

Missed opportunities for osteoporosis management in older patients: a literature review

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Background: Osteoporosis is a chronic and progressive disease leading to gradual deterioration of skeletal tissue, which predisposes the sufferer to an increased risk of fracture, deformity, disability and even premature death. The growth of this ‘silent epidemic’ is projected to escalate worldwide with the changing demographics of an ageing population. Recent reviews have highlighted the frequency of missed opportunities for secondary prevention following a fracture, though these reported on practice in the mid-1990s when pharmacologic approaches to fracture reduction were in transition. **Aim:** This review examines the current body of literature regarding the investigation of osteoporosis and prescribing of secondary bone prevention medication in older patients following fragility fractures. **Method:** A standard Boolean search framework was used to find all pertinent studies on the literature review question. A further set of results was obtained using a ‘snowballing’ technique by pursuing references of the initial studies and reviews found. As the aim was to determine if there have been changes in prescription rates in elderly patients in the light of new guidelines, studies were excluded if they had featured in recent systematic reviews. **Findings:** The consistently low intervention rates reported in all included studies provide evidence that elderly individuals who experience fragility fractures are still not receiving adequate investigation or treatment for osteoporosis. Furthermore, this review has identified the potential for future research to describe the true extent of this problem in the UK.

Key words: fragility fracture; investigation; osteoporosis; secondary bone prevention

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Introduction

Osteoporosis is a chronic and progressive disease leading to gradual deterioration of skeletal tissue, which predisposes the sufferer to an increased risk of fracture, deformity, disability and even premature death. The growth of this ‘silent epidemic’ is projected to escalate worldwide with the changing demographics of an ageing population (Khaw, 1999).

Recent studies have shown that 80%–90% of fractures in post-menopausal women are associated with osteoporosis, and in these individuals

there is a 20-fold increase in risk of sustaining a further fracture in the future (Andrade *et al.*, 2003). The high morbidity and mortality rates following an osteoporotic fracture are particularly distressing given that since the early 1990s, several effective pharmacological therapies have been proven to reduce fracture risk by 40%–60% within the first year (Epstein and Goodman, 1999). There is a general worldwide consensus that osteoporosis should be actively sought in patients over 50 presenting with a fragility fracture, and it is widely recognised that great benefit can be gained from timely initiation of effective treatment (National Osteoporosis Foundation, 1999).

Two detailed reviews were conducted on this topic in (Elliot-Gibson *et al.*, 2004 and Giangregorio

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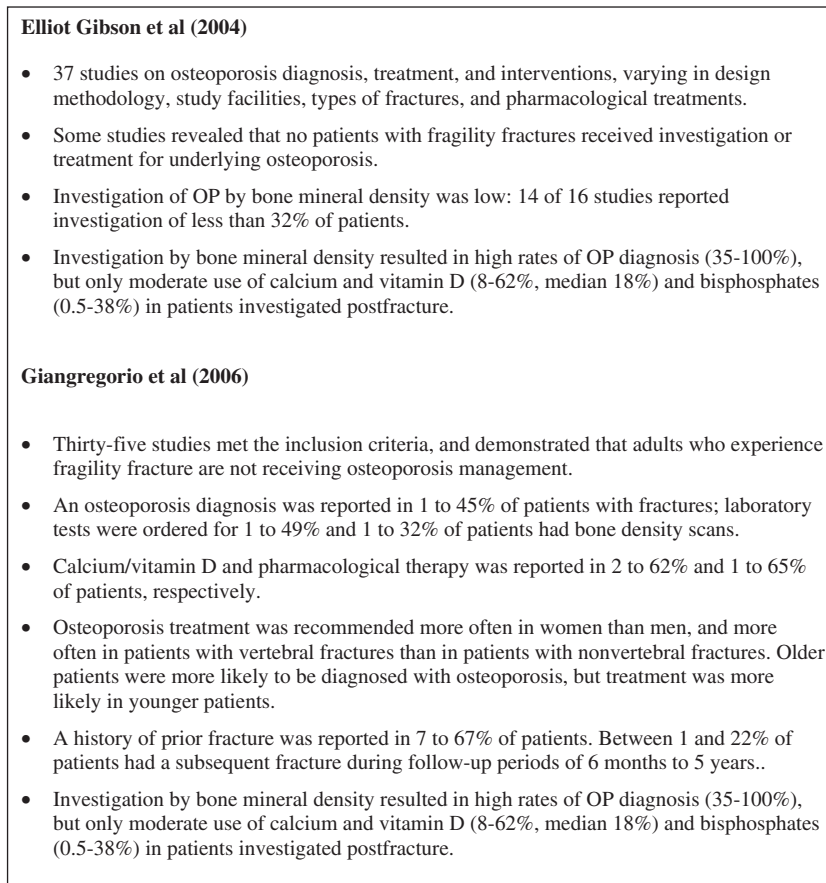


Figure 1 Summary of the results of the literature reviews of 2004 and 2006

et al., 2006) and both highlighted the frequency of missed opportunities for secondary prevention following a fracture (Figure 1). It is important to note, however, that these reviews included many studies reporting on practice in the mid-1990s when pharmacologic approaches to fracture reduction were in transition, and did not focus specifically on older patients in whom osteoporosis is most prevalent.

