Scottish Needs Assessment Programme

Osteoporosis

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Further copies of the report are available from Ms Jackie Gregan, SNAP, 69 Oakfield Avenue, Glasgow G12 8QQ, tel: 0141 330 5607.

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CONTENTS

Please note that, with the exception of Chapter 4 and Chapter 5, all tables and figures are contained within the appendices.

EXECUTIVE SUMMARY

Osteoporosis is characterised by the loss of bone mass which leads to bone fragility and subsequently a high risk of bone fracture. Osteoporotic fractures (those occurring as a result of bone fragility) most commonly occur at the hip, wrist and spine. Osteoporosis is also associated with significant loss of height and pain. Postmenopausal women are the largest group at risk of osteoporosis, although there are a number of other well established risk factors. The risk of fractures doubles every ten years after the menopause. Osteoporosis can also occur as the secondary effect of a number of diseases or drug therapies.

In Scotland, it is estimated that more than 40,000 men and in excess of 200,000 women aged over 50 have osteoporosis of the hip. Between July 1991 and June 1994, 17,862 people were admitted to hospital in Scotland with a principal diagnosis of fractured neck of femur. Of these, 91.6% survived beyond thirty days. At present, it is not possible to obtain routinely information on fractures, such as Colles' or vertebral, which do not lead to admission.

Primary Prevention

Osteoporosis can be prevented by a number of lifestyle modifications in both men and women. Exercise should be encouraged at all ages, with particular emphasis on children, young adults and the elderly. Alcohol in moderation does not seem to affect bone density but consumption can affect stability and increase the risk of falling. Smoking is deleterious to bone and when combined with lower weight will tend to counteract any protective effects of oestrogen use. Attention to diet and dietary balance is important at all ages.

Secondary Prevention

Oestrogen is of proven value in the prevention of osteoporotic fractures in women. Women who have had a premature menopause (surgical or natural) should always be advised to take hormone replacement therapy (HRT) for future prevention of osteoporosis and cardiovascular disease. HRT can cause side effects and many women tolerate the return of menstrual bleeding poorly, although the new 'no period HRT' is likely to improve compliance. There is a role for specialist menopause clinics to offer expertise on the management of complex menopause and HRT problems.

At present there is insufficient evidence to support population screening for osteoporosis.

Correction of calcium and vitamin D deficiency in the elderly in nursing and residential homes reduces fracture risk.

Tertiary Prevention

The bisphosphonates have been shown to increase bone density at various sites. Etidronate and alendronate have been shown to reduce vertebral fracture risk and evidence of risk reduction for certain non-vertebral sites is now available for etidronate. Criteria for selection of women remains a crucial and problematic determinant of their value as preventive therapy. Calcitonin and salcatonin are of benefit as therapeutic agents in selected patients.

Whilst there is limited evidence for any single intervention to reduce the incidence of falls amongst those with low bone density, the following programmes are recommended in light of the recent Effective Health Care Bulletin: balancing (e.g. Tai Chi); low impact aerobic or muscle strengthening exercise; home visiting to identify and remedy environmental and personal risks for falling, with subsequent interventions; and the introduction of hip pads amongst those in residential settings. The implementation of any such programmes should be carefully monitored and evaluated.

There is reasonable evidence that side effects of drug therapy in the elderly contribute to falls and fractures. This confirms the value of a general focus on improving prescribing in the elderly. Ongoing collaboration between Health Board Medical and Pharmacist Prescribing Advisers and their clinical colleagues in this respect should be encouraged.

Current Services in Scotland

There is wide variation between Boards in both service provision and the attention that osteoporosis has attracted thus far.

Options

Fourteen options for prevention, detection and management of osteoporosis were identified and where possible costed. The majority of options for primary prevention can be achieved with little or no additional funding. Secondary and tertiary prevention options attract a wide range of differing resource implications.

Conclusion

The challenge to purchasers is to create a balance between investment in programmes which give immediate benefits, such as in drugs for established osteoporosis, and those which confer long term benefits, such as primary prevention programmes. Such decisions are subjective and it is the responsibility of individual Health Boards to decide their relative priority in the light of competing priorities. It is important, however, that Boards should consider services for primary, secondary and tertiary care. In order to assist Boards in this, a number of recommendations in each of these areas are included overleaf.

RECOMMENDATIONS

Primary Prevention (section 3.1)

Programmes aimed at encouraging exercise, reducing alcohol and cigarette consumption and promoting a balanced diet should explicitly promote the benefits of osteoporosis prevention.

Exercise should be encouraged at all ages and Boards should consider encouraging those who care for 'at risk' groups to undergo training in exercise and mobility for these groups.

Secondary Prevention (section 3.2)

At this time, the SNAP working group does not feel that there is sufficient evidence to support population use of HRT or population based screening. Instead, HRT should be targeted at those most at risk from developing osteoporosis. In this group there is a role for specialist menopause clinics. At present the role of DEXA screening in high risk groups is yet to be established.

Women who have a premature menopause (under the age of 45) should be advised to take HRT. Purchasers should ensure that gynaecology providers monitor the use of HRT after surgically induced menopause. Urgent action should be taken to determine effective means of improving compliance amongst those women who do initiate HRT. A clear deterrent to compliance is the double prescription charges HRT attracts.

Further research is required to determine risk factors to allow the targeting of services.

Good evidence exists for the use of calcium and vitamin D supplementation for elderly females in residential care. Health Boards should carefully evaluate the costs and benefits of such a programme.

Purchasers should review critically the provision of services for osteoporosis, including access to bone densitometry facilities.

Tertiary Prevention (section 3.3)

Awareness raising amongst prescribers of the impact of drugs and use of alcohol which increase the risk of falling in elderly patients should continue.

Fall prevention is a multi-agency problem. However, providers of services for the elderly (both acute and community based) should give priority to finding methods for reducing and limiting the effect of falls. Urgent action should be taken by purchasers to alleviate the uncertainty surrounding the prescription and cost of hip pads, which have been shown to reduce significantly the incidence of hip fracture.

In patients with post menopausal osteoporosis the bisphosphonates offer an alternative to HRT and may be useful for those for whom HRT is unsuitable or poorly tolerated (including men). Etidronate and alendronate have been shown to reduce vertebral fracture risk and evidence of risk reduction for certain non-vertebral sites is now available for etidronate. Criteria for selection of women for treatment remains a crucial and problematic determinant of their value as preventive therapy.

Purchasers should seek to ensure that contracts for A&E include provision of osteoporosis prevention advice and, where appropriate, referral for post-menopausal women presenting with minimal trauma Colles' fractures.

Monitoring (chapter 6)

More information is required on the use of HRT, in particular concerning which groups of women receive therapy and the length of time these individuals comply with treatment. Data is also needed to ensure that all vertebral and Colles' fractures are recorded in order to provide a baseline against which to measure the success of prevention, detection and treatment policies. The development of SMR0 to include diagnostic information should be considered.

INTRODUCTION

1.1 The remit of the SNAP Osteoporosis Group is:

- to quantify the burden osteoporosis places on the NHS and individuals in Scotland and the trends over time
- to review existing services in Scotland for prevention, detection and management of osteoporosis
- to review current evidence with regard to prevention, management and detection of osteoporosis
- to consider the costs, and where possible, the outcome of options for prevention, detection and management of osteoporosis
- to consider the monitoring of services for prevention, detection and management of osteoporosis
- to make recommendations for Health Boards

1.2 Osteoporosis is commonly referred to as 'brittle bones' and can lead to fractures. It affects both women and men, but is most commonly seen in elderly women. More technically, it was described by the World Health Organisation in 1994 as 'a disease characterised by low bone mass and micro-architectural deterioration of bone tissue, leading to enhanced bone fragility and a consequent increase in fracture risk'. Fractures occur most commonly at the hip, wrist and vertebral bodies of the spine.

1.3 Osteoporosis is defined in terms of bone mineral density (BMD) as follows:

Normal - a value of BMD within 1 standard deviation (SD) of the young adult reference mean

Osteopaenia - a value of BMD more than 1 SD below the young adult mean but less than 2.5 SD below this value

Osteoporosis - a value of BMD 2.5 SD or more below the young adult mean

1.4 The sequelae of osteoporosis are a major public health problem, associated with high levels of morbidity and mortality. These sequelae include pain, deformities and loss of independence. The prognosis of patients who have sustained a hip fracture is poor, 50% are never able to walk independently again and up to 25% will die within 18 months (DoH 1994). In Scotland it is estimated that over 40,000 men aged over 50 and in excess of 200,000 women aged 50 and over have osteoporosis of the hip (see 2.3.3). Hence, it is associated with very high social and health service costs; one estimate put the total cost of the problem to the NHS in England and Wales at more than £750 million per annum and this will increase over time as the population ages (DoH 1994).

1.5 The major risk factors for osteoporosis are being female and being elderly. In addition there are a number of other well-established risk factors which are listed below. These risk factors do not, however, have sufficient sensitivity or specificity to identify individual specific risk (Peel & Eastell 1995).

Risk factors for osteoporosis

Early menopause (age <45)
Hypogonadism
Smoking
High alcohol intake
Physical inactivity
Thin body type

Heredity

1.6 Secondary osteoporosis accounts for about 20% of cases in women and 40% of cases in men (Peel & Eastell 1995). Secondary causes of osteoporosis are listed below.

Secondary causes of osteoporosis

Endocrine disorders
(including thyrotoxicosis, primary hyperparathyroidism, Cushing's syndrome)

Gastrointestinal disorders
(malabsorption syndrome, partial gastrectomy, liver disease)

Rheumatological conditions
(rheumatoid arthritis, ankylosing spondylitis)

Malignancy
(multiple myeloma, metastatic carcinoma)

Certain drugs
(corticosteroids, heparin)

1.7 This report will firstly present some detailed information on the epidemiology of osteoporosis, drawing on both national and local information systems, as well as the literature. The report will then go on to discuss the evidence currently available on the primary, secondary and tertiary prevention of osteoporosis. Section 4 will then review the current services in Scotland for osteoporosis, including those provided by health promotion departments. The resource use associated with a number of options for the management of osteoporosis, including primary and secondary prevention will then be presented. Section 6 will discuss methods for monitoring the prevention, detection and management of osteoporosis. Evidence presented throughout the report is drawn together in a series of recommendations.

2 EPIDEMIOLOGY

2.1 Introduction

2.1.1 Osteoporosis is characterised by the loss of bone mass which leads to bone fragility and subsequently a high risk of bone fracture. A combination of bone fragility and the force applied to the bone determines whether a fracture occurs.

2.1.2 Loss of bone mass occurs as a result of normal ageing. An individual's bone mass increases and reaches a maximum over the period of growth and adolescence, reaching a peak in the mid-30s and then begins to decrease slowly. Bone density post-adolescence is therefore dependent on the peak bone mass achieved during early adulthood. Other factors, particularly the menopause in women, increase the rate of bone mass loss.

2.1.3 Osteoporotic fractures (those occurring as a result of bone fragility) most commonly occur at the hip, wrist and spine. These sites, more so than others, experience pressure and are therefore associated with an increased risk of fracture. Hip fracture usually occurs as the result of a fall, although they can occur as a result of minimal trauma. Vertebral fractures are more difficult to diagnose clinically and hence are difficult to quantify. They do however impose a significant burden in terms of morbidity. The risk of hip and vertebral fractures increases with age. Wrist (Colles') fractures are common but exhibit a different pattern of occurrence from hip and vertebral fractures. Hip fractures rise exponentially with age in both males and females. Vertebral fractures rise rapidly after the menopause. In females, Colles' fractures increase rapidly at the time of the menopause and plateau at age 70, while incidence in men is low throughout life. Minimum trauma Colles' fractures tend to be the first indication of reduced bone mass in post-menopausal women.

2.2 Data on Osteoporosis

2.2.1 To examine the epidemiology of osteoporosis accurately would require data on bone mineral density, which establishes the presence or absence of osteoporosis and the stage of the condition. This information is not available routinely, therefore data on certain fractures in the elderly are commonly used as a proxy. This has its limitations since not all fractures are associated with bone mass reduction, that is, not all are osteoporotic fractures. On this basis estimates of the incidence of osteoporosis derived from fracture data may be over-estimates. Conversely, bone mass reduction associated with osteoporosis may not always result in fractures. To minimise the effect of over-estimation focus can be restricted to fractures in the older population (say, over 50 years of age). By excluding the younger age groups, where there is unlikely to be significant bone mass loss and associated fractures, better estimates of incidence will be obtained. Obviously this approach is not exact. Fractures due to trauma occurring in the over 50s would be erroneously included and genuine osteoporotic fractures occurring in younger people would be excluded.

2.2.2 Information is most readily available for hip fracture. There are few data concerning the incidence and prevalence of vertebral and Colles' fracture. Vertebral fractures are often difficult to diagnose and, as with Colles' fractures, rarely result in an admission to hospital and hence no Scottish Morbidity Recording (SMR) with details of diagnosis is generated. As a result hip fracture rates are frequently reported in the medical literature in relation to the epidemiology of osteoporosis.

