

Multinational survey of osteoporotic fracture management

Karsten E. Dreinhöfer · Mary Anderson
Jean-Marc Féron · Antonio Herrera · Robert Hube
Olof Johnell · Lars Lidgren · Kim Miles
Umberto Tarantino · Hamish Simpson
W. Angus Wallace

Received: 4 June 2004 / Accepted: 9 June 2004 / Published online: 16 September 2004
© International Osteoporosis Foundation and National Osteoporosis Foundation 2004

Abstract Osteoporosis is characterized by a decreased bone mass and an increased bone fragility and susceptibility to fracture. Patients with a fragility fracture at

any site have an increased risk of sustaining future fractures. Orthopedic surgeons manage most of these fractures and are often the only physician seen by the patient. Mounting evidence that orthopedic surgeons are not well attuned to osteoporosis led the Bone and Joint Decade (BJD) and the International Osteoporosis Foundation (IOF) to survey 3,422 orthopedic surgeons in France, Germany, Italy, Spain, the United Kingdom, and New Zealand. The majority of the respondents in all countries had the opinion that the orthopedic surgeon should identify and initiate the assessment of osteoporosis in patients with fragility fractures. Heterogeneous practice patterns exist in different countries; however, identification and treatment of the osteoporotic patient seems to be insufficient in many areas: half of the orthopedic surgeons surveyed received little or no training in osteoporosis. Only approximately one in four orthopedic surgeons in France, the UK and New Zealand regarded themselves as knowledgeable about treatment modalities. Less than one-fifth of the orthopedic surgeons arranged for a surgically treated patient with a fragility fracture to have a bone mineral density (BMD) test. Twenty percent said that they never refer a patient after a fragility fracture for BMD. Only half of the orthopedic surgeons in southern Europe know about the importance of some external risk factors for hip fractures (cataracts, poor lighting, pathway obstacles, poor balance). In summary, this survey clearly indicates that many orthopedic surgeons still neglect to identify, assess and treat patients with fragility fractures for osteoporosis. More educational opportunities need to be offered to orthopedic surgeons through articles, web-based learning and educational seminars. Development of a simple clinical pathway from evidence-based guidelines is an important step to ensure that optimal care is provided for patients with fragility fractures.

K.E. Dreinhöfer (✉)
Department of Orthopaedics, Rehabilitationskrankenhaus,
Ulm University, Oberer Eselsberg 45,
89081 Ulm, Germany
E-mail: karsten.dreinhoefer@medizin.uni-ulm.de
Tel.: +49-731-1771112
Fax: +49-731-1771118

M. Anderson
International Osteoporosis Foundation,
Mill Valley, California, USA

J. Féron
Service de Chirurgie orthopédique et traumatologique,
Hopital Tenon, Paris, France

A. Herrera
Servicio de Cirugía Ortopédica y Traumatología,
Hospital Universitario “Miguel Servet”,
Zaragoza, Spain

R. Hube
Department of Orthopaedic Surgery,
Martin-Luther University, Halle, Germany

O. Johnell
Department of Orthopaedics, Malmö General Hospital,
Malmö, Sweden

L. Lidgren
Department of Orthopaedics,
Lund University, Lund, Sweden

K. Miles
New Zealand Orthopaedic Association,
Wellington, New Zealand

U. Tarantino
Department of Orthopaedic Surgery,
University of Rome, Rome, Italy

H. Simpson
Department of Orthopaedics, University of Edinburgh,
Edinburgh, UK

W. Wallace
Department of Orthopaedics, University Hospital,
Queen’s Medical Centre, Nottingham, UK

Keywords Bone density · Fractures/etiology/
*prevention and control (*physician’s practice
patterns) · Orthopedics · Osteoporosis/diagnosis/

*prevention and control (*physician's practice patterns) · Osteoporosis · Postmenopausal/drug therapy

Introduction

Osteoporosis reduces bone strength, which results in fragility fractures. The diagnosis of osteoporosis is based on a bone mineral density (BMD) measurement, and low BMD is associated with an increased risk of fracture [1]. Osteoporotic fractures are characterized by a low-impact trauma and can occur in every bone, femoral neck, vertebral, and distal radius fractures being the most common. Low-energy fractures of the pelvis, around the knee, ankle and shoulder are all strongly influenced by the presence of osteoporosis, and all should now be considered as potentially osteoporosis-related fractures. The likelihood of sustaining these fragility fractures increases with age: 90% of patients with hip fracture are above 65 years of age. Age-related loss of BMD and falls are the most common causes of hip fractures [2].