In the US, 2002–2011 has been named the National Bone and Joint Decade (Bush, 2002), which was implemented to increase awareness of osteoporosis amongst patients and physicians. Thus, there is now a need to discover if there has been an improvement in osteoporosis care since these earlier reviews, particularly in light of recent management guidance and education aimed at healthcare practitioners (National Osteoporosis Foundation, 1999; NICE, 2003; NICE, 2008).

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The specific question to be addressed is: is there a lack of **investigation** to detect osteoporosis and prescribing of **secondary bone prevention** medication to **older** patients following **fragility fractures**?

The terms in bold warrant further clarification:

- **‘Investigation’**: the use of bone mineral density (BMD) scans or ‘dual energy X-ray absorptiometry’ (DEXA) scans to confirm osteoporosis.
- **‘Secondary bone prevention’**: the use of medication to reduce the risk of further osteoporosis-related fractures, including bisphosphonates, raloxifene, teriparatide, hormone replacement therapy, calcium and vitamin D supplements.
- **‘Older’**: patients aged over 50.
- **‘Fragility fracture’**: fracture resulting from a fall from standing height or less, suggesting for skeleton weakness.

Method

Search strategy

The databases, electronic journals and search engines used were:

- PubMed
- MEDLINE
- EMBASE
- HMIC
- BMJ
- Cochrane Library
- Google Scholar

All searches were restricted from 1995–2008, as this was deemed appropriate to yield the most relevant span of literature, and only English language studies were located.

The standard Boolean search framework was used to find all pertinent studies on the literature review question. A further set of results was obtained using a ‘snowballing’ technique by perusing the reference lists of the initial studies and reviews found.

Table 1 demonstrates the key search terms and selected synonyms employed during the search.

The four key search terms were determined using the original research question. These were then exploded using the MeSH tool in the PubMed database to obtain the relevant synonyms. For example, when the term ‘osteoporosis’ was exploded, the entry term ‘post traumatic osteoporosis’ was obtained which was not considered relevant as

the research question was only concerned with the age-related osteoporosis, and thus was excluded. The specific anatomical fragility fracture terms used were selected, as these are the most common osteoporotic fracture sites.

As the primary aim for the review was to establish the rates of secondary bone prevention prescribing, it was not necessary to include ‘investigation’ or ‘diagnosis’ as a search term as this was not a pre-requisite for inclusion – if this had been used, studies that only focused on medication rates would not have been located.

The search terms were combined systematically, by using one synonym from each column every time and until all possible combinations were exhausted. In practice, it was not necessary to use every combination each time, as data saturation occurred before the list was completed in each individual database or search engine. The algorithm was continued until no additional new studies were obtained.

The search strategy yielded 803 abstracts from the databases, once duplications were deleted.

Study selection criteria

Studies were selected for review if they met the following inclusion criteria:

- a) The subjects included patients with a fragility fracture.
- b) The subjects were all over the age of 50.

Table 1 Search terms used

1	2	3	4
Osteoporosis	Medication	Older	Fragility fracture
Osteoporoses	Control	Post menopausal	Fracture
Age-related bone loss	Treatment	Aged	Pathological fracture
Senile bone loss	Prophylaxis	Elderly	Spontaneous fracture
Senile osteoporosis	Therapy	Old	Hip fracture
Age-related osteoporosis	Secondary prevention	Senile	Spinal fracture
	Anti-resorptive	Aged men	Vertebral fracture
	Drug	Aged women	Wrist fracture
	Preventive therapy	Elderly men	
	Preventive measures	Elderly women	
	Drug therapy	Old men	
	Pharmacotherapy	Old women	
	Prescribing	Elderly women	
	Bisphosphonates	Senile men	
	Prescribing pattern	Senile women	
	Practice pattern	Aged 50+	
	Pharmacological therapy		

- c) The results reported the number of patients who had been treated for osteoporosis following the fracture treatment outcomes included the initiation of calcium, Vitamin D, multi-vitamins, hormone replacement therapy, bisphosphonates, calcitonin and any other anti-resorptive therapies.