2.2.3 Another limitation of fracture data is that not all osteoporotic fractures will be detected; vertebral fractures in particular are commonly missed. Retrospective linking of hospital episodes relating to the same individual (data linkage) gives data on the number of patients with such a diagnosis as opposed to the number of episodes. This is problematic with hip fractures as SMR1 rarely distinguishes between the left and right hip and hence linkage creates a possibility of underestimation in those who have fractured both hips.

2.3 Incidence Of Osteoporotic Fractures

2.3.1 It is estimated that osteoporosis results in approximately 60,000 hip fractures per year in the United Kingdom. Ninety percent of these are in people over the age of 50, and 80% are in women (DoH 1994).

2.3.2 The preponderance in older women is due to the link between the menopause and rapid bone loss, caused by oestrogenic deficiency. Post-menopausal women are therefore at high risk of osteoporotic fractures. The risk of fractures doubles every 10 years after the menopause (Fogelman 1991). Almost half of the female population in the UK will experience a fracture by the age of 70 (DoH 1994).

2.3.3 Prevalence estimates for osteoporosis (using WHO definitions) of the hip in men and women aged 50 years or older in England and Wales have been adapted from Kanis *et al* (MSD 1995) (see Appendix 1, Table 2.1.) This shows the widening gap between males and females. The prevalence in women continues to increase up to 85+. Prevalence is relatively low in males up to 80 years of age. Application of the 50+ rate to Scotland's population indicates that 40,453 men and 201,589 women have osteoporosis of the hip, based on 1994 population data.

2.3.4 Vertebral fractures and deformities, as pointed out earlier, are difficult to diagnose. Data from USA population samples have provided estimates of the incidence of new vertebral fractures in the general population. In post-menopausal white women the incidence of vertebral deformities is estimated as three times that of hip fracture. The incidence of clinically ascertained vertebral deformities is, however, substantially lower (DoH 1994).

2.3.5 Data from four British centres involved in a European epidemiological study of vertebral deformities were combined to give a prevalence estimate of 3.5% in women aged 50-54 years which rose to 27.9% in those 85 years and above (DoH 1994).

2.3.6 Data on wrist fractures indicate that in women the rate increases between the ages of 40 and 65 years and then stabilises. For men, however, the rate stays constant between 20 and 80 years (DoH 1994). The plateau in the rate for women may be due to an increasing tendency to fall on the hip rather than the wrist.

2.3.7 In Scotland routine data on fractures are available primarily from the SMR scheme. Information on each discharge from hospital, following an inpatient stay, is recorded on the SMR1 form. Hospital episodes with an associated diagnosis of fractured hip or vertebrae can be identified. In the case of wrist and vertebral fractures, hospital admission will rarely occur, consequently no SMR1 data would be generated. Currently the SMR0 system is being developed to routinely collect information, including diagnosis, for outpatients. This will prove invaluable in measuring the size of the problem in Scotland, with particular reference to Colles' fractures presenting at Accident and Emergency (A&E) departments. At present however, there are no national data on fractures in outpatients, although individual Health Board areas could, in theory, have local systems and data. One such database exists - at the South Ayrshire Hospitals NHS Trust's A&E Department. Since 1992 data have been collected on all patients presenting at A&E. Those with fractures, at various sites, can be identified. Developments in the GP Continuous Morbidity Recording system will allow limited estimates of the prevalence of back pain and other symptoms which are associated with vertebral fractures in some circumstances.

2.3.8 A detailed description of the information contained on this A&E database is given in Appendix 2. Combining the fractures which we would associate with osteoporosis (vertebral, hip and wrist) for females accounted for 49.4% of all fractures and for males 34.1% (Table A2.3, Appendix 2). Vertebral fractures make up only a small proportion of the fractures seen at A&E despite the fact that this type of fracture is thought to be more common than hip fracture in women. Perhaps this highlights the difficulty in clinically diagnosing vertebral fractures as well as the likely absence of major trauma resulting in an acute event which merits presentation at A&E.

2.3.9 SMR1 data on the number of emergency admissions with a diagnosis of fractured neck of femur (ICD 9 code 820) discharged in 1980, 1985, 1990 and 1994 were extracted by Health Board for both males and females in five-year age groups. The total

number of hip fractures in Scotland for those aged 50 and over in these years was as follows: 1980-3361; 1985-3799; 1990-4785; 1994-5220.

2.3.10 Table 2.2 (Appendix 1) illustrates the rise in incidence of emergency admissions to hospital for a fractured neck of femur between 1980 and 1994. In all cases it is clear that the number of fractures is greater in females compared with males and this is particularly apparent in the older age groups. An increasing trend over time can be observed in older groups and is also more apparent in females.

2.3.11 SMR1 data for Scotland also shows differences between the 15 Health Board areas. From Table 2.3 (Appendix 1) it can be seen that almost all Health Board areas' confidence interval for standardised admission ratio crosses the Scottish average of 100. Four Health Boards depart from this pattern suggesting a significant deviation. Most Health Board areas had an incidence of hip fracture around that which would be expected. There is some indication that rural areas such as Dumfries and Galloway and Borders have a lower ratio.

2.3.12 The projected increase in the elderly population is of concern regarding the number of hip fractures likely to occur. A 'best fit' analysis was carried out to project the increase we are likely to see to the year 2010. Figure 2.1 (Appendix 1) indicates that the standardised admission rate for Scotland is likely to increase to 156.2 compared to 100 in 1980. Hence, a 56% increase in admissions for hip fracture is expected by 2010 using 1980 as a baseline. From all perspectives, this is a worrying prediction and is likely to place an increased burden on the NHS, social services as well as individuals.

2.4 Morbidity and Mortality Associated with Osteoporotic Fractures

2.4.1 In Scotland information is routinely published on deaths within 30 days of being admitted to hospital with fractured neck of femur (CRAG Clinical Outcomes Working Group, 1995). Between July 1991 and June 1994, 17,862 people were admitted to hospital in Scotland with a principal diagnosis of fractured neck of femur (ICD9 code 820). Of these, 91.6% survived beyond thirty days. The age, sex, case-mix standardised percentage across the different Trusts ranged from 88.72% to 96.17%. During the same period, of all emergency admissions from home with fractured neck of femur, 63.93% were discharged home within 56 days. Trusts ranged from 54.33% to 74.41%. This illustrates that potentially there are substantial costs associated with long lengths of stay and supporting those disabled in the community.

2.4.2 For 40-44% of those who fracture their hip, the resulting loss of mobility and independence results in long term nursing home care. It has also been estimated that a hip fracture is fatal in 12-20% of cases. (Cummings *et al* 1985). However, there is an argument that those who fracture their hips are already at risk of death rather than the hip fracture leading to death. Further studies have shown that vertebral fractures are also associated with excess mortality at five years following diagnosis (DoH 1994), although once more the same concerns surrounding causality apply.

2.4.3 Osteoporosis is also associated with significant loss of height and pain. The pain caused by vertebral fractures is often not relieved by standard pain relief. Loss of height and spine deformity are of significant concern to sufferers (National Osteoporosis Society 1994).

Summary

- *Osteoporosis is characterised by the loss of bone mass which leads to bone fragility and subsequently a high risk of bone fracture.*

- *Osteoporosis fractures (those occurring as a result of bone fragility) most commonly occur at the hip, wrist and spine.*

- *Routine information is most readily available for hip fracture. There are few data concerning the incidence and prevalence of vertebral and Colles' fractures.*

- *In Scotland, it is estimated that more than 40,000 men and in excess of 200,000 women aged over 50 have osteoporosis of the hip in Scotland.*

- *Between July 1991 and June 1994, 17,862 people were admitted to hospital in Scotland with a principal diagnosis of fractured neck of femur. Of these, 91.6% survived beyond thirty days.*

- *There is likely to be a 56% increase in the number of hip fractures by the year 2010 from the 1980 baseline.*

- *Osteoporosis is associated with significant loss of height and pain.*

3 REVIEW OF CURRENT EVIDENCE

This chapter seeks to review the current evidence on primary and secondary prevention of osteoporosis, detection of osteoporosis and management of established osteoporosis. Each section concludes with a summary for consideration by purchasers. These are evaluated more fully in Chapter 5.

3.1 Primary Prevention

3.1.1 The primary prevention of age related osteoporosis rests principally with improving peak bone density and bone strength before middle age and encouraging a lifestyle that will mitigate the effects of a decreasing bone density in later life.

3.1.2 Primary prevention of osteoporotic fractures on the other hand can be divided into three areas related to age (National Osteoporosis Society 1994):

- children and young adults; improving peak bone density and establishing an appropriate lifestyle pattern
- middle age; continuing the healthy lifestyle and employing therapeutic measures to prevent or delay the onset of age related bone loss
- older age; continuing the healthy lifestyle and taking steps to reduce the risks of falling.

3.1.3 In young adults, studies have shown that athletes, dancers and sportsmen and women have greater cortical bone mass (Jones *et al* 1977, Dalen & Olsson 1974, Nilsson & Westlin 1971, Nilsson *et al* 1978) and that intense physical training increases bone mineral content and cortical area (Margulies *et al* 1986, Woo *et al* 1981). However there is evidence (e.g. from lifestyle surveys) that the proportion of adults who consider they exercise sufficiently exceeds those who actually do exercise in accordance to minimum recommended levels (Grampian Health Board 1994). Women who exercise three times a week have higher bone density than sedentary women at all ages from young adulthood to elderly (Talmage *et al* 1986).

3.1.4 Continuing or even initiating exercise in later life can also help to maintain bone density, even reversing the age related loss of bone seen in post menopausal women (Chow *et al* 1987, White *et al* 1984, Aloia *et al* 1978, Smith *et al* 1984, Krolner *et al* 1983, Simkin *et al* 1987, Rundgren *et al* 1984, Smith *et al* 1981).

3.1.5 The effect of exercise may not be localised to just the exercised limb and many forms of exercise can increase bone density although weight bearing exercise is preferable (Dalen & Olsson 1974, White *et al* 1984, Minaire 1989, Heinonen *et al* 1996). This means that the most popular form of exercise amongst young women (Greater Glasgow Health Board 1994), swimming, is unlikely to be protective.

3.1.6 Immobility with associated lack of exercise and loss of muscle strength can lead to an increase in the loss of bone density (Nguyen *et al* 1993), which, when combined with postural instability, can result in a higher risk of osteoporotic fractures. This frailty need not be a characteristic of old age provided appropriate exercise programmes can be developed (Fiatarone *et al* 1994).

3.1.7 Alcoholics have lower bone density and an increased risk of hip fractures. However, moderate consumption of alcohol does not appear to affect bone density. Although there is an increased hip fracture risk, this may be due to a predisposition to falling! (Rico 1990, Lalor *et al* 1986, Cooper *et al* 1988, Hutchinson *et al* 1979, Stevenson *et al* 1989, Hall *et al* 1990, Hansen *et al* 1991, Angus *et al* 1988, Paganini-Hill *et al* 1981, Paganini-Hill *et al* 1991, Holbrook *et al* 1988, Felson *et al* 1988). It is not clear what effect the Government's recent redefinition of "safe" alcohol consumption levels will have on total alcohol consumption or future bone density levels.

3.1.8 Smoking has been shown to accelerate the rate of post menopausal bone loss (Krall & Dawson-Hughes 1991) and smoking is associated with a greater risk of hip fracture in

both men and women, the risk increasing with higher consumption (Paganini-Hill *et al* 1981, Paganini-Hill *et al* 1991, Williams *et al* 1982, Kreiger & Hilditch 1986, Lau *et al* 1988, Cooper & Wickham 1990, Wickham *et al* 1989, Kiel *et al* 1990). The relative risk of vertebral fractures is higher in smokers than the risk of hip fracture (Cooper & Wickham 1990). Lower bone density in smokers is partly related to a lower body weight and body mass (Law 1990) with thin people having less dense bones on average. Relative risks of hip fractures in smokers are lowered when adjusted for a lighter body weight but still remain raised compared to non smokers. Smoking will to a certain extent counteract the protective effect of post menopausal oestrogen use, especially if the woman also has a low body mass. The prevalence of smoking is decreasing over time although almost the same proportion of women smoke in each age group as men nowadays (OPCS 1995a). In the 11-15 year old group more Scottish girls are classed as regular smokers than boys (OPCS 1995b).

3.1.9 The effects of diet and dietary supplements are complex, and some study results have been contradictory. There is an association between peak bone density and dietary calcium intake in childhood (Angus & Eisman 1988, Cumming 1990). Women with a history of anorexia nervosa are at particular risk of osteoporosis, partly due to low body mass. Randomised trials in post menopausal and elderly women of the effect of pharmaceutical calcium preparations have shown a reduction in the rate of bone loss in the femur and forearm, although the effect on the spine is less certain (Dawson-Hughes *et al* 1990, Riis *et al* 1987). The effects are less than those produced with oestrogen replacement and less pronounced in women with a higher dietary calcium content. Reducing sodium, protein and caffeine intakes may all have a positive effect on calcium balance and reduce any need for calcium supplementation. Reducing sodium intake will also have a beneficial effect on high blood pressure (Shortt & Flynn 1990, Kersletter & Allen 1990, Kiel *et al* 1990, Cappuccio & MacGregor 1991). Vitamin D supplementation has also been shown to increase femoral neck bone mineral density in elderly women, although a degree of natural supplementation could be achieved by increased exposure to sunshine (Ooms *et al* 1995, Scragg & Murphy 1991). This issue is of particular relevance to Scotland, and even more so in the north. Poor diet resulting in malnutrition can contribute to osteoporotic fractures by an effect on bone density; by an increased propensity to fall; and by reducing subcutaneous fat which cushions the impact of a fall (Vellas *et al* 1990).