Fragility fractures are a major risk factor for future events: following the first fracture, patients have a four-to-five times increased risk of experiencing additional fractures within the next year [3, 4]. Treatment of osteoporosis with estrogens, bisphosphonates, SERMs or calcitonin has been shown in large randomized controlled trials to increase BMD and reduce fracture risk [5]. Clinical trials have demonstrated that treatment of patients with fragility fractures with such agents can reduce the risk of future fractures by up to 50% [5, 6]. However, recent reports [7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17] suggest that orthopedic surgeons still neglect to identify, assess and treat such patients for osteoporosis.

To further determine this, the Bone and Joint Decade (BJD) and the International Osteoporosis Foundation (IOF) initiated a multinational survey of the current care of osteoporotic fracture patients in a range of countries with different health care systems in Europe (France, Germany, Italy, Spain, the UK) and New Zealand.

Material and methods

The presidents of the national orthopedic societies [the British Orthopaedic Association (BOA), Deutsche

Gesellschaft für Orthopädie und Orthopädische Chirurgie (DGOOC), Sociedad Española de Cirugía Ortopédica y Traumatología (SECOT), Società Italiana di Ortopedia e Traumatologia (SIOT), La Société Française de Chirurgie Orthopédique et Traumatologie (SOFOT) and the New Zealand Orthopaedic Association (NZOT)] were invited to participate in and coordinate the survey within their membership. A questionnaire was developed by a working group of national project coordinators, based, to some extent, on an American survey [18]. The questionnaire was translated into the national language and distributed to the members of the societies. The optimal method for national distribution of the survey was determined by the national project coordinator. Anonymous responses were collected nationally and analyzed centrally.

There were 3,422 orthopedic surgeons that participated, representing approximately every fourth (20%–28%) member from the European societies, and a 70% response rate from New Zealand (Table 1). The percentage of female participants was 26% in Germany and 12% in Spain, but much lower in Italy (6%), UK (3%), New Zealand (3%), and France (1%). The majority of respondents were experienced physicians; more than 70% had completed their training more than 10 years ago. More than half of the orthopedic surgeons surveyed said they had received no or insufficient training in osteoporosis; only in Italy and Spain did two-thirds of the respondents claim to receive moderate or a lot of training (Fig. 1).

The working environment varied: two-thirds of the respondents worked in a hospital; 13% had an academic affiliation. There were large differences between countries: in Germany and France approximately 40% were in private practice, whereas the majority in Italy and Spain worked in a hospital setting. Most of the orthopedic surgeons in the UK and New Zealand practiced partly in a private setting and partly in a hospital (Fig. 2).

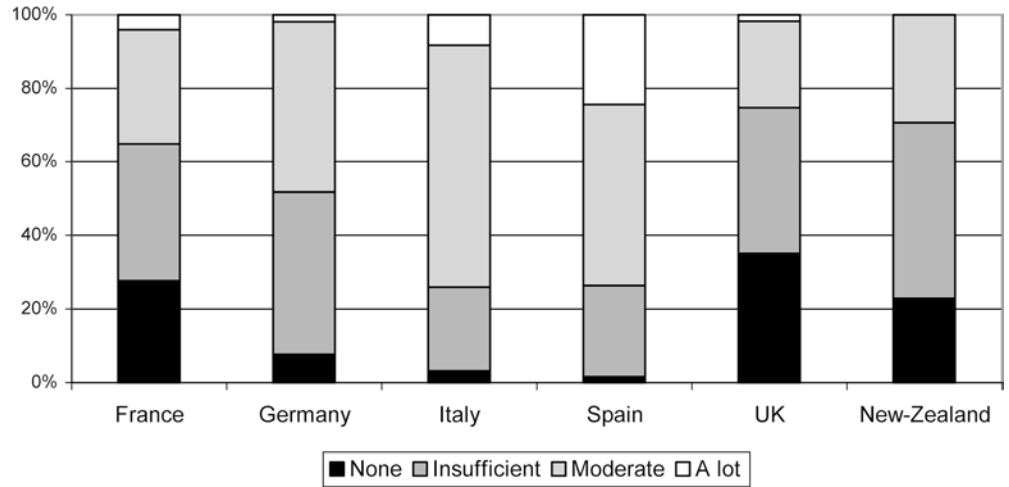
Results

Most of the surgeons in France and Germany worked in private practice where they treat fewer than 20 patients per month with a fragility fracture, while in the other countries, on average, 20–50 patients were seen. In the UK every fourth respondent worked in a clinical setting