Articles were excluded if:

- They were not reported in the English language.
- They were evaluating an intervention to improve treatment practice.
- They focused on concomitant diseases such as corticosteroid-induced osteoporosis.
- They had been previously included in the prior reviews of 2004 and 2006.
- They were an opinion article or a letter to the editor.

Following application of these inclusion and exclusion criteria, only nine studies remained. Of these, only seven were formally appraised for the review since, on closer evaluation, two were not directly relevant to the research question (Table 2).

Results

Critical appraisal of the evidence

Examination of the nine studies obtained revealed several consistent themes. All of the studies assessed the treatment outcomes in patients following a fragility fracture, but six of the nine studies further reported the rates of investigation in the affected patients, and several additionally commented on the influence of age and gender on prescribing patterns (Table 3).

Treatment rate

All of the studies concluded that there continues to be a lack of active therapeutic intervention for osteoporosis in elderly people.

For example, the two lowest rates of treatment intervention reported were 9.5% and 15.4% by Papaioannou *et al.* (2008) and Bessette *et al.* (2008), respectively. These studies adopted prospective cohort designs through the use of patient surveys as their primary research method. Both involved substantial sample numbers focusing on a particular gender (2187 men and 903 women, respectively).

Papaioannou *et al.* (2008) found that after five years, 90% of community dwelling Canadian men

Table 2 Justifications for the rejection and inclusion of studies appraised

Marginal relevance due to major limitations

Nixon <i>et al.</i> (2007)	Only looked at one type of fracture in two hospitals in Leicester over a two-month period, reducing its external validity.
Prasad <i>et al.</i> (2006)	Undermined by the small sample size of twenty-seven patients, and short study time frame of two months.

Some limitations, therefore relevant but not essential for inclusion

Gehlbach <i>et al.</i> (2007)	<p><i>Limitations</i></p> <p>Questionable validity of the way in which medication use was reported by the patients</p> <p><i>Strengths</i></p> <p>Use of 9700 exclusively older women</p> <p>Data from two cycles of a national health survey</p>
Papaioannou <i>et al.</i> (2008)	<p><i>Limitations</i></p> <p>Questionable validity of the way in which medication use was reported by the patients</p> <p><i>Strengths</i></p> <p>Large sample size of 2187</p> <p>Unique focus on men</p> <p>Lengthy follow-up of five years</p> <p>Wide range of study sites used</p>

Essential inclusion

Bessette *et al.* (2008)
 Freedman *et al.* (2008)
 Hooven *et al.* (2005)
 Perreault *et al.* (2005)
 Suhm *et al.* (2008)

Table 3 Summary of the studies used

Study and Year	Country of study	Participants	Method	Prescribing rate of anti-resorptive therapy (%)	DEXA results (if applicable)
Suhm <i>et al.</i> (2008)	Switzerland	870 M and 2797 F	Consecutively recruited patients over 8-16 months, used patient records	19.7	31.4%
Freedman <i>et al.</i> (2008)	USA	267 M and F	Retrospective study using X-rays and patient records	28	39%
Besette <i>et al.</i> (2008)	Canada	903 F	Prospective cohort study using phone interviews	15.4	52%
Gehlbach <i>et al.</i> (2007)	USA	9700 F	Interviews from a national health survey	32	-
Papaioannou <i>et al.</i> (2008)	Canada	2187 M	Prospective recruitment over five years, interviewer led questionnaire	9.5	-
Hooven <i>et al.</i> (2005)	USA	381 F	Mail survey over two year period	33	38%
Perreault <i>et al.</i> (2005)	Canada	Ranging from 1370 to 1883 F	Database information used over five years	25	From 20.4% in 1995 to 41.1% in 2000

DEXA = dual energy X-ray absorptiometry; M = male; F = female.

aged 50 or over with a clinical fragility fracture remained untreated. Participation was entirely voluntary in this study, however, and thus subject to non-response bias. For example, those on treatment may have been more or less willing to participate due to personal views about the medication they had been prescribed. Furthermore, though the number of men lost to follow up was small (2.4%), a greater proportion of these were older. As the study concluded that older men are more likely to have fractures and to be treated, this may have led to an underestimation of the true treatment rate.

The validity of the method used is also questionable since the detailed interviewer led questionnaire resulted in fractures being self-reported and the medication rates were based on the instruction to participants to 'bring all of the contents of their medicine cabinets'. Clearly medications that were not adhered to are unlikely to have been included, regardless of prescription. Nevertheless, the sample size was and this is the first population based, cohort study to examine this topic in men.