Summary

- *Exercise is encouraged at all ages, with particular emphasis on children and young adults and the elderly.*

- *Alcohol in moderation does not seem to affect bone density but consumption can affect stability and increase the risk of falling.*

- *Smoking is deleterious to bone even allowing for a lower average body mass; and when combined with lower weight will tend to counteract any protective effects of oestrogen use.*

- *Attention to diet and dietary balance at all ages, but especially for the elderly, will reduce the need for supplementation.*

- *These principles apply to both men and women.*

3.2 Secondary Prevention

3.2.1 Prevention of bone loss at the menopause

3.2.1.1 Oestrogen deficiency is the dominating pathogenic factor for osteoporosis in women. It has been known for more than half a century that loss of ovarian function in women is a significant factor in the development of osteoporosis and age-related fractures (Albright 1941). At the cellular level, declining oestrogen levels are associated with an increase in bone turnover in which bone resorption predominates and is not balanced by new bone formation, leading to decreased bone mass and susceptibility to fracture. At the time of the menopause, or earlier if there is oestrogen deficiency for any reason, there is a marked acceleration in the rate of bone loss. The rate of bone loss in the first ten years post-menopausally varies widely from one woman to another, ranging from 1% to more than 5% per year. It is well established that oestrogen is of proven value in arresting progressive bone loss in post menopausal women and reducing the number of osteoporotic fractures (Lindsay 1976).

3.2.1.2 Oestrogen therapy post-menopausally mimics the protective effect of oestrogens produced by the ovaries before the onset of the menopause. Oestrogen increases bone mass by a primary anti-resorptive effect with a direct effect on bone cells but also affects parathyroid function and regulates calcium absorption by its intestinal receptors (Eastell 1991). This effect of oestrogen on bone is dose dependent and if sufficient serum concentrations of oestrogen are not obtained then bone loss will not be arrested completely (Christiansen 1982). The minimum effective dose for prevention of bone loss is 0.625 mg conjugated equine oestrogen or 2 mg oestradiol orally daily.

3.2.1.3 Hormone replacement therapy (HRT) is an important element in the prevention of osteoporosis in women in the form of oestrogen alone or combined regimes of oestrogen and progestogen to give endometrial protection. Substantial data have now accumulated that use of HRT will prevent the rapid loss of bone which occurs at the time of the menopause and, more importantly, is associated with a reduction in fracture risk in the hip, spine and radius (Ettinger 1985). When started soon after the menopause, HRT decreases the incidence of subsequent osteoporosis related fracture by around 30-60 % when used for at least 5 years (Grady 1992). The greatest benefit of HRT is obtained if it is instituted shortly after menopause although there is clear evidence that HRT prevents bone loss at all stages of post-menopausal life (Christiansen 1990).

3.2.1.4 Use of HRT is not without practical difficulties - many women fail to comply with HRT schedules. Fear of cancer, particularly of the breast, causes many healthy women to reject taking HRT. Side effects and return of menstrual bleeding cause many women to stop taking HRT after only a brief period. Good counselling before commencing HRT will improve compliance. Many women need to try a variety of preparations before they find one which suits them. Use of the newer 'no-bleed' preparations often improves compliance in older postmenopausal women. Some epidemiological data suggests that use of HRT in excess of 5 years is associated with an increased risk of breast cancer (McPherson 1995) although this is still a much debated issue. Recent publications have also suggested use of HRT increases venous thrombo-embolism. The HRT risk/benefit analysis for any individual woman is therefore complex and outwith the scope of this report.

3.2.1.5 Combined oestrogen and progestogen HRT regimes appear to have similar effects on bone mass as unopposed oestrogen regimes (Munk-Jensen 1988). Recent evidence also suggests that progestogen only regimes also independently conserve bone density and may be useful in women who have contra-indications to or cannot tolerate oestrogens (Gallagher 1991). There is some evidence that HRT preparations containing continuous oestrogen and progestogens regimes particularly improve bone density (McNeely 1991).

3.2.1.6 Withdrawal of oestrogen treatment appears to result in bone loss at a rate that is similar to that in the immediate postmenopausal period so it is likely that the effect of oestrogen is essentially to 'buy time' (Stevenson 1992).

3.2.1.7 Oestrogens may also reduce risk of fracture by increasing mobility and dexterity and improving mental function, thereby reducing risk of falling in older women (Tang et al 1996).

3.2.1.8 Prescribing rates for HRT in the UK are generally low - 10% of women in their 50s in England and Wales take HRT in comparison with 30% of comparable women in North America (Leather 1993). Prescribing rates for HRT in Scotland are even lower but are steadily increasing as shown by the data in Tables 3.1 and 3.2 (Appendix 1). A possible reason for low compliance amongst women is the double prescription charge that combined preparations of HRT currently attracts.

3.2.1.9 Although it is appropriate that women receive information and advice about menopausal symptoms and HRT in the primary care setting, specialist menopause clinics can offer expertise in the management of complex cases.

3.2.1.10 In conclusion, postmenopausal women are by far the largest risk group for osteoporosis. There is widespread consensus that oestrogen is currently the only

well established prophylactic agent that reduces the frequency of osteoporotic fractures in women.

Summary

- *Postmenopausal women are the largest risk group for osteoporosis.*
- *Oestrogen is of proven value in the prevention of osteoporotic fractures.*
- *Women who have had a premature menopause (surgical or natural) should always be advised to take HRT for future prevention of osteoporosis and cardiovascular disease.*
- *HRT can cause side effects and many women tolerate the return of menstrual bleeding poorly - new 'no period HRT' is likely to improve compliance.*
- *There is a role for specialist menopause clinics to offer expertise on the management of complex menopause and HRT problems.*

3.2.2 Population screening

3.2.2.1 Bone densitometry is a diagnostic tool by which BMD can be measured, and osteopaenia and osteoporosis differentiated from normal bone mass. It has been demonstrated that BMD measurement will identify a group, with BMD values lying in the lowest quartile, with up to an eight-fold increase in risk of sustaining a femoral fracture (Cummings *et al*, 1993). Current evidence, however, does not support the use of BMD measurement around the menopause as a mass screening tool. Low BMD in itself is a necessary, but not sufficient, indicator of fracture risk. A meta-analysis of all prospective cohort studies between 1985 to 1994 which included a baseline measurement of bone density in women and subsequent follow up of fractures, concluded that measurement of BMD around the menopause can predict future fracture risk, but cannot identify those individuals who will sustain a fracture (Marshall *et al* 1996). The Advisory Group Report on Osteoporosis recommendation that there is no evidence to support the case for population screening has been reiterated in recent advice from the NHS Executive.

Summary

- *Population screening for osteoporosis is not currently recommended.*

3.2.3 Clinical Indications for BMD measurement

3.2.3.1 The Report of the Advisory Group on Osteoporosis (DoH 1994) recommended that Health Authorities and GP Fundholders in England & Wales should purchase services for osteoporosis patients which include the availability of bone densitometry for specified clinical indications based on agreed criteria. These criteria include:

- assessing the management of patients with established osteoporosis who are being treated with oestrogen and the more potent skeletally active agents (such as bisphosphonates)
- case finding among asymptomatic individuals with a variety of conditions predisposing them to osteoporosis
- assessing osteopaenia in patients with vertebral deformities or other fractures following moderate or minimal trauma
- helping women, on an individual basis, decide, after counselling, whether to take preventive therapy

This recommendation has been supported by the NHS Executive in England and Wales.

3.2.3.2 However, the acceptance of bone density measurement is not universal, as was demonstrated in the recent 'Controversies in Management' article in the BMJ where Sheldon and colleagues (1996) argued that the screening of high risk groups is not justified by available evidence. The senior academics in the field of osteoporosis research involved in the Barlow Report go on to answer these concerns (Barlow *et al* 1996) by arguing that bone densitometry remains the only validated and practically useful marker of future fracture risk. They also acknowledge that the technology should be set against other competing priorities and that service development should be considered at local level. A certain contradiction is also apparent in the push for BMD screening - HRT is advocated in ‘healthy’ women as a means of maintaining BMD and hence it is unclear how much screening of those at risk would actually change recommended patient management. However, it has been shown that HRT compliance is increased by BMD assessment (Ryan et al 1992, Torgerson et al 1995).

In the absence of guidance from the ME in Scotland, it remains the responsibility of individual Health Boards to make decisions about the availability of bone densitometry in clinical decision making. It is recommended that Boards review their current service provision for osteoporosis and consider critically the role of bone densitometry.

Summary

- *The value of bone densitometry in clinical decision making is the subject of an ongoing debate.*

3.3 Tertiary prevention

3.3.1 Pharmacological treatment

3.3.1.1 Trial evidence for the efficacy of drugs in treating osteoporosis is complicated by a number of factors. The main aim of treatment is to reduce fracture incidence and this should therefore be the primary endpoint. However, the slow progress of the disease and the low incidence of fractures means large, prolonged trials would be necessary. Bone mineral density (BMD) is often therefore used as an endpoint. A further problem is that the osteoporotic process varies with age after the menopause, with different fracture sites being more common at different ages. The use of different fractures as endpoints, and different ages of women in studies, makes generalisation difficult. In particular, vertebral fractures are most often used (as these occur at a younger age). However, they represent a relatively small component of the clinical burden of osteoporotic fractures. Other factors such as risk status of women entered into studies confounds interpretation. Doses of drugs used in trials vary and are often used in combination, thus further complicating matters.

3.3.1.2 The use of calcium and vitamin D (and oestrogen therapies) has already been considered above as 'replacement therapy'. In summary, calcium supplementation may be of some benefit in terms of bone mass in older women with inadequate dietary intake (Dawson-Hughes *et al* 1990, Reid *et al* 1993, Riis *et al* 1987, Elders *et al* 1991). An extension of one of these studies (Reid *et al* 1995) also suggests benefit in terms of reduced fracture rates. However, this was not a primary endpoint in the study and the numbers were small. RCTs involving cholecalciferol and ergocalciferol (the former with concomitant use of calcium) suggest they can reduce fracture risk in elderly women living in residential care (Reid *et al* 1995, Chapuy *et a*l 1992, Chapuy *et al* 1994).

3.3.1.3 Bisphosphonates inhibit bone resorption (and to a variable extent bone mineralisation). Two are presently licensed in the UK for the treatment of osteoporosis. Etidronate is licensed for indefinite treatment of vertebral disease and is given for 14 days in every 90, with calcium supplements in the intervening period. Alendronate has a licence which is not restricted vertebral disease and is also for an unspecified duration. The possible inhibitory effects of biphosphonates on bone mineralisation have been a cause for some concern, hence the reason for cyclical administration of etidronate. At therapeutic doses the present evidence suggests alendronate does not inhibit mineralisation. There have been reports of significant oesophageal side effects associated with alendronate which have warranted comment in the CSM Pharmacovigilance Reports and the BNF.

3.3.1.4 There are a number of trials (Heikinheimo *et al* 1992, Storm *et al* 1990, Watts *et al* 1990, Harris *et al* 1993, Libermann *et al* 1995) demonstrating that both etidronate and alendronate can increase BMD, some of which (Heikinheimo *et al* 1992, Storm *et al* 1990, Harris *et al* 1993) also demonstrate a reduction in vertebral fractures. All the studies are of relatively short duration (2-3 years) and all involve calcium supplementation. Outcome in terms of other fractures is unknown.

3.3.1.5 The Fracture Intervention Trial (Black *et al* 1993) is attempting to determine the effect of alendronate on fracture rates in over 6000 women. The trial consistes of two arms. The first ("treatment" arm) involved 2027 women with existing vertebral fracture (on radiography) and low bone mass (determined by BMD) and the results have now been reported (Black *et al* 1996). There was a significant reduction in both the relative risk of new radiographic vertebral fractures (the primary end point) and in clinical vertebral fractures (a secondary end point) in women taking alendronate for 2.9 years than in those receiving placebo. There were also significant reductions in hip and wrist fractures in women taking alendronate although because of the smaller number of events the confidence intervals are wider. There was no reduction in the cumulative incidence of other fractures.

3.3.1.6 While these results clearly demonstrate a beneficial effect on bone mass and fracture rates a number of questions remain. Analysis of the results by the number of women

needed to treat to prevent one woman sustaining a new fracture (NNT) gives the following results:

Fracture Type	NNT for 2.9 years
Radiographic vertebral	14.13
Any clinical	21.70
Any clinical non vertebral	35.85
Wrist	51.89
Clinical vertebral	36.70
Hip	89.86

3.3.1.7 Thus, in this selected "at risk" group a considerable number of women have to be treated for 2.9 years to benefit one woman. The effect of stopping treatment after 2.9 years is unknown, and while continued treatment may increase the benefits it will also increase the cost.

