥ 60yr are included, as the latter group are at greater immediate fracture risk and, depending on their DXA result, are more likely to require treatment. Targeting patients ≥ 60yr is consistent with SIGN 71(64). Those who present with fractures between 50 to 60yr should ideally be re-evaluated for treatment when they reach the age of 60yr.

Assumptions:

1. Population demographics are similar between Glasgow and the rest of Scotland.

2. Fracture epidemiology and demographics are similar between Glasgow and the rest of Scotland.
3. The gender differences in vertebral fracture incidence reported in EVOS study hold true for Glasgow (25).

4. DXA will be required in about 65% of non-vertebral fracture patients; in the remainder, because comorbidities and frailty may limit potential use of interventions for fracture secondary prevention, DXA may not required for all patients.

5. About 75% of the Western Infirmary cohort of vertebral fracture cases identified from review of spine X-rays undertaken in this audit were single vertebral fractures. SIGN 71 endorses use of DXA in this subgroup to determine who requires treatment. For the 25% with 2 or more vertebral fractures, DXA is not essential for determining the need for treatment.

6. Patients with past fracture history should be offered assessment for osteoporosis. This group may not be readily identifiable in many settings, although may become so if initiatives that promote their identification through primary care are adopted. For this modelling of potential workload, the cohort of patients with previous fractures in the last 5 years is considered, and it is assumed that each year 20% will be identified and be referred for DXA.

**Annual DXA requirement for new and past fracture cases among women and men ≥ 60yr is:**

a) 65% of 24,300 new non-vertebral fractures (see assumption 4) plus
b) 75% of 6,400 new vertebral fractures (see assumption 5) plus

c) 20% (see assumption 6) of 65% of 121,500 previous non-vertebral fractures (see assumption 4) plus

d) 20% (see assumption 6) of 75% of 32,000 previous vertebral fractures (see assumption 5)

\[= \text{a) } 15,795 + \text{b) } 4,800 + \text{c) } 15,795 + \text{d) } 4,800\]

\[= 41,190 \text{ DXA scans per annum.}\]
Abstract Title:
A MULTI-CENTRE COMPARISON OF STRATEGIES FOR THE SECONDARY PREVENTION OF OSTEOPOROTIC FRACTURES AFTER HIP & WRIST FRACTURES.

Authors:
AR McLellan[1], D Reid[2], K Forbes[1], R Reid[2], C Campbell[3], A Gregori[4], N Raby[1], A Simpson[5].

Abstract Text:
A fracture at any skeletal site is associated with morbidity that includes a 2-3X increase risk of further fractures: identification of fracture cases who have osteoporosis by axial DXA, permits targeting of evidence-based treatments that can potentially halve their future risk of vertebral and non-vertebral fracture. The purpose of this 3year audit programme was to review outcomes after hip and wrist fractures at 6 Scottish centres to evaluate the success of different approaches to providing post-fracture assessment for osteoporosis and/or treatment for fracture secondary prevention. 704 hip and 919 wrist fracture cases who presented in year 2000 were identified from secondary care record systems and their pathways of care were followed back to their Primary Care (or failing that to their secondary care) records to identify whether they had been offered assessment for osteoporosis and/or whether they had been prescribed treatment for the secondary prevention of fractures. Interim results were presented (McLellan et al. O.I. 2003:14;suppl.4, abst OC2,S4).

Centre W has a Fracture Liaison Service in which 'case-finding' and post fracture evaluation for osteoporosis are routinely offered within secondary care via a nurse-led service dedicated to this task; centres A, G & S provide DXA services on an 'open-' or 'direct-' access basis to patients from Primary Care, but depend upon GPs for the 'case-finding' of fracture patients. Centre H empowers the patients with advice to seek referral for DXA by their GP. Centre I lacks any service or strategy. Rates for providing the offer of assessment and/or treatment for osteoporosis following fracture differed significantly among the 6 participating centres. After hip fracture, proffered osteoporosis assessment &/or treatment rates range from 16% (centre I) to 97% (centre W)(Chi-Square = 239.738, df = 5, p<0.0001); after wrist fracture rates ranged from 11% (centre I) to 95% (centre W) (Chi-Square = 407.323, df = 5, p<0.0001).

The FLS service model is uniquely successful in offering assessment and/or treatment for osteoporosis after hip or wrist fractures; this goal is achieved ~6X and 3-4X more often respectively than where no service exists or where 'open-access DXA' services are available. The FLS service model is the best approach to achieve assessment and treatment to prevent future fractures.
Abstract Title:
SECONDARY PREVENTION AFTER VERTEBRAL FRACTURE

Authors:
AR McLellan[1], D Reid[2], K Forbes[1], R Reid[2], C Campbell[3], A Gregori[4], N Raby[1], A Simpson[5].

Abstract Text:
After vertebral fracture (VFx), patients have at least 2-3X increased risk of further fractures at any skeletal site; the risk is much higher after multiple VFx. Successful secondary prevention after VFx requires 'case-finding' of patients and subsequent intervention, including DXA, when appropriate, and treatment. The purpose of this 3 year audit programme was to review outcomes after VFx (443 whose VFx were identified on X-rays requested by GPs and 831 whose spine X-rays were requested by secondary care clinicians (SCC)) at 6 Scottish centres in year 2000 to evaluate the impact of 1) reporting of VFx on X-rays, 2) clinicians in Primary and secondary care and 3) access to services & DXA on post-fracture assessment for osteoporosis &/or treatment for fracture secondary prevention.

Results: 1) Diverse and confusing terminology is used by Radiologists reporting spine X-rays. Explicit reference to a 'fracture' on spine X-ray reports was associated with greater assessment &/or treatment rates (in 65%) compared to reports that lacked explicit reference to 'fracture' (but included other terms (such as 'wedging', height loss, etc.))(Chi-Square = 4.483, df = 1, p=0.034)). The presence of multiple VFx was associated with higher response rates (67%) v single VFx (54%) (Chi-Square = 19.545 df = 1, p=0.0001). 2) VFx cases identified from Secondary care were less likely (52%) to be assessed &/or treated than cases from Primary Care (70%)(Chi-Square = 39.185, df = 1, p<0.0001). Marked variation in assessment/treatment rates were seen among the 6 participating centres: from 47% (Centre I) to 84% (Centre G) of VFx cases identified on X-rays by GPs and from 25% (centre H) to 69% (centre G) of VFx cases identified by SCC. 3) Availability of a local osteoporosis service with DXA trebles the assessment &/or treatment rates after VFx (O.R. 2.56 (1.89 to 3.48)(p<0.0001). Highest rates overall were achieved by GPs with 'open-' or 'direct-access' to DXA although in the centres with these services, poorer rates of assessment &/or treatment were achieved by SCC.

After VFx, rates of assessment &/or treatment for secondary prevention of fractures are suboptimal. Potential opportunities to improve have been identified including: a)the need for Radiologists to adopt a standardised VFx reporting system based on the term 'fracture', b)wider provision of open-access DXA services and c) revision of service access to SCC coupled with appropriate education programmes.