The second lowest prescribing rate of 15.4% reported by Besette *et al.* (2008), also in Canada, was determined through a series of telephone interviews over a six to eight month period following the initial fracture. Once again, whilst a clear strength of the study is its large sample size, this is undermined by the fact that participation was significantly lower amongst women over 70. Since osteoporosis prevalence increases with age one might expect a correlation between the rate of secondary bone prevention prescribing and the age of the patient. Consequently the selection bias caused by the over representation of younger women in the sample may have overestimated the true medical care gap the study claims to identify.

In addition, the internal validity of the results is questionable due to the effects of recall bias from relying on patients' accounts to determine prescribing rates. The validity may also have been influenced through the use of telephone interviews, since the extent of a patients' osteoporosis, and thus potential degree of immobility, may affect their likelihood of answering a telephone survey. The acknowledgement of funding provided by pharmaceutical companies such as Procter and Gamble also raises concerns, as this could have incentivised the researchers to report

NICE guide summary (October 2008): Osteoporosis - secondary prevention including strontium ranelate:

Whether or not a postmenopausal woman who has had a bone fracture because of osteoporosis is offered treatment to prevent further fractures will depend on her age, her bone density and how many risk factors for fracture she has.

Alendronate is recommended as a possible treatment for preventing bone fractures in postmenopausal women who have already had a fracture and have had osteoporosis diagnosed.

The guidance says that women who are 75 or over may not need a bone scan to diagnose their osteoporosis.

British Orthopaedic Association (BOA) guideline summary (September 2003) *The Care of Fragility Fracture Patients*:

It is recommended that: 'all patients more than 60 years old presenting with fragility fracture should be evaluated for osteoporosis by measurement of bone density, preferably by means of axial DEXA (dual-energy X-ray absorptiometry) if this is available'.

Treatment is then advocated on the basis of DEXA scan results. In addition, the guidelines state that patients younger than 60 years with fragility fractures should be assessed for the presence of risk factors for osteoporosis and scanned only if such risk factors are present.

(Marsh et al 2003)

Figure 2 Summary of National Institute of Clinical Excellence and British Orthopaedics Association Guidelines for Osteoporosis Management

low prescribing rates to encourage increased usage of anti-resorptive drugs.

This is also true of Gehlbach *et al.* (2007), though the credibility of their finding of only a 32% treatment rate in American females over 65 with a prior fracture is strengthened by the use of 9700 females – the largest sample size of all the studies included. However, similar to Papaioannou *et al.* (2008), the validity of their method is in part undermined by confirming reporting of prescription rates by subjects with 'interviewer inspection of containers' only, as opposed to direct examination of their medical records.

Whilst all the aforementioned studies were conducted in America, in the UK the publication of osteoporosis guidelines by the British Orthopaedic Association (BOA) and most recently the National Institute of Clinical Excellence (NICE) hoped to address ways that the care of fragility fracture patients could be improved (Figure 2). To assess the effect of publication of the BOA guidelines in 2003, Nixon *et al.* (2007) reviewed the case notes of 602 fracture patients from 2003 to 2005. They found that the proportion of patients discharged on osteoporosis medication remained below 25% every year, with no significant improvements between the years. The authors assert that this demonstrates that the

BOA guidelines have had no impact, but this conclusion is weakened by the limited generalisability of their results, based only on proximal femoral fractures admitted to two Leicester hospitals in only January and February each year.

Investigation rate

Prescriptions are not the only indicator of a healthcare practitioner's recognition of osteoporosis in patients with recently diagnosed fragility fractures. Diagnostic modalities are known to be relatively accurate, inexpensive, non invasive and readily available for these patients (Brown and Bradio, 2000). Nevertheless, this review found consistently low rates of investigation of osteoporosis with possible fragility fracture.

Prasad *et al.* (2006) found that, on conducting a retrospective audit of patient records for those admitted to a Scottish hospital over a two-month period, just one of the 27 patients eligible were referred for a DEXA scan. These findings, alarming though they may appear, must be viewed with discretion due to the small sample size and focus on one type of fracture in one hospital and over a short period of time. An additional limitation of the retrospective method employed is that it is impossible to determine

whether the lack of prescribing was influenced by drug tolerability, other co-morbidities, or individual patient choice.

Further studies reported similarly low investigation rates. Most recently in October 2008 Suhm *et al.* found that DEXA scans were used in just 31.4% of the 3667 patients recruited across eight Swiss medical centres. A limitation of this study is that although a dedicated nurse was responsible for data collection at each site, the variation between sites in the time they could allocate to the project sometimes led to incomplete data collection.

These limitations should be viewed in context with several strengths, such as the large sample and the increased validity of using patient records to obtain the relevant information, in comparison to the approach adopted in some of the studies mentioned previously of asking the patients directly.