3.3.1.8 Identifying the 2704 potential entrants to this study (women with radiographic verebral fracture and low BMD) involved BMD measurement in more than 26,000 women and radiography in over 13,000. The issue of efficiently identifying women most likely to benefit from therapy therefore remains crucial to the cost effectiveness of biphosphonate therapy.

3.3.1.9 The second, the "prevention" arm of the trial, has enrolled women with low BMD after screening but with no evidence of vertebral fracture. Treatment with alendronate or placebo is planned to last 4.2 years and the study outcome has yet to be reported.

3.3.1.10 In conclusion, the biphosphonates appear effective at reducing fracture risk in selected women. However, the cost effectiveness of therapy is critically dependent on identifying women at most risk of fracture and the means of doing this remains problematic.

3.3.1.11 Several studies have shown that calcitonin, in conjunction with calcium supplementation, can increase vertebral bone mass (Overgaard *et al* 1992, MacIntyre *et al* 1988) and retard trabecular bone loss after the menopause (Overgaard *et al* 1992, MacIntyre *et al* 1988, Overgaard *et al* 1989, Reginster *et al* 1987). Intranasal salcatonin has been shown to reduce the rate of new fractures in one study of patients with established osteoporosis (Overgaard *et al* 1992).

3.3.1.12 Salcatonin is licensed for short term use in postmenopausal osteoporosis. It is presently only available in the UK as an injection, which combined with its cost, precludes its use for prophylaxis in asymptomatic individuals. It has an analgesic effect and is therefore useful in selected patients with vertebral fractures. It is recommended that a calcium supplementation be given with salcatonin.

Summary

- *Correction of calcium and vitamin D deficiency in the elderly reduces fracture risk.*
- *Etidronate and alendronate have been shown to reduce vertebral fracture risk and evidence of risk reduction for certain non-vertebral sites is now available for etidronate. Criteria for selection of women for treatment remains a crucial and problematic determinant of their value as preventive therapy.*
- *Calcitonin and salcatonin are of benefit as therapeutic agents in a few selected patients.*

3.3.2 Fall Prevention

3.3.2.1 Approximately one third of the population ≥65, and rising to over 50% of those women aged over 85, and an even greater proportion of those living in institutional settings, will fall at least once a year (Department of Trade and Industry 1993). Given the growing proportion of the elderly who reside in institutional settings, a crucial clinical issue is the assessment of risk factors and prevention of such falls (Morley and Silver 1995). The most

common serious injuries which result from such falls are fractures (Hindmarsh & Estes 1989). Specific targets were set for a reduction in the death rate from falls amongst the elderly in the Health of the Nation key area of accidents (Health of the Nation 1992). In Scotland's Framework for Action, a target to "cut the rate of accidents at home, at work and on the roads" was established (The NHS in Scotland 1991).

3.3.2.2 A number of risk factors have frequently been cited as potential risk factors associated with falls, and the fractures which result from them, in the elderly (Effective Health Care 1996).

1 Nutritional status
Vitamin D and calcium deficiency (see 3.3.1.2).

2 Environmental hazards
Between one-third and a half of all falls among older people in the community are due to environmental hazards, including loose carpets, poor lighting and so on.

3 Medication
Certain categories of prescribed drugs (see 3.3.2.3 to 3.3.2.5) have been associated with an increased risk of falling.

4 Lack of exercise
Insufficient exercise is associated with weak muscles, poor balance, poor gait and accelerated bone loss.

5 Ageing changes and medical condition
Deteriorating vision and cognitive impairment have also been forwarded as possible risk factors, although the extent to which these factors are independent is unclear.

3.3.2.3 The charity "Research into Ageing" has recently produced a checklist for the elderly on fall prevention (reproduced in Appendix 3). The advice contained in this list should be made available to the elderly in an attempt to reduce falls.

3.3.2.4 Many drugs cause side effects which may increase the risk of falls. Separating such effects from the effects of the diseases for which they are prescribed is difficult. However, given the large proportion of the elderly who take drugs, and the influence of ageing on pharmacokinetics the elderly are clearly at increased risk of side effects. Drugs commonly cited as potentially contributing to falls include: anti-depressants, benzodiazepines and other hypnotics, sedative analgesics, tranquillisers, diuretics and laxatives.

3.3.2.5 A number of studies have suggested, or demonstrated, an association between drug consumption and falling, or fractures secondary to falls (Campbell *et al* 1981, Tinker 1979, Wild *et al* 1980, Campbell *et al* 1989, Blake *et al* 1988, Goodwin & Regan 1982, Hole *et al* 1984, Muckle 1976, Whitlock *et al* 1978, Prudham & Evans 1981). A multifactorial intervention trial in the USA which included review of medication demonstrated a reduction in falls in the intervention group (Tinetti *et al* 1994).

3.3.2.6 This issue is particularly pertinent given the recent survey of neuroleptic prescribing in Glasgow nursing homes which found potentially inappropriate and large doses of neuroleptics being used in these individuals (McGrath & Jackson 1996). Awareness amongst prescribers regarding the cognitive impairment induced by such drugs should be raised, whilst also encouraging them to consider the effect prescribing is likely to have on the incidence of falls.

3.3.2.7 A randomised controlled trial (RCT) of external hip protector pads in people aged 70 and over living in residential care found that the risk of hip fracture in those who received protective hip pads was more than halved. (Age adjusted relative risk = 0.4, 95% CI - 0.18 to 0.82) (Lauritzen *et al* 1993). Hip pads are therefore a highly promising intervention in those at particularly high risk of fracture. The acceptability of such pads in the community is however less certain and the results of an RCT underway in such a setting are eagerly awaited (Wallace *et al* 1993).

Summary

- *Whilst there is limited evidence for any single intervention to reduce the incidence of falls amongst those with low bone density, the following programmes are recommended in light of the recent Effective Health Care Bulletin (Effective Health Care 1996).*

- *Balancing (e.g. Tai Chi), low impact aerobics or muscle strengthening exercise tuition should be made available to older people.*

- *Home visiting to identify and remedy environmental and personal risks for falling, with subsequent interventions including the removal of loose rugs, improved lighting and the installation of non-skid bath mats.*

- *The introduction of hip pads amongst those in residential settings is recommended.*

- *The implementation of any such programmes should be carefully monitored and evaluated.*

4 CURRENT SERVICES IN SCOTLAND

4.1 In order to gather information about current services for osteoporosis in Scotland the Working Group sent out a questionnaire to Directors of Public Health (DsPH) in all 15 Health Boards. The response rate was 100%. Health Promotion Departments in each Board were also contacted directly by the group to ask about initiatives relating to osteoporosis and once again a 100% response rate was achieved. Details of the replies received are given in the following tables. The results indicate that there is wide variation between Boards in both service provision and the attention that osteoporosis has attracted thus far.

4.2 Health Boards were asked if there had been any public health initiatives specifically addressing the prevention of osteoporosis. Argyll and Clyde conducted a local review in 1991 whilst Greater Glasgow had a "Health Gain Commissioning Team" looking at all issues surrounding osteoporosis. In Forth Valley, Dr Rod Muir is leading a SNAP group on hip fracture, whilst Tayside are examining the possibility of a limited bone densitometry service.

4.3 Only four Health Boards have considered in detail the recommendations of the Barlow report: Ayrshire and Arran; Greater Glasgow; Lothian; and Shetland.

4.4 There were few reported initiatives in primary care, with only two Boards (Greater Glasgow and Highland) identifying specific initiatives. Three Health Boards (Fife, Grampian and Orkney) have local guidelines for GPs to assist in the management of osteoporosis. Greater Glasgow is at the development stage. By contrast, there were a number of osteoporosis related health promotion activities identified, as shown in Table 4.1, although several Boards commented that this was part of general lifestyle advice and not specifically targeted at osteoporosis.

Table 4.1
Health Promotion initiatives specifically addressing prevention of osteoporosis

Argyll & Clyde	• Diet and Exercise, specifically addressing osteoporosis with Lifestyle Survey
Ayrshire & Arran	• Part of the promotion of exercise has included osteoporosis prevention. There is also a "Look After Yourself!" module which includes osteoporosis. • Attendance at Scottish Exercise and Health Promotion Group symposium on physical activity & osteoporosis in 1993 • Development of short lived Osteoporosis working Group • Membership of N.O.S • Weightwise training programme for primary care staff incorporating lifestyle issues & HRT • Advice on general lifestyle changes
Borders	• No specific initiatives
Dumfries & Galloway	• Included in general work with community groups • Use of N.O.S resources
Fife	• No specific initiatives
Forth Valley	• No specific initiatives • Targeted physical activity programmes
Grampian	• Addressed mainly as part of wider lifestyle programme • Events planned for National Osteoporosis Week to raise awareness about osteoporosis and its prevention
Greater Glasgow	• Community Pharmacy training sessions on osteoporosis • Look After Yourself Programme including osteoporosis • Mini-mags on menopause and sport • Exercise referral schemes
Highland	• Part of lifestyle advice
Lanarkshire	• Included in wider programmes of lifestyle advice • Use of N.O.S resources • Seminar held in 1993 'Physical activity and osteoporosis prevention and care with the Scottish Exercise & Health Promotion Group
Lothian	• As part of a series of booklets on the menopause, 3 booklets produced in 1993 on HRT, diet & exercise, which included information on osteoporosis. Booklets aimed at peri-menopausal women, but encouragement included to pass on messages to younger women to reduce risk of osteoporosis. • HRT booklet currently being updated
Orkney	• Osteoporosis pack produced
Shetland	• Exercise referral programme
Tayside	• General nutritional advice with regard to Vitamin D and Calcium intake • Secondary benefits of HRT
Western Isles	• Within general information for women

4.5 DsPH were asked to indicate if a dedicated osteoporosis service was available in their area. Results from this question are presented in Table 4.2.

Table 4.2
Details of Health Boards who purchase a dedicated osteoporosis service

	Lead clinician	Position	Specialty	Service base	Access
Grampian	Dr D Reid	Consultant Physician	Rheumatology	Aberdeen Royal Hospitals NHS Trust	GPs, Consultants via Dr Reid
Orkney	Dr D Reid	Consultant Physician	Rheumatology	Aberdeen Royal Hospitals NHS Trust	GPs
Dumfries & Galloway	Dr J McCrea	Consultant Rheumatologist	Rheumatology	Whitehaven West Cumbria	ECR basis

4.6 A number of Boards also purchase dedicated menopause services. These are identified in Table 4.3.

Table 4.3
Details of Health Boards who purchase a dedicated menopause clinic

	Number	Expertise in management of post-menopausal osteoporosis?	Direct clinic access to bone density scanning?
Argyll & Clyde	1	N/A	N/A
Dumfries & Galloway	1	No	No
Grampian	1	No	No
Greater Glasgow	5+	Yes	Yes
Lothian	1	Yes	Yes
Tayside	1	No	No

4.7 Table 4.4 provides details of Boards with a bone densitometry machine. In addition, two Boards, Ayrshire and Arran and Orkney, purchase densitometry for their residents from other Health Board areas. Table 4.5 gives estimates of the numbers of scans purchased annually by each Health Board. Additionally, heel scanning services have been set up in Forth Valley and Borders Health Boards using soft funding.

Table 4.5
Number of bone scans by Health Board 1995/6

Argyll & Clyde	Not available
Ayrshire & Arran	Patients requiring bone scanning are referred to Glasgow (numbers not known)
Fife	Not reported
Forth Valley	Unknown - presumed very small
Grampian	~870 patients (NHS)
Greater Glasgow	WIG 1153 GRI & Stobhill Unknown SGH not operational in 95/6
Highland	N/A at present; probably 150-200
Lanarkshire	Not reported
Lothian	Increasing demand - ~700 (1994)
Orkney	Unknown
Shetland	4 scans
Tayside	Unofficial figures - 120 in 1995 (rise from 25 in 1990)
Western Isles	Not reported

4.8 The survey also asked about current research projects being undertaken into aspects of osteoporosis. These are listed in Table 4.6

Table 4.6
Current research projects relating to osteoporosis

Grampian	Acceptability of BMD measurement and Research on accuracy of measurement (Rheumatology) Urinary markers of bone metabolism - Rowatt Research Institute - Nutrition The place of quantitative ultrasound in the assessment of osteoporosis The cost-effectiveness of bone density assessment Genetic factors in the predisposition to osteoporosis The effects of corticosteroids on osteoporosis risk Multi-centre placebo controlled trials examining the benefit of risendronate, raloxifene and idoxifene in the prevention and treatment of postmenopausal and corticosteroid induced osteoporosis The role of second generation imaging bone densitometry in the assessment of osteoporotic fractures
Greater Glasgow	Genetic determinants of osteoporosis in the West of Scotland - the role of Vitamin D polymorphisms A multi-centre randomised, placebo controlled, double blind, parallel group study to determine the efficacy and safety of ruedronate in the treatment of osteoporosis in elderly women Normal bone density in 50 to 70 year old women in one Glasgow general practice Collagen cross link in a population of normal women aged 50 to 70 years Assessment of the optimum form of sample collection for urinary collagen cross link excretion 10 year study of the effects of combined continuous HRT on lumbar spine density Megestrol acetate 40-80mg daily with/without Tamoxifen in patients with a personal history of breast cancer, thrombo-embolism and sever endometriosis Effects of a vaginal oestradiol releasing sylastic ring pessary on bone density measured by biochemical indices and bone densitometry

4.9 Finally, Regional Advisers in General Practice in Departments of Postgraduate Medical Education were contacted regarding PGEA accredited meetings on or related to osteoporosis. Results are provided in Table 4.7.