The low rates of diagnostic workup were confirmed by Perreault *et al.* (2005) who focused solely on Canadian female patients over 70, by randomly selecting 40% of women listed in a health database from 1995 to 2001. Crude rates of BMD testing improved from 20.4% in 1995 to 41.1% in 2000, though remaining unsatisfactory overall. Though a large sample was used over the five years (ranging from 1370 to 1883 patients), the validity may be reduced by the possibility of differential and non-differential information bias from determining anti-resorptive therapy usage using a computer-based administrative database, as acknowledged by the authors.

Influence of age and gender on prescribing patterns

The following analysis of the studies commenting on the influence of age and gender on

prescribing patterns is not directly relevant to the main research question, but is nonetheless valuable in developing a more detailed picture of the influences on the current medical care gap in osteoporosis management.

It is widely recognised that the prevalence of osteoporosis increases with age, and the efficacy of anti-resorptive therapies has been most successfully demonstrated in the elderly population. Furthermore, the adverse impact of future fragility fractures on quality of life, morbidity and mortality is far more consequential in older patients. Combined with the expectation that the number of people over 60 years of age is expected to increase by 40% over the next 40 years, it is clear that there is a critical need for adequate detection and urgent treatment of osteoporosis in elderly fragility fracture patients.

Encouragingly, Hooven *et al.* (2005) and Bessette *et al.* (2008) reported an increase in the likelihood of treatment following a fracture with increasing age. Once again the use of a survey by Hooven *et al.* (2005) raises concerns over the representative nature of the sample due to the influence of non-response bias, and the impact on validity of recall bias. The internal validity is also affected because the critical question asked (Figure 3) could have been interpreted in varying ways by the patients. Often different medications are known by several generic brand names, and confusion may have arisen if patients had experienced fragility fractures before the fracture in question. The use of a postal as opposed to an interviewer led survey resulted in the authors not being able to clarify such inherent ambiguities, and there is no evidence of a pilot study having been used to pre-empt such difficulties.

Whilst the focus on a predominantly white female population from one medical centre

Question:
 'Has a physician ever prescribed (name of medication) for you?'

Response Options

- Yes, before my fracture only
- Yes, after my fracture only
- Yes both before and after my fracture
- No
- Cannot recall

Figure 3 Critical question used in survey by Hooven *et al.* (2005)

reduces the generalisability of the authors' findings that a sizeable intervention opportunity exists for patients with a fracture history, the study has merits in its sample size of 311 patients and the inclusion of patients over an extended time period of two years.

Despite the fact that postmenopausal females are often regarded as the population subset most at risk of osteoporosis, it is increasingly being recognised as an important cause of morbidity and mortality on older men. Given that the long term risk of subsequent fracture and diagnostic and therapeutic recommendation are the same in both genders, it is important to note that Freedman *et al.* (2008), for example, concluded that there is a significant deficiency in care in males in particular. Though their use of only 156 predominantly male participants from a military retiree population in a single US healthcare system limits the generalisability of this conclusion, their findings were confirmed by Suhm *et al.* (2008) who included over 3000 patients across eight healthcare centres in Switzerland.

Discussion

The findings of this review are in accordance with the previous reviews of 2004 and 2006, but differ in that the focus was exclusively on individuals over 50 years of age. Furthermore, all of the studies included were conducted since 2006, when pharmacologic approaches to fracture reduction are no longer regarded as in transition, but have been reinforced through published guidance.

Several factors may contribute to missed opportunities in osteoporosis management for patients presenting with fragility fractures. As Ferrari (2008) suggests, the fragmented delivery of care – where the role of the orthopaedic surgeon is to 'fix' the fracture, the geriatricians' to manage any potential systemic complications, and the primary care physicians' to rehabilitate the patient and facilitate their return to a normal degree of function – may result in blurred lines of responsibility for the initiation of osteoporosis treatment.

A perception that orthopaedic surgeons were not well attuned to osteoporosis care led the Bone and Joint Decade and the International Osteoporosis Foundation to survey 3422 orthopaedic surgeons in France, Germany, Italy, Spain,

the UK and New Zealand in 2004. The authors concluded that the orthopaedic surgeon, as often the only physician seen by the fracture patient, has a unique opportunity to assess the risk of future fractures and initiate treatment if required and thus they must be provided with more educational opportunities regarding appropriate care (Dreinhöfer *et al.*, 2004). However in a UK survey of 230 surgeons and general practitioners by Chami *et al.* (2006), only 17% of orthopaedic surgeons said they would initiate treatment or refer a 55-year old women with a low-trauma wrist fracture to the appropriate service. A similar survey at the Mayo Clinic found orthopaedic surgeons favoured addressing osteoporosis with patients if necessary, but advocated the use of a nurse practitioner so that the onus would not rest solely with them (Simonelli *et al.*, 2002).

Harrington *et al.* (2005) argue that weaker interventions that simply overlay traditional care, such as the education of busy physicians, have failed in many healthcare systems. Therefore they implemented a four-year clinical improvement project in a US health system using evidence-based guidelines and rapid cycle process improvement methods (plan-do-study-act cycles). Their adoption of a multi-faceted approach, incorporating a nurse centred management program, direct referral from orthopaedics to an osteoporosis care service, clinical process management software, telephone monitoring, and algorithms to define care and provider roles, was found to be highly effective in addressing the care gap of osteoporotic patients, and may have applicability to the UK.

Rather than passing responsibility between the orthopaedic surgeon and primary care physician, consistent and continuous collaboration between healthcare professionals is more likely to be effective in promoting appropriate osteoporosis care. In 2003, an Ontario initiative known as the 'Fracture? Think Osteoporosis' Program, aimed to reduce the rate of future fractures in patients presenting with fragility fractures by improving osteoporosis recognition and treatment. It involved education of the geriatric and rehabilitation teams, including one-on-one and group-based sessions, and since its launch the initiation of secondary anti-resorptive therapy has substantially improved. Again, the approach may have utility in the UK.

Beyond the lack of sufficient education amongst physicians as a root cause of the deficiency in care, Simonelli *et al.* (2002) found that the most frequently indicated factors limiting the treatment of presumed osteoporosis in post-fracture patients were concerns about medication adverse effect and cost. Yet a cost effectiveness analysis by Borgström *et al.* (2009), assuming a willingness to pay for a quality-adjusted life years of £30 000, concluded that a prior fragility fracture was a sufficiently strong risk factor to indicate that treatment was cost-effective from the age of 65 years – even in women in whom BMD was not known. Such issues require to be addressed by appropriately tailored education to health professionals.

However, whilst many prospective clinical trials have demonstrated the efficacy and cost effectiveness of bisphosphonates, an increasing number of studies have concluded that compliance with this treatment in normal practice might differ from that in the trials (Andrade *et al.*, 1995; McClung, 2001). Only approximately 1% of bisphosphonates are absorbed during oral ingestion, and due to their action as chelators for mineral ions, they easily form complexes with mineral ions in the diet. Therefore there are many restrictions for the ingestion of these drugs – such as being taken on an empty stomach, without milk, and with the patient advised to remain in an upright position for 30 to 60 min after consumption. As Kamatari *et al.* (2007) found, it was these restrictions that resulted in the poor compliance rates for the majority of patients. Furthermore, three types of adverse effects are associated with some or all bisphosphonates: renal toxicity, acute-phase reactions and gastrointestinal disorders. More recently, osteonecrosis of the jaw has also emerged as a growing issue (Diel *et al.*, 2007). In light of these adverse effects, it is important to remember the demographics of the patient population under discussion – in whom polypharmacy is an increasing concern and multiple comorbidities are likely to be present. The impact of such factors, which would have remained hidden, in many of the studies included here, need to be fully investigated.

Nonetheless, the National Osteoporosis Foundation guidelines explicitly indicate that all postmenopausal women who experience a low-impact fracture deserve attention to osteoporosis, and

therapy may be offered without BMD testing if necessary. With the availability, accuracy and relative inexpensive nature of diagnostic modalities and the high efficacy of antiosteoporotic drugs, there is a clear need to recognise the possible presence of osteoporosis underlying fragility fractures. Subsequent initiation of the necessary treatment has the potential to dramatically reduce the detrimental impact of osteoporosis on the morbidity and mortality of our elderly population. The advent of more recent therapies, such as the fully human monoclonal antibody Denosumab, which is currently being studied, may offer further effective treatment avenues for postmenopausal osteoporosis (McClung *et al.*, 2006). The potential economic impact must also be considered – in the UK more than £1.7 billion a year is spent on social and acute care for treating the current level of osteoporotic fractures, and this is expected to increase to £2.1 billion by 2010 with an ageing population (Nice Guidelines, 2003).

Of particular relevance to UK primary care, the National Orthopaedic Society has campaigned since 2005 against the omission of osteoporosis from quality and outcomes framework (QOF) guidelines. In the latest QOF review, an independent expert panel considered the evidence and agreed that including some osteoporosis indicators in the QOF was necessary on both clinical and cost effectiveness grounds. However, in the face of a lack evidence from the UK the reviewers eventually concluded that future research was required to more clearly delineate the true extent any deficiencies of osteoporosis care in this country. Such research must include a detailed exploration the barriers to adhering to current guidelines, and a search for the precise reasons for any treatment gap identified. Only then can guidelines be improved and treatment delivery optimised.