Table 4.7
PGEA accredited meetings on osteoporosis

West of Scotland	7 (over the last 2 years)
Dundee	6 (since September 1995)
Edinburgh	9 (since March 1994)
Inverness	no recollection
Aberdeen	1 (over the last 2 years)

4.10 As shown in Section 3, there is a large body of evidence about different aspects of prevention, detection and treatment of osteoporosis. This section has shown, however, that the provision of services across Scotland is subject to wide variation. In order to assist Health Boards in planning appropriate services, the next section looks at the resource implications of different options in the prevention, detection and treatment of osteoporosis.

Summary

- *There is wide variation between Health Board areas in both service provision and the attention that osteoporosis has attracted thus far.*
- *Four Health Boards are involved in public health initiatives regarding osteoporosis.*
- *Only four Health Boards have considered in detail the recommendations of the Barlow Report.*
- *There are few reported activities in primary care, with only two Health Boards identifying specific initiatives.*
- *Three Health Boards have local guidelines for GPs to assist in the management of osteoporosis.*
- *A number of health promotion activities in osteoporosis were identified.*
- *Six Health Boards purchase dedicated menopause services.*
- *Bone densitometry facilities are available in six Health Boards.*
- *Limited information was available on the number of bone scans carried out in each area.*

5 COSTED OPTIONS FOR PREVENTION, DETECTION AND MANAGEMENT

5.1 In light of the evidence presented, a number of possible options have been considered. Where feasible the relevant costs and benefits have been identified and measured to assist in decision-making in this area. Fourteen options have been explored in total, covering primary, secondary and tertiary prevention. It is recognised, however, that these options are not mutually exclusive. Where spreadsheet models have been utilised, these are available on request to allow changes to be made in various assumptions to reflect local information.

Table 5.1 Summary of options considered

Option	Option Description
Primary Prevention	
1	Promote exercise at all ages
2	Reduce alcohol consumption to moderate levels
3	Reduce alcohol levels in the elderly where this affects stability
4	Reduce cigarette consumption
5	Promote a balanced diet
Secondary Prevention	
6	Consider calcium & vitamin D_3 supplementation for elderly females in residential care.
7	Always advise women who have had a premature menopause to take HRT
8	HRT in all women for 5-10 years at the menopause
9	Bone densitometry for all women at the menopause
10	Bone densitometry for women at high risk of osteoporosis at the menopause
Tertiary Prevention	
11	Avoid administering drugs which increase the risk of falls in the elderly
12	Fall prevention and trauma minimisation in the home
13	Bisphosphonates
14	Follow up of post-menopausal women with Colles' fractures.

5.2 Primary prevention

1. Promote exercise at all ages, especially weight-bearing and those activities designed to promote stability and co-ordination in later life.

5.2.1 Exercise is a key feature of health promotion activity and a number of Boards already include this as a key component of osteoporosis prevention (see Table 4.1, page 18). Two programmes are available to train staff who work with groups at particular risk of osteoporosis, e.g. post-menopausal women.

5.2.2 The first of these programmes is known as 'EXTEND' which targets staff who work in residential care settings and provides training in exercise and mobility for people with restricted mobility. For a 12 day course, this programme costs approximately £350 per person.

5.2.3 The 'Look After Yourself' training programme enables individuals to teach holistic health and fitness classes and includes a specific module which relates to osteoporosis. The cost of the RSA accredited course for 20 participants is £10,000.

2. Reduce alcohol consumption to moderate levels in all age groups.
3. Reduce alcohol consumption in the elderly where this affects stability.
4. Reduce cigarette consumption.
5. Promote a balanced diet with higher consumption of calcium and vitamin D and lowered consumption of sodium, protein and caffeine.

5.2.4 Options 2-5 need not incur additional costs to the NHS since the reduction of alcohol and cigarette consumption and the advocacy of dietary balance are key functions of health promotion. The only change involved would be the explicit inclusion of the avoidance of osteoporosis as a potential benefit.

5.3 Secondary Prevention

6. Consider calcium and vitamin D supplements for elderly females in residential care whose diet is sub-optimal and cannot easily be changed.

5.3.1 This option was based on the study by Chapuy *et al* (1992,1994) which demonstrated a significant reduction in hip fractures after supplementation with calcium and vitamin D_3. The hip fracture rate in nursing/residential homes is estimated to be double that in the general elderly population - this would imply a rate of 3.48% per year (Torgerson & Kanis). Chapuy *et al's* study indicates that a 22% reduction in hip fractures can be achieved, based on 72% compliance.

5.3.2 The Chapuy *et al* study concerned females living in residential care. To estimate the size of this population in Scotland, a survey from 1993 in the Strathclyde Region (de Ville *et al* 1993) was extrapolated to the rest of Scotland to obtain an assessment of the size of the target group.

5.3.3 The annual financial cost of this option for Scotland would be £488,304. The annual financial implications for each Health Board are shown in Appendix 4, Table 5.2.1. The total discounted cost for Scotland for 3 years supplementation in this population would be £1,383,558. The cost per hip fracture averted using this calcium and vitamin D_3 supplementation would be £9,689.

5.3.4 It should be noted that other likely benefits may occur from this treatment, such as reduced Colles' fractures and vertebral fractures. There is some evidence that hip fractures are fatal in 12-20% of cases (Cummings *et al* 1985). If this is the case, there would also be some element of life years saved from calcium and vitamin D_3 supplementation. There is however some debate as to whether individuals who are likely to die fracture their hips or if hip fractures lead to death (see section 2.4.2).

7. Women who have had a premature menopause (surgical or natural) should always be advised to take HRT for future prevention of osteoporosis.

5.3.5 Prevalence of surgical premature menopause was determined from the prevalence of women who have had either an oophorectomy or an oophorectomy with hysterectomy, in aged 20-50 by ten year age bands. This data was extrapolated from work carried out in Greater Glasgow Health Board (Hui Liao, personal communication). Table 5.2.2 (Appendix 4) details the prevalence estimates used. It was assumed that women who had a surgically induced menopause would receive HRT until such a time when natural menopause would have occurred, assumed here to be 50 years of age. Compliance was estimated to be 50% of target population. Costs were calculated for Premarin®, an unopposed oestrogen used in women without a uterus. Given the small size of the oophorectomy alone group who would receive opposed oestrogen, it was assumed that all of the target group would receive Premarin®. A 6% discount rate was used.

5.3.6 The total discounted cost of such a programme in the current population (maximum length of therapy being 25 years) is £3,427,312. If such a programme was initiated in Scotland, the annual financial implications would be in the region of £265,000.

5.3.7 The total discounted costs and annual financial implications for each Health Board are set out in Table 5.2.3 in Appendix 4.

5.3.8 No evidence on the benefits of HRT in this particular group are available at this time, although these are likely to be significantly higher than in the general population. Data are unavailable on the prevalence of naturally occurring premature menopauses and therefore the likely costs and benefits are impossible to calculate in this group, although once

more it is likely that these individuals would benefit much more than a general population sample receiving HRT.

8. HRT to all women for 5-10 years at the menopause

5.3.9 Using the same assumptions as Option 7, the cost of providing HRT for all women for 5-10 years was calculated. All women currently between 50 and 54 were assumed to be included in treatment, thereafter, all 'new' 50 year olds. An assumption of 95% suitability was used with compliance either 50 or 100%.

5.3.10 Benefits were calculated in terms of hip fractures averted. The incidence of hip fracture was taken as constant across Scotland, using the Scottish average for 10 year age bands. Reduction in fracture incidence in the period of therapy was assumed to be 30 or 60% (see section 3.2.1.3). For the period after therapy had ceased, a 15% reduction in hip fractures incidence was assumed each year until aged 79.2 (average Scottish female life expectancy at age 50). A figure of 15% was used arbitrarily as half the lowest possible benefit whilst taking HRT. Considerable controversy does however persist on the waning effect of oestrogen post HRT. A 6% discount rate was used to discount the costs of HRT, the hip fractures averted and the value of resources saved by averting hip fractures. Identification and monitoring costs were not included as it was assumed that the initial administration and monitoring of HRT would be included in normal contact with general practitioners.

5.3.11 Annual financial costs for Scotland ranged from £4,186,334 (Prempak-C® for 5 years with 50% compliance) to £39,376,862 (Estracombi® for 10 years with 100% compliance). Annual financial costs reflect the undiscounted cost of HRT after the initial cohort of 50-54 year olds have been treated. Annual costs for each Health Board are provided in Table 5.2.4, Appendix 4. These costs exclude the opportunity cost to GPs.

5.3.12 Cost per hip fracture averted ranged from £37,725 (Prempak-C® for 5 years with 50% compliance and a 60% reduction in fractures during period of therapy) to £605,698 (Estracombi® for 10 years with 50% compliance and a 30% reduction in fractures during period of therapy).

9. All women should receive bone densitometry at the menopause, and HRT targeted at those in the lowest quartile.

5.3.13 This option would involve assuming women reached menopause at the average age (52 years) and inviting them to attend for a DEXA. Following DEXA, HRT for 10 years would then be targeted at those with bone mineral density in the lowest quartile.

5.3.14 On the basis of the assumptions detailed in Appendix 4, various costs were calculated. The annual cost of DEXAs in Scotland would be £501,393 with administration costs of £79,205. Ten year total costs including HRT were also calculated for the Year 1 cohort, for Scotland as a whole this ranged from £2,144,382 (Prempak C®) to £4,881,484 (Estracombi®). The annual costs for each Health Board and the ten year costs for the cohort for each Health Board are set out in Table 5.2.4, Appendix 4.

5.3.15 The benefits in terms of changes in the number of fractures or bone density are not available for this particular strategy. Moreover, this costing assumes that DEXA is a 'one-off' when in fact follow-up DEXAs are likely to occur.

10. Women at high risk of osteoporosis should receive bone densitometry at the menopause and target HRT at those with low bone density.

5.3.16 The risk factors outlined in sections 1.5 and 1.6 are widely acknowledged as placing individuals at risk of osteoporosis, although there is still some doubt over particular determinants (Peel and Eastell 1995). It should further be noted that these risk factors encompass significant proportions of the current population.

5.3.17 Whilst these risk factors are known, there is inadequate information on the prevalence of these risk factors, and no information on the likely proportion of a population these risk factors will affect. Hence, before targeting DEXA at high risk groups, more information is required at a local level on the prevalence of risk factors before embarking on this option. Information should also be collected on the numbers who would be suitable for HRT after screening those at high risk. However, it should be noted that the specificity and sensitivity of these risk factors in identifying individuals at risk is relatively low and so a significant number of cases of osteoporosis would be missed (Peel and Eastell 1995).

5.4 Tertiary Prevention

11. Avoid administering drugs which increase the risk of falls in the elderly wherever possible

5.4.1 Drugs which have been indicated as increasing the incidence of falls in the elderly are listed in section 3.3.2.4. Awareness raising amongst prescribers on the impact of such medication on cognitive function and hence risk of falls should continue to be pressed by the Scottish CAPOs group and local Medical Prescribing Advisers. This approach would have little or no resource implications.

12. Prevent falls in the elderly and minimise trauma where falls occur.

5.4.2 Fall prevention cannot be addressed by the NHS alone and requires local authority action, e.g. to ensure adequate street lighting and even pavements. However, the NHS can contribute to fall risk assessment wherever there are frail elderly individuals. This should include acute hospitals and the group is aware of one such pilot study at the West Glasgow Hospitals University NHS Trust. All acute units should pilot methods to reduce the incidence of falls. In residential and nursing homes the assigned community based nurse should assess fracture risk for that institution. In the community fall risk assessment could be incorporated into the 75+ health check. Fall risk assessment should be followed up with appropriate preventive action, including simple measures such as the removal of rugs and so on. No published benefits are available on such a programme, but given the low resource implications and the likely benefit in such a high risk group, such a programme is to be advocated.

5.4.3 The evidence on the use of hip pads in residential care is encouraging and should be implemented. To date however, the group has been unable to determine if such

products are available in the UK and if so, who prescribes them to individuals and at what cost. This position requires urgent attention to allow the implementation of effective practice.

13. Management of existing osteoporosis using bisphosphonates

5.4.4 The management of existing osteoporosis using bisphosphonates was, until relatively recently, limited to the use of etidronate. The recent launch of alendronate has however offered a more potent bisphosphonate to clinicians treating osteoporosis. Whilst being more potent alendronate is however a more expensive drug.