In conclusion, the changing demographics of our population and increasing workload and financial pressures on the National Health Service, means it would be perilous to ignore the growing tide of the ‘silent epidemic’ of osteoporosis. The consistently low-intervention rates reported in all of the seven studies appraised to provide evidence that elderly individuals in the US and Switzerland who experience fragility fractures are still not receiving adequate investigation or treatment for osteoporosis. Further

research is needed as a matter of priority to describe the situation in the UK.

References

- Andrade, S.E., Walker, A.M., Gottlieb, L.K., Hollenberg, N.K., Testa, M.A., Saperia, G.M. and Platt, R.** 1995: Discontinuation of antihyperlipidemic drugs: do rates reported in clinical trials reflect rates in a primary care setting? *New England Journal of Medicine* 332, 1125–31.
- Andrade, S.E., Majumdar, S.R., Chan, K.A., Buist, D.S., Go, A.S., Goodman, M., Smith, D.H., Platt, R. and Gurwitz, J.H.** 2003: Low frequency of treatment of osteoporosis among postmenopausal women following a fracture. *Archives of Internal Medicine* 163, 2052–57.
- Besette, L., Ste-Marie, L.G., Jean, S., Davison, K.S., Beaulieu, M., Baranci, M., Bessant, J. and Brown, J.P.** 2008: The care gap in diagnosis and treatment of women with a fragility fracture. *Osteoporosis International* 9, 79–86.
- Borgström, F., Ström, O., Coelho, J., Johansson, H., Oden, A., McCloskey, E.V. and Kanis, J.** 2009: The cost-effectiveness of risendronate in the UK for the management of osteoporosis using the FRAX(R). *Osteoporosis International* [Epub ahead of print].
- Brown, M.A. and Bradio, N.** 2000: Cost effectiveness of bone density measurement. *Journal of the British Menopause Society* 7, 130–35.
- Bush, G.W.** 2002: *Nation Bone and Joint Decade Proclamation*. Office of the Press Secretary, 22 March 2002.
- Chami, G., Jeys, L., Freudmann, M., Connor, L. and Siddiqi, M.** 2006: Are osteoporotic fractures being adequately investigated? a questionnaire of GP and orthopaedic surgeons. *BMC Family Practice* 7, 7.
- Diel, I., Bergner, I. and Grötz, K.** 2007: Adverse effects of bisphosphonates: current issues. *Journal of Supportive Oncology* 5, Retrieved 20 September 2009 from <http://www.supportiveoncology.net/journal/articles/0510475.pdf>.
- Dreinhöfer, K.E., Féron, J.M., Herrera, A., Hube, R., Johnell, O., Lidgren, L., Miles, K., Panarella, L., Simpson, H. and Wallace, W.A.** 2004: Orthopaedic surgeons and fragility fractures. A survey by the bone and joint decade and the international osteoporosis foundation. *Journal of Bone and Joint Surgery British volume* 86, 958–61.
- Elliot-Gibson, V., Bogoch, E.R., Jamal, S.A. and Beaton, D.E.** 2004: Practice patterns in the diagnosis and treatment of osteoporosis after a fragility fracture: a systematic review. *Osteoporosis International* 15, 767–78.
- Epstein, S. and Goodman, G.R.** 1999: Improved strategies for diagnosis and treatment of osteoporosis. *Menopause* 6, 242–50.
- Ferrari, S.** 2008: Secondary prevention of osteoporotic fractures: why not apply the evidence? *Swiss Medical Weekly* 138, 674–83.
- Primary Health Care Research & Development* 2010; **11**: 155–165
- Freedman, B.A., Potter, B.K., Nesti, L., Giuliani, J., Chadwick, H. and Kuklo, T.** 2008: Osteoporosis and vertebral compression fractures-continued missed opportunities. *The Spine Journal* 8, 756–62.
- Gehlbach, S.H., Avrunin, J.S., Puleo, E. and Spaeth, R.** 2007: Fracture risk and antiresorptive medication use in older women in the USA. *Osteoporosis International* 18, 805–10.
- Giangregorio, L., Papaioannou, A., Cranney, A., Zytaruk, N. and Adachim, J.D.** 2006: Fragility fractures and the osteoporosis care gap: an international phenomenon. *Seminars in Arthritis Rheumatism* 35, 293–305.
- Harrington, J.T., Barash, H.L., Day, S. and Lease, J.** 2005: Redesigning the care of fragility fracture patients to improve osteoporosis management: a health care improvement project. *Arthritis Rheumatism* 53, 198–204.
- Hooven, F., Gehlbach, S.H., Pekow, P., Bertone, E. and Evan, B.** 2005: Follow up treatment for osteoporosis after fracture. *Osteoporosis International* 16, 296–301.
- Kamatari, M., Koto, S., Ozawa, N., Urao, C., Suzuki, Y., Akasaka, E., Yanagimoto, K. and Sakota, K.** 2007: Factors affecting long-term compliance of osteoporotic patients with bisphosphonate treatment and QOL assessment in actual practice: alendronate and risendronate. *Journal of Bone Mineral Metabolism* 25, 302–09.
- Khaw, K.T.** 1999: How many, how old, how soon? *British Medical Journal* 319, 13500–502.
- Marsh, D., Simpson, H. and Wallace, A.** 2003: *The care of fragility fracture patients*. London: BOA.
- McClung, B. and McClung, M.** 2001: Pharmacologic therapy for the treatment and prevention of osteoporosis. *The Nursing Clinics of North America* 36, 433–40.
- McClung, M.R., Lewiecki, E.M. and Cohen, S.B.** 2006: Denosumab in postmenopausal women with low bone mineral density. *The New England Journal of Medicine* 354, 821–31.
- NICE Guidelines.** 2003: Osteoporosis: assessment of fracture risk and the prevention of osteoporotic fractures in individuals at high risk. [Online]. Retrieved 12 November 2008 from <http://www.nice.org.uk/guidance/index.jsp?action=byID&r=true&o=11621>
- NICE Guidelines.** 2008: Osteoporosis: secondary prevention (replaced by TA161). [Online]. Retrieved 12 September 2009 from <http://guidance.nice.org.uk/TA87>
- National Osteoporosis Foundation.** 1999: Physicians' Guide to Prevention and Treatment of Osteoporosis. [Online]. Retrieved 26 November 2008 from <http://www.nof.org/physguide.htm>
- Nixon, M.F., Ibrahim, T., Johari, Y., Eltayef, S., Hariharan, T. and Taylor, G.J.** 2007: Managing osteoporosis in patients with fragility fractures: did the British Orthopaedic Association guidelines have any impact? *Annals of the Royal College of Surgeons of England* 89, 504–509.
- Papaioannou, A., Kennedy, C.C., Ioannidis, G., Gao, Y., Sawka, A.M., Goltzman, D., Tenenhouse, A., Pickard, L., Olszynski, W.P., Davison, K.S., Kaiser, S., Josse, R.G., Kreiger, N., Hanley, D.A., Prior, J.C., Brown, J.P.,**