5.4.5 Comparisons between the fracture trials of the two drugs are problematic due to different study populations, follow up times and outcome measures. For example, the etidronate trial involved a younger population with a mean age of 65.1 (Watts et al 1990) compared with 70.8 in the alendronate study (Black et al 1996). Femoral neck BMD was also higher in the etidronate trial. The trials also involved different end points: the etidronate trial used new vertebral fractures while the alendronate study used women with new fractures. Hence, for the purpose of this secondary analysis, it has been assumed that those individuals in the F.I.T. with "two or more fractures" had two fractures, to allow us to derive the actual number of vertebral fractures.

5.4.6 The trials of both drugs also involved the use of calcium supplements. Etidronate is supplied as Didronel PMO® which comes with 76 day calcium supplementation for every 14 days of etidronate therapy. Hence, calcium supplementation costs for 76 days have to be added to the cost of alendronate to allow equal comparison. Based on a daily dose of 10mg, the cost of 90 days alendronate (Fosamax®) is £82.58. Including 76 days of calcium supplementation, the cost of a comparable alendronate regimen is £88.66. The cost of etidronate (Didronel PMO®) for 90 days is £40.20.

5.4.7 The results of the etidronate trial showed 29.5 vertebral fractures in the active arm compared with 62.9 in the placebo group for 1000 patient treatment years. Taking this to be an imaginary cohort of 333 women being treated for three years, the total discounted cost (using 6%) would be £153,976. This would avert 33.4 fractures over three years, implying a cost per vertebral fracture averted of £4881.

5.4.8 The results of the alendronate trial can be manipulated using the assumption noted in 5.4.5 to show that 28 vertebral fractures occurred in the active arm compared with 62.7 on the placebo group for 1000 patient treatment years. Again, taking this to be an imaginary cohort of 333 women being treated for 3 years, the total discounted cost (using 6%) would be £373 592. This would avert 34.7 fractures over three years, implying a cost per vertebral fracture averted of £11 399.

5.4.9 At this stage, this analysis does not include any costs averted due to avoiding vertebral fractures which, despite, causing significant disability and distress, rarely result in an admission to hospital. Furthermore, improvements in vertebral fracture rates are likely to be followed by avoiding hip fractures, which do impose significant NHS costs and would therefore improve the cost-effectiveness of bisphosphonates.

5.4.10 While the prescribing of bisphosnates is much less in terms of value, as compared with HRT, the trend is steadily upwards (see figure 5.2.1, Appendix 4) and purchasers should pay close attention to this pressure while awaiting further results from F.I.T. on hip fractures.

14. Post-menopausal women who present with a Colles' fracture should be the subject of risk factor counselling including advice on HRT, diet, exercise and smoking

5.4.11 This option is unlikely to involve resource implications in itself and would probably only entail minor amendments to care, particularly in Accident and Emergency Departments. Given the widespread belief that a number of women with osteoporosis do present with a Colles' fracture at an early stage in the disease, it is unclear if this option would in the long term utilise extra resources, as need which was previously untreated was uncovered.

Summary

5.5 Table 5.2 overleaf summarises the results of this section, by identifying the strength of the evidence and the resource implications of the options evaluated.

6 MONITORING OF SERVICES FOR PREVENTION, DETECTION AND MANAGEMENT OF OSTEOPOROSIS

6.1 Prevalence and incidence of osteoporosis

Much of the information used in this report relating to the incidence and prevalence of osteoporosis has been extrapolated from work in other geographical areas, or by using educated guesses. To this end there is a requirement for information to be collected at Health Board and national level on a number of indicators.

6.2 Risk Factors

To inform the purchasing of appropriate services within individual Health Boards, it is important that information is available on the size of the population most 'at risk' from osteoporosis. Some of this information, such as smoking prevalence, is collected as part of the Health Promotion initiative in general practice and this information can be accessed fairly easily. Information relating to surgically induced menopause could be obtained from SMR1. For other risk factors derivation of this information may require local 'case finding' projects, whereby information is obtained directly from primary care records.

6.3 Preventive Therapy

More information is required on the use of HRT, in particular concerning which groups of women receive therapy and the length of time these individuals comply with treatment. This information is particularly relevant to women most at risk, i.e. pre-menopausal women with oophorectomy and early menopause. A good monitoring point for purchasers of gynaecology services is the proportion of women with oophorectomy who are not only counselled on HRT but who receive it until the age of 50 years.

6.4 Fracture Incidence

Information is required on the incidence of all fractures potentially related to osteoporosis. Although SMR1 covers hip fractures there is a need for data collection systems to ensure that all vertebral and Colles' fractures are recorded, such as that described at South Ayrshire Trust. Such information will provide a baseline against which to measure the success of prevention, detection and treatment policies.

Audit should take place of the management and follow up of post-menopausal women with minimal trauma Colles' fractures.

6.5 Research

The Advisory Group on Osteporosis Report (DoH 1994) set out a full agenda for research into aspects of osteoporosis. In particular, Health Boards and Trusts should encourage research which will provide effective and cost-effective interventions at primary, secondary and tertiary levels.

7 REFERENCES

Albright F, Smith P H, Richardson A M. Postmenopausal osteoporosis: its clinical features. ***Journal of the American Medical Association*** 1941;**116**:2465 - 2474.

Aloia J F, Cohn S H, Ostuni J A, *et al* Prevention of involutional bone loss by exercise ***Ann Internal Med*** 1978;**89**:356-8.

Angus R M, Eisman J A Osteoporosis: the role of calcium intake and supplementation ***Med J Aust*** 1988;**148**:630-3.

Angus R M, Sambrook P N, Pocock N A, Eisman J A Dietary intake and bone mineral density ***Bone Miner*** 1988;**4**:265-77.

Barlow D *et al.* Controversies in management: Department of Health is fair to patients with osteoporosis. ***Br Med J*** 1996; 312: 297-8.

Black D.M., Reiss, T.F., Nevitt, M.C. Design of the fracture intervention trial ***Osteoporosis International*** 1993;**3 suppl 3**:29-40.

Black D.M. *et al*. Randomised trial of effect of alendronate on risk of fracture in women with existing vertebral fractures. ***Lancet*** 1996;**348**:1535-1541.

Blake A. J. *et al*. Falls by elderly people at home: prevalence and associated factors. ***Age Ageing*** 1988;**17**:365-72.

Campbell A J *et al*. Falls in old age: a study of frequency and related clinical Factors. ***Age Ageing*** 1981; 10: 264-70.

Campbell, A.J., Barrie, M.J., Spears, G.F. Risk factors for falls in a community based prospective study of people 70 years and older. ***J Gerontol*** 1989;**44**:M112-117.

Cappuccio F P, MacGregor G A Preventing osteoporosis ***Br Med J*** 1991;**303**:921.

Chapuy MC *et al*. Vitamin D_3 and calcium to prevent hip fractures in elderly women. ***N Eng J Med*** 1992;327:1637-1642.

Chapuy MC *et al*. Effect of calcium and cholecalciferol treatment for 3 years on hip fractures in elderly women ***Br Med J*** 1994;**308**:1081-1082.

Chesnut, C.H., McClung, M.R., Ensrud, K.E. *et al*. Alendronate treatment of the postmenopausal osteoporotic women: effect of multiple dosages on bone mass and bone remodelling. ***Am J Med*** 1995;**99**:144-152.

Chow A, Harrison J E, Notarius C Effect of 2 randomised exercise programmes on bone mass of postmenopausal women ***Br Med J*** 1987;**295**:1441-4.

Christiansen M S, Hagem C, Christiansen C *et al*: Dose-response evaluation of cyclic oestrogen/gestagen in postmenopausal women: Placebo-controlled trial of its gynaecologic and metabolic action. ***Am J Obstet Gynaecol*** 1982;**144**:873 - 879.

Christiansen C, Riis B J 17B oestradiol and continuous norethisterone: A unique treatment of established osteoporosis in elderly women. ***J Clinc Endocrinol Metab*** 1990;**71**:836 - 841.

Cooper C, Barker D J P, Wickham C Physical activity, muscle strength and calcium intake in fracture of the proximal femur in Britain ***Br Med J*** 1988;**297**:1443-7.

Cooper C, Wickham C Cigarette smoking and the risk of age related fractures pp 93-100 in Wald N J, Baron J (ed) ***Smoking and Hormone Related Disorders*** Oxford University Press. Oxford 1990.

CRAG Clinical Outcomes Working Group ***Clinical Outcome Indicators*** Clinical Resource and Audit Group 1995.

Cummings, S.R., Kelsey, J.L., Nevitt, M.C., O'Dowd, K.J. Epidemiology of osteoporosis and osteoporotic hip fractures. ***Epidemiol Rev*** 1985;**7**:178-208.

Cummings SR *et al*. Bone density at various sites for the prediction of hip fracture. ***Lancet*** 1993; 341: 72-75.

Cumming R G Calcium intake and bone mass: a quantitative review of the evidence ***Calcif Tissue Int*** 1990;**47**:194-201.

Dawson-Hughes B *et al* A controlled trial of the effect of calcium supplementation on bone density in postmenopausal women ***N Eng J Med*** 1990;**323**:878-83.

Dalen N, Olsson K E Bone mineral content and physical activity ***Acta Orthop Scand*** 1974;**45**:170-4.

Department of Health ***Advisory Group on Osteoporosis*** Report Department of Health London 1994.

Department of Trade and Industry ***HASS listings for 1993, for males and females aged 50 and above for falls***. Consumer Unit DTI 1993.

Eastell R, Yergey A L, Vieira N E, *et al* Inter-relationship among vitamin D metabolism, true calcium absorption, para-thyroid function and age in women: evidence of an age-related intestinal resistance to 1,25 - dihydroxyvitamin D action. ***J Bone Miner Res*** 1991;**6**:125 - 132.

Effective Health Care Preventing falls and subsequent injury in the elderly ***Effective Health Care*** 1996; volume 2; number 4.

Elders P J *et al*. Calcium supplementation reduces vertebral bone loss in perimenopausal women: a controlled trial in 248 women between 46 and 55 years of age. ***J Clin Endocrinol Metab*** 1991;**73**:533-40.

Ettinger B, Genant H K, Cann C E. Long term oestrogen replacement therapy prevent bone loss and fractures. ***Ann Intern Med*** 1985;**102**:319 - 324.

Felson D T, Kiel D P, Anderson J J, Kannel W B Alcohol consumption and hip fractures: the Framingham study ***Am J Epidemiol*** 1988;**128**:1102-10.

Fiatarone M A, O'Neill, E F Ryan N D *et al*. Exercise training and nutritional supplementation for physical frailty in very elderly people. ***N Eng J Med*** 1994;**330**:769-55.

Fogelman I. Oestrogen, the Prevention of Bone Loss and Osteoporosis. ***Br J Rheumatology*** 1991;**30**:276-281.

Gallagher J C, Kable W T, Goldgar D. Effect of progestin therapy on cortical and trabecular bone: comparison with oestrogen. ***Am J Med*** 1991;**90**:171 - 178.

Goodwin, J. S., Regan, M. Cognitive dysfunction associated with naproxen and ibuprofen in the elderly. ***Arthr Rheum*** 1982;**25**:1013-14.

Grady D, Rubin S M, Pettiti D B *et al*. Hormone therapy to prevent disease and prolong life in postmenopausal women. ***Ann Intern Med*** 1992;**117**:1016 - 1037.

Grampian Health Board “Adult Lifestyle Report” Grampian Health Board 1994.

Greater Glasgow Health Board “Health Related Behaviour Survey of Young People” Greater Glasgow Health Board 1994.

Hall M L, Heavens J, Cullum I D, Eli P J The range of bone density in normal British women ***Br J Radiol*** 1990;**63**:266-9.

Hansen M A, Overgaard k, Riis B J, Christiansen C Potential risk factors for development of postmenopausal osteoporosis - examined over a 12 year period ***Osteoporosis International*** 1991;**1**:95-102.

Harris S T *et al*. Four year study of intermittent cyclical etidronate treatment of postmenopausal osteoporosis: three years of blinded therapy followed by one year of open therapy. ***Am J Med*** 1993;**95**:557-67.

Health of the Nation ***A Strategy for Health in England***. London HMSO 1992.

Heikinheimo R J *et al*. Annual injection of vitamin D and fractures of aged bones. ***Calcif Tissue Int*** 1992;**51**:105-110.

Heinonen *et al.* Efficacy of exercise regimens in increasing bone mineral density in premenopausal women. ***The Lancet*** 1996; 348: 1343-1347.

Hindmarsh, J.J., Estes, E.J. Falls in older persons. Causes and interventions. ***Archives of Internal Medicine*** 1989;149:2217-2222.

Holbrook T L, Barrett-Connor E, Wingard D L Dietary calcium and risk of hip fracture: 14 year prospective population study ***The Lancet*** 1988;**2**:1046-9.

Hole, W. E. *et al*. Central nervous system symptoms of elderly subjects using anti-hypertensive drugs. ***J Am Geriatr Soc*** 1984;**32**:5-10.

Hutchinson T A, Polansky S M, Feinstein A R Postmenopausal oestrogens protect against fracture of hip and distal radius ***The Lancet*** 1979;**2**:705-9.

Jones H H, Priest J D, Hayes W C *et al* Humeral hypertrophy in response to exercise ***Am J Bone Joint Surg*** 1977;**59**:204-8.

Kersletter J E, Allen L H Dietary protein increases urinary calcium ***J Nutr*** 1990;**120**:134-6.

Kiel D P *et al* Caffeine and the risk of hip fracture: the Framingham study ***Am J Epidemiol*** 1990;**132**:675-84.

Kiel D P, Baron J A, Anderson J J, Felson D T Cigarette smoking counteracts the effects of oral estrogens on hip fracture ***Clin Res*** 1990;**38**:512A.

Krall E A, Dawson-Hughes B Smoking and bone loss among post menopausal women ***J Bone Miner Res*** 1991;**6**:331-7.

Kreiger N, Hilditch S Cigarette smoking and estrogen dependent diseases ***Am J Epidemiol*** 1986;**123**:200.

Krolner B, Toft B, Pors Neilsen S, Tondevold E Physical exercise as prophylaxis against involutional vertebral bone loss: a controlled trial ***Clin Sci*** 1983;**64**:541-6.

Lalor B C, France M W, Powell D, *et al* Bone and mineral metabolism and chronic alcohol abuse ***QJ Med*** 1986;**59**:497-511.

Lau E, Donnan S, Barker D J P, Cooper C Physical activity and calcium intake in fracture of the proximal femur in Hong Kong ***Br Med J*** 1988;**297**:441-3.

Lauritzen, J.H., Petersen, M.M., Lund, B. Effect of external hip protectors on hip fractures. ***The Lancet*** 1993;341:11-13.

Law M Smoking and osteoporosis pp 83-92 in Wald N J, Baron J (ed) ***Smoking and Hormone Related Disorders*** Oxford University Press. Oxford 1990.

Leather A T, Studd J W W. Estrogen replacement therapy without the withdrawal bleed. pp 291-99 in Asch R H, Studd J W W (ed) ***Annual Progress in Reproductive Medicine*** Parthenon Publishing Group. Lancashire 1993.

Libermann UA, Weiss SR *et al*. Effect of oral alendronate on bone mineral density and the incidence of fractures in postmenopausal osteoporosis. ***N Eng J Med*** 1995;**333**:1437-1443.

Lindsay R, Aitken J M, Andersen J B *et al* Long term prevention of postmenopausal osteoporosis by oestrogen. ***The Lancet*** 1976;**1**:1038 - 1040.

McNeely S G, Schinfield J S, Stoval T G, *et al* Prevention of osteoporosis by medroxy-progesterone acetate in postmenopausal women. ***Int J Gynaecol Obstet*** 1991;**34**:253-256.

McGrath, A.M., Jackson, G.A. Survey of neuroleptic prescribing in residents of nursing homes in Glasgow. ***Br Med J*** 1996;**312**:611-2.

MacIntyre I *et al*. Calcitonin for prevention of postmenopausal bone loss. ***The Lancet*** 1988;**1**:900-902.

McPherson K. Editorial - Breast cancer and hormonal supplements in postmenopausal women. ***Br Med J*** 1995;**311**:699 - 700.

Margulies J Y, Simkin A, Leichter I *et al* Effect of intense physical activity on the bone-mineral content in the lower limbs of young adults ***Am J Bone Joint Surg*** 1986;**68**:1090-3.

Marshall D *et al*. Meta analysis of how well measures of bone density predict occurrence of osteoporotic fractures. ***Br Med J*** 1996; 312: 1254-59.

Minaire P Immobilisation osteoporosis: a review ***Clin Rheumatol*** 1989;**8 (suppl 2)**:95-103.

Morley, J.E., Silver, A.J. Nutritional issues in nursing home care. ***Ann Intern Med*** 1995;**123**:850-9.

MSD “Osteoporosis - Implications for Health Resource” Merck Sharp and Dohme Ltd. 1995.

Muckle, D. S. Iatrogenic factors in femoral neck fractures. ***Injury*** 1976;**8**:98-101.

Munk-Jensen M, Pors Nielsen S, Obel E B, *et al* Reversal of postmenopausal vertebral bone loss by oestrogen and progestogen: a double blind study. ***Br Med J*** 1988;**296**:1150 - 2.

The National Health Service in Scotland ***Framework for Action*** Edinburgh HMSO 1991.

National Osteoporosis Society “Priorities for Prevention” National Osteoporosis Society: Bath: 1994.

Nguyen T, Sambrook P, Kelly P *et al* Prediction of osteoporotic fractures by postural instability and bone density ***Br Med J*** 1993;**307**:1111-1115.

Nilsson B E, Andersson S M, Havdrup T, Westlin N E Ballet dancing and weight lifting - effects on BMC ***American Journal of Roentgenology*** 1978;**131**:541-2.

Nilsson B E, Westlin N E Bone density in athletes ***Clin Orthop*** 1971;**77**:199-82.

Ooms M E *et al* Prevention of bone loss by Vitamin D supplementation in elderly women: a randomised double-blind trial ***J Clin Endocrinol Metab*** 1995;**80**:1052-8.

OPCS Living in Britain: preliminary results from the 1994 General Household Survey ***OPCS Newsletter*** 1995a;4:12-13.

OPCS Smoking among secondary school children in 1994 ***OPCS Newsletter*** 1995b;**4**:11-12.

Overgaard, K. *et al* Effect of salcatonin given intranasally on early post-menopausal bone loss. ***Br Med J*** 1989;299:477-9.

Overgaard K *et al*. Effect of salcatonin given intranasally on bone mass and fracture rates in established osteoporosis: a dose-response study. ***Br Med J*** 1992;**305**:556-61.

Paganini-Hill A, Chao A, Ross R K, Henderson B E Exercise and other factors in the prevention of hip fracture: the Leisure World study ***Epidemiology*** 1991;**2**:16-25.

Paganini-Hill A, Ross R K, Gerkins V R, *et al* Menopausal estrogen therapy and hip fractures ***Ann Intern Med*** 1981;**95**:28-31.

Peel, N., Eastell, R. ABC of Rheumatology - Osteoporosis. ***Br Med J*** 1995;**310**:989-992.

Prudham, D., Evans, J. G. Factors associated with falls in the elderly: A community study. ***Age Ageing*** 1981;**10**:141-6.

Reginster J Y *et al*. One year controlled randomised trial of prevention of early postmenopausal bone loss by intranasal calcitonin. ***The Lancet*** 1987;**2**:1481 - 1483.

Reid I R *et al*. Effect of calcium supplementation on bone loss in postmenopausal women. ***N Eng J Med*** 1993;**328**:460-4.

Reid I R *et al*. Long term effects of calcium supplementation on bone loss and fractures in postmenopausal women: a randomised controlled trial. ***Am J Med*** 1995;**98**:331-335.

Rico H Alcohol and bone disease ***Alcohol*** 1990;**25**:345-52.

Riis B, Thomson K, Christiansen C Does calcium supplementation prevent postmenopausal bone loss? ***N Eng J Med*** 1987;**316**:173-7.

Rundgren A, Aniansson A I, Ljungberg P, Wetterqvist K Effects of a training programme for elderly people on mineral content of the heel bone ***Arch Gerontology Geriatrics*** 1984;**3**:243-8.

Ryan P *et al*. Compliance with HRT after screening for osteoporosis. ***Br J Obstet Gynaecol*** 1992; 99: 325-8.

Scragg R, Murphy S Preventing osteoporosis ***Br Med J*** 1991;**303**:921.

Sheldon TA *et al*. Controversies in management: Department of Health shoots itself in the hip. Why the report of the advisory Group on Osteoporosis undermines evidence based purchasing. ***Br Med J*** 1996 312: 296-7.

Shortt C, Flynn A Sodium-calcium inter relationships with specific reference to osteoporosis ***Nutr Res Rev*** 1990;**3**:101-15.

Simkin A, Ayalon J, Leichtner I, Increased trabecular bone density due to bone loading exercises in postmenopausal osteoporotic women ***Calcif Tissue Int*** 1987;**40**:59-63.

Stevenson J C, Kanis J A, Christiansen C. Letter. ***Lancet*** 1992;**339**:370-371.

Smith E, Reddan W, Smith P Physical activity and calcium modalities for bone mineral increase in aged women ***Med Sci Sports Exerc*** 1981;**13**:60-4.

Smith E L, Smith P E, Ensign C J, Shea M M Bone involution decrease in exercising middle-aged women ***Calcif Tissue Int*** 1984;**36**:5129-38.

Stevenson J C, Lees B, Devenport M, Cust M P, Ganger K F Determinants of bone density in normal women: risk factors for future osteoporosis? ***Br Med J*** 1989;**298**:924-8.

Storm, T., Thamsborg, G., Steiniche, T. *et al*. Effect of intermittent cyclical etidronate therapy on bone mass and fracture rate in women with postmenopausal osteoporosis. ***N Eng J Med*** 1990;**322**:1265-71.

Talmage R V, Stinnett S S, Landwehr J T, *et al* Age-related loss of bone mineral density in non-athletic and athletic women ***Bone Miner*** 1986;**1**:115-25.

Tang M X, Jacobs D and Stern Y *et al.* Effect of oestrogen during menopause on risk and age at onset of Alzheimer's disease. ***Lancet*** 1996; **348**: 429-32.

Tinetti *et al*. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. ***N Eng J Med*** 1994;**331**:821-827.

Tinker, G.M. Accidents in a geriatric department. ***Age Ageing*** 1979;8:196-8.

Torgerson, D.J., Kanis, J.A. The cost effectiveness of preventing hip fractures in the elderly using vitamin D and calcium. ***QJ Med*** 1995; 88(2): 135-9.

Torgerson DJ, Donaldson C, Russell IT, Reid DM. Hormone replacement therapy: compliance and cost after screening for osteoporosis risk. ***Eur J Obstet Gynaecol Reprod Biol*** 1995; 59: 57-60.

de Ville, A.C., Donald, S.C., MacPherson, I.A. Survey of residential accomodation for elderly and adult care groups in Strathclyde. ***Priority Services Research Team, Aberdeen*** Report No. **3** June 1993.

Vellas B *et al*. Malnutrition and falls. ***The Lancet*** 1990;**336**:1447.

Wallace, R., Ross, J., Huston, J. *et al* Iowa FICSIT trial: the feasibility of elderly wearing a hip joint protective garment to reduce hip fractures. ***J Am Geriatr Soc*** 1993;41:341-43.

Watts N B *et al*. Intermittent cyclical etidronate treatment of postmenopausal osteoporosis. ***N Eng J Med*** 1990;**323**:73-79.

White M K, Martin R B, Yeater R A, *et al* The effects of exercise on the bones of postmenopausal women ***Int Orthop*** 1984;**7**:209-14.

Whitlock, F. A., Boyce, L., Siskind, V. Accidents in old age. ***Aus Fam Phys*** 1978;**7**:388-9.

Wickham C A, Walsh K, Cooper C Dietary calcium, physical activity, and risk of hip fracture: a prospective study ***Br Med J*** 1989;**299**:889-92.

Wild, D., Nayak, U.S.L., Isaacs, B. Characteristics of old people who fell at home. ***J Clin Exp Gerontol*** 1980;**2**:271-8.

Williams A R, Weiss N S, Ure C L, *et al* Effect of weight smoking and estrogen use on the risk of hip and forearm fractures in postmenopausal women ***Obstet Gynaecol*** 1982;**60**:659-9.

Woo S L Y, Kuei S C, Amiel D *et al* The effect of prolonged physical training on the properties of long bones: a study of Wolff's Law. ***Am J Bone Joint Surg*** 1981;**63(5)**:780-7.

Tables and Figures

Table 2.1
Estimated prevalence of osteoporosis of the hip in those 50 years and older in England and Wales

Age (years)	Men % affected	Women % affected
50 - 54	0.4	5.1
55 - 59	6.0	8.1
60 - 64	4.1	9.6
65 - 69	3.4	15.3
70 - 74	7.2	33.4
75 - 79	6.7	38.7
80 - 84	27.1	57.5
85 +	29.1	60.5
50 +	5.8	22.5

Table 2.2
Scottish Age & Sex Specific Rates of Emergency Admissions for Fractured Neck of Femur per 10,000 Population 1980-2010

	1980	1985	1990	1994	2010
Males					
50-59	3.1	2.4	3.1	3.6	4.0
60-69	5.5	5.2	6.9	7.7	10.2
70-79	17.1	18.2	21.8	21.4	27.4
80+	54.1	64.4	76.0	79.8	116.6
Females					
50-59	4.2	2.5	5.1	4.0	4.9
60-69	11.7	11.0	14.1	13.9	17.3
70-79	41.8	44.1	50.9	51.7	64.2
80+	131.2	157.4	186.8	206.8	289.1

Table 2.3
Standardised Emergency Admission Ratios Fractured Neck of Femur 1994 Scotland in patients 50+ by Health Board of Residence (Scotland=100)

Health Board	Observed	Expected	SAR	95% Confidence Interval Range	
Argyll & Clyde	402	441.4	91.1	82.2	100.0
Ayrshire & Arran	391	401.4	97.4	87.7	107.1
Borders	118	138.3	85.3	69.9	100.7
Orkney	19	21.3	89.1	49.0	129.2
Shetland	17	22.0	77.3	40.6	114.1
Tayside	496	463.8	106.9	97.5	116.4
Western Isles	32	39.5	81.1	53.0	109.2
Dumfries & Galloway	129	171.7	75.1	62.2	88.1
Forth Valley	262	270.2	97.0	85.2	108.7
Greater Glasgow	1026	947.2	108.3	101.7	114.9
Lanarkshire	456	467.2	97.6	88.6	106.6
Fife	321	365.6	87.8	78.2	97.4
Grampian	505	508.4	99.3	90.7	108.0
Highland	219	214.5	102.1	88.6	115.6
Lothian	827	747.4	110.6	103.1	118.2
Scotland	5220	5220	100		

Figure 2.1 Fractured Neck of Femur Standardised Emergency Admissions Ratio (Based on 1980 Age, Sex Specific Rates) Trends 1980-1994, Forecast to 2010.