- Anastassiades, T.** and **Adachi, J.D.** 2008: The osteoporosis care gap in men with fragility fractures: the Canadian multicentre osteoporosis study. *Osteoporosis International* 19, 581–87.
- Perreault, S., Dragomir, A., Desgagné, A., Blais, L., Rossignol, M., Blouin, J., Moride, Y., Ste-Marie, L.G.** and **Fernandès, J.C.** 2005: Trends and determinants of antiresorptive drug use for osteoporosis amongst elderly women. *Pharmacoepidemiology Drug Safety* 14, 685–95.
- Prasad, N., Sunderamoorthy, D., Martin, J.** and **Murray, J.M.** 2006: Secondary prevention of fragility fractures: are we following the guidelines? Closing the audit loop. *Annals of the Royal College of Surgeons of England* 88, 470–74.
- Simonelli, C., Killeen, K., Mehle, S.** and **Swanson, L.** 2002: Barriers to osteoporosis identification and treatment among primary care physicians and orthopedic surgeons. *Mayo Clinic Proceedings* 77, 334–38.
- Suhm, N., Lamy, O.** and **Lippuner, K.** 2008: Management of fragility fractures in Switzerland: results of a nationwide survey. *Swiss Medical Weekly* 138, 656 [Early Online Publication]. Retrieved 14 November 2008 from [http://74.125.77.132/search?q=cache:07liX4yn57YJ:www.smw.ch/docs/pdf200x/2008/45/smw-12294.PDF+Suhm,+N.,+Lamy,+O.,+Lippuner,+K+\(2008\).+Management+of+fragility+fractures+in+Switzerland:+results+of+a+nationwide+survey.+Swiss+Medical+Weekly&hl=en&ct=clnk&cd=2](http://74.125.77.132/search?q=cache:07liX4yn57YJ:www.smw.ch/docs/pdf200x/2008/45/smw-12294.PDF+Suhm,+N.,+Lamy,+O.,+Lippuner,+K+(2008).+Management+of+fragility+fractures+in+Switzerland:+results+of+a+nationwide+survey.+Swiss+Medical+Weekly&hl=en&ct=clnk&cd=2)