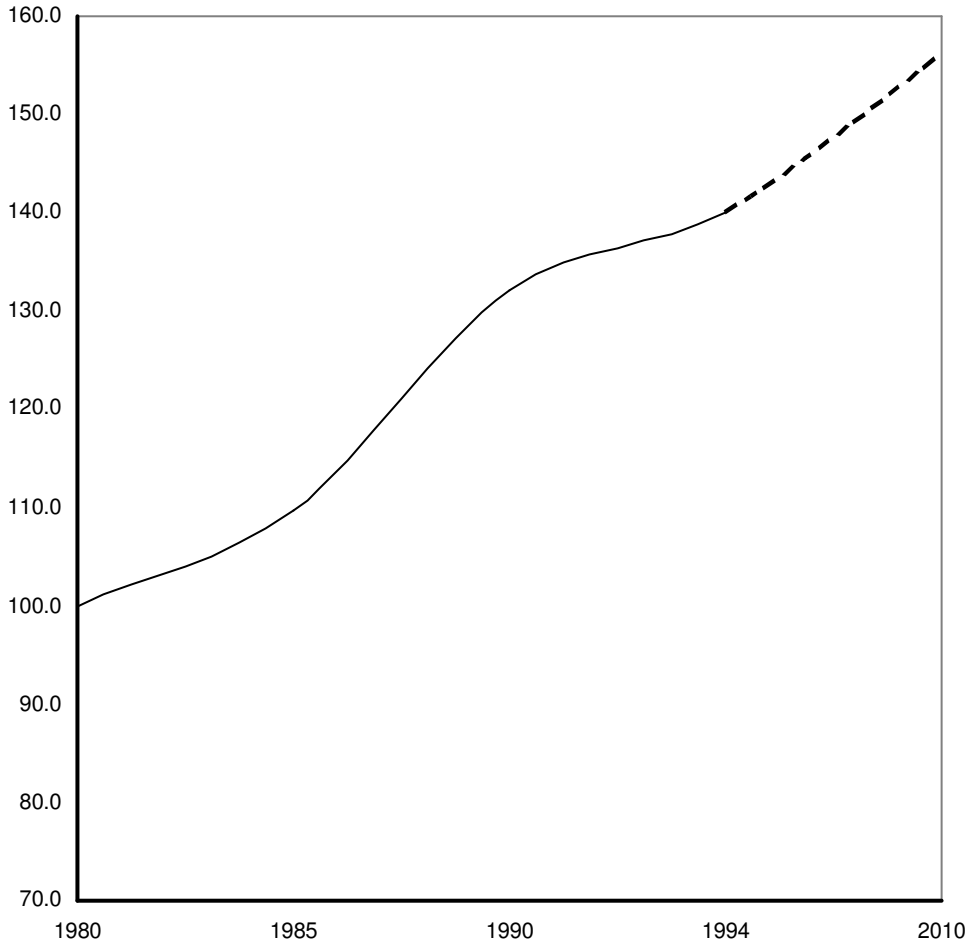

Table 3.1
Number of prescriptions issued for Oral, Patch and Vaginal HRT 1991 to 1995 Scotland

	1991	1992	1993	1994	1995
Oral	266,820	321,686	351,024	380,487	410,204
Patch	91,953	113,344	128,452	132,406	139,135
Vaginal	49,518	50,927	50,915	51,572	52,093

Table 3.2
Number of prescriptions issued for Combined Oestrogen-Progesterone and Oestrogen only HRT 1991 to 1995 Scotland

	1991	1992	1993	1994	1995
Oestrogen & progesterone	193,841	281,964	252,579	337,491	358,401
Oestrogen only	206,470	182,267	248,008	190,172	202,775

Sources: Management Information and Research Centre, Pharmacy Practice Division

Prevalence Data from South Ayrshire Trust Database

Data relate to those individuals aged 50 or older attending the A&E department at the South Ayrshire Hospitals NHS Trust with a fracture between February 1992 and April 1995. There were 3158 records.

Inspection of the data suggest that approximately 97% of the attendees were Ayrshire and Arran residents. The population served by the hospital is difficult to define but can be approximated by the Local Government Districts of Cumnock and Doon Valley and Kyle and Carrick which are in the South of Ayrshire. The over 50 years of age population sizes for males and females are given in Table A2.1.

Table A2.1
Individuals attending South Ayrshire Trust A&E with fracture

Gender	Number	Percentage of all cases	Popul. of Cumnock & D.V./Kyle & Carrick over 50	Estimated incidence of fracture /100 people
Female	2354	74.5	30016	7.8
Male	798	25.3	23009	3.5
Total	3152	100.0	53025	5.9

Missing values 6

Females accounted for 74.5% of fractures presenting (Table A2.1). Of all fractures, 97% were closed and 3% open. (Table A2.2)

Table A2.2
Type of fracture

Type	Number	Percentage
Closed	3066	97.1
Open	92	2.9
Total	3158	100.0

The most common site of a fracture was the wrist (25.1%) followed by the hip (17.3%) and then the ankle (10.6%) (Figure A2.1 overleaf). The site of the fracture varied between males and females (Pearson Chi-squared statistic = 153.13, p = 0.00000). For example, 28.3% of all female fractures were at the wrist, compared with 15.6% of males fractures (Table 2.3).

Table A2.3
Number of fractures (% of all fractures) presenting at A&E between February 1992 and April 1995, by site and gender

Site of fracture	Females	Males	Total
Vertebrae (c,t,l,sc spine)	67	34	101
	(2.8)	(4.3)	(3.2)
Wrist	667	124	791
	(28.3)	(15.6)	(25.1)
Neck of femur	431	113	544
	(18.3)	(14.2)	(17.3)
Lower limb*	615	234	849
	(26.1)	(29.4)	(27.0)
Upper limb*	298	176	474
	(12.7)	(22.1)	(15.0)
Other*	275	116	391
	(11.7)	(14.6)	(12.4)
TOTAL	2353	797	3150

* - excluding fractures of the neck of femur, vertebrae and wrist.

The mean age differed significantly between fracture sites (ANOVA, $F = 42.53$, $p = 0.000$). Figure A2.2 overleaf illustrates the varying age distributions for the different fracture sites. Fractures of the hip and the pelvis in particular were associated with older people. Those with hip fractures had a median age of 82 ranging from 50 to 95 years. For fracture of the pelvis median age was 83, ranging from 51 to 94 years.

Research into Ageing

Falls are not an inevitable consequence of ageing and there are certain steps you can take to reduce the risk of falling:

1. Take some exercise regularly to improve your muscle strength and suppleness.
2. Consult your doctor if you are experiencing dizzy spells. A medication or combination of medicines or a health problem may be the cause.
3. Have your eyesight checked regularly. It is estimated that around 25% of older people's eyesight could be improved by being prescribed new glasses. Such checks can also pick up on eye disease at an early stage.
4. Don't get out of bed or up from chairs quickly as low blood pressure may cause dizziness and your body takes longer to adjust as you get older.
5. Choose well fitting shoes and replace worn slippers. Avoid clothes that are too long.
6. If bending over causes dizziness, don't keep items on the floor. Fit shelves, use drawers and collect post in a rack.

Use the checklist below to reduce the risks in your own home:

1. Keep all areas well lit, particularly the stairs. A torch by the bed is sensible in case of power failures.
2. Don't leave objects lying around or run cables across the floor.
3. Fix down any loose edges of carpets and rugs. Use non-slip mats in bathrooms and toilets.
4. Fit handrails where appropriate - bathroom, toilet, top of stairs, by external doors.
5. Use proper steps to reach items, not a chair or table.
6. Check out paving slabs and outside paths for damage and repair before the winter sets in. Store salt for de-icing paths.

(Research into Ageing ***Research into Ageing News*** 1996**;3**.)

Costed Options

Table 5.2.1
Option 6 - Annual Financial Implications for Scotland

	Annual Financial (£)
Argyll & Clyde	41,435
Ayrshire & Arran	37,580
Borders	12,286
Dumfries & Galloway	15,980
Fife	33,887
Forth Valley	25,134
Grampian	45,932
Greater Glasgow	90,659
Highland	19,513
Lanarkshire	45,851
Lothian	70,584
Orkney	1,847
Shetland	1,927
Tayside	42,398
Western Isles	3,292
Scotland	**488,304**

Table 5.2.2
Option 7 - Prevalence Estimates per 1000 Population

Age Band	Hysterectomy with oophorectomy	Oophorectomy only	"Surgically Induced Menopause"
20-29	0.3	0.2	0.5
30-39	4.5	2.7	7.2
40-49	25.7	15.1	40.8

Prevalence was assumed to be constant across Scotland. Prevalence of hysterectomies with oophorectomies and oophorectomies alone were derived from Glasgow data on the prevalence of all hysterectomies assuming that the relationship between the three groups was the same as that between the incidence.

Figures were only available in 5 year age bands. It was therefore assumed that women in each age group would be at the midpoint, hence for the 20-29 year old group, women were assumed to 25 and HRT has been costed for 25 years.

Table 5.2.3
Option 7 - Annual financial implications and discounted lifetime costs (where lifetime is HRT to aged 50) of HRT in women who currently have surgically induced menopause

	Annual Financial (£)	Discounted Costs (£)
Argyll & Clyde	22,413	289,305
Ayrshire & Arran	20,084	260,096
Borders	5,640	73,187
Dumfries & Galloway	7,673	99,442
Fife	18,532	239,591
Forth Valley	14,671	189,787
Grampian	28,289	365,169
Greater Glasgow	43,875	562,496
Highland	11,209	145,346
Lanarkshire	29,286	377,649
Lothian	39,771	512,146
Orkney	1,043	13,545
Shetland	1,187	15,351
Tayside	20,553	266,067
Western Isles	1,398	18,137
Scotland	**265,623**	**3,427,312**

Option 9

It is envisaged that local Health Boards would receive a list of women residents who had reached their 52nd birthday in the previous 6 months, twice yearly. This is a relatively straightforward request from CHI systems and would be unlikely to incur any additional costs. General Practitioners would then be sent a list of those women who had become suitable for DEXA and asked to check if there were any reasons why those particular women should not be invited for DEXA. The women who proved to be suitable would then be sent a letter by the Health Board inviting them for screening.

Various assumptions have been made in calculating the costs of this option. Firstly, 95% of women would be suitable for a DEXA scan. Assuming that uptake amongst women would be lower than for breast screening which has a higher profile than osteoporosis, uptake was assumed to be 60%. (National breast screening uptake = 72%.) It was further assumed that 35% of those scanned would fall in to the lowest quartile given that they will be a self selecting group. Compliance with HRT was set at 60% - higher than normal as DEXA is argued to improve compliance. In order to administer this programme, it was estimated that for every 5000 women identified per annum, 1 A&C Grade 4 would be required to write to GPs, invite women and remind women. The cost of a DEXA was set at £30.00. Once again the three types of HRT were used in the calculations.

Table 5.2.5
Option 9 - Annual Costs for DEXA and Administration and Total Costs over 10 Years for Year 1 Cohort of Women

	Annual Costs - DEXA (£)	Annual Costs Admin (£)	Total Cost over 10 Years for Year 1 Cohort (DEXA, admin & HRT) (£)		
			Prempak C®	Kliofem®	Estracombi®
Argyll & Clyde	43,899	6,935	187,750	343,246	427,395
Ayrshire & Arran	39,416	6,226	168,574	308,189	383,743
Borders	10,900	1,722	46,616	85,223	106,116
Dumfries & Galloway	16,481	2,604	70,487	128,864	160,456
Fife	33,920	5,358	145,069	265,216	330,236
Forth Valley	28,106	4,440	120,203	219,757	273,632
Grampian	48,653	7,686	208,081	380,416	473,678
Greater Glasgow	83,499	13,190	357,114	652,879	812,937
Highland	22,127	3,495	94,636	173,014	215,429
Lanarkshire	57,302	9,052	245,073	448,044	557,885
Lothian	71,225	11,251	304,618	556,906	693,435
Orkney	2,264	358	9,683	17,702	22,042
Shetland	2,182	345	9,332	17,061	21,243
Tayside	38,588	6,096	165,035	301,718	375,686
Western Isles	2,832	447	12,111	22,141	27,570
Scotland	501,393	79,205	2,144,382	3,920,376	4,881,484