Table 1 Demographic characteristics of participants in the survey

Country	Total number of society members	Number of participants	Percentage of society members	Percentage of survey participants
France (SOFOT)	1,500	326	22	9.5
Germany (DGOOC/BVO)	5,700	1,132	20	33.1
Italy (SIOT)	4,000	983	25	28.7
Spain (SECOT)	1,800	403	22	11.8
United Kingdom (BOA)	1,682	466	28	13.6
New Zealand (NZOT)	160	112	70	3.3

Fig. 1 Amount of formal training in osteoporosis treatment



where 50–100 fragility fractures were treated every month. In Spain, the UK and New Zealand each survey respondent personally treated, on average, 11–15 patients per month with a fragility fracture, while in Germany, Italy and France, on average, six to ten patients were seen.

While in France, the UK and New Zealand 80% of the orthopedic surgeons do not prescribe any medication for osteoporosis, 60% of the respondents in Italy and Spain prescribed medication for one to ten patients a month. Nearly 40% of the orthopedic surgeons in Germany prescribe osteoporosis medication for one to ten patients a month, 20% for one to 20 patients and another 30% for more than 20 patients a months (Fig. 3).

Densitometry is reported as being reasonably accessible; in all countries fewer than 10% of the respondents reported that they do not have access to bone mineral densitometry in their facility or neighborhood. Periph-

eral densitometry units (66%) are most accessible in all countries except Spain; however, total body densitometry units are almost as accessible (60%). Quantitative computer assisted tomography (39%) and quantitative ultrasound (22%) are less readily available. In Spain total body densitometry and quantitative computer assisted tomography are the most accessible BMD technologies (Fig. 4).

The approach to treatment of osteoporosis is quite different between countries: the majority of the respondents in all countries believed that the orthopedic surgeon should identify and initiate the assessment of osteoporosis in patients with fragility fractures (Fig. 5). However, only 10% of the orthopedic surgeons in most of the countries make sure that a surgically treated patient with a fragility fracture is referred for a bone density test. Approximately 20% report that they never refer a patient after such a fracture for BMD-testing. Only in Germany do the participating surgeons report

Fig. 2 Workplace of participants in the survey

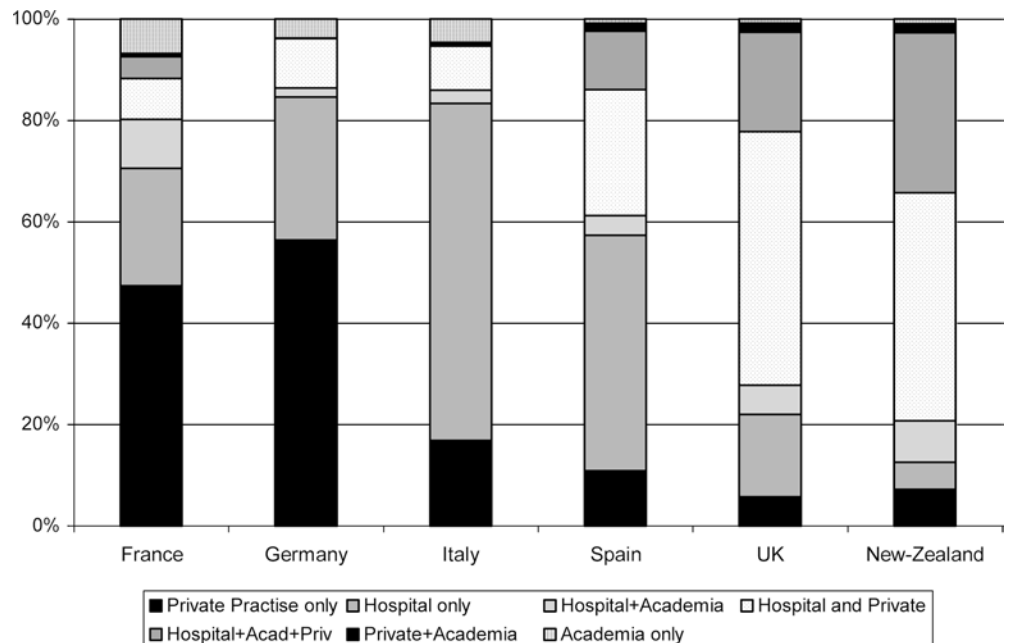


Fig. 3 Number of patients for whom each participant prescribed medication for osteoporosis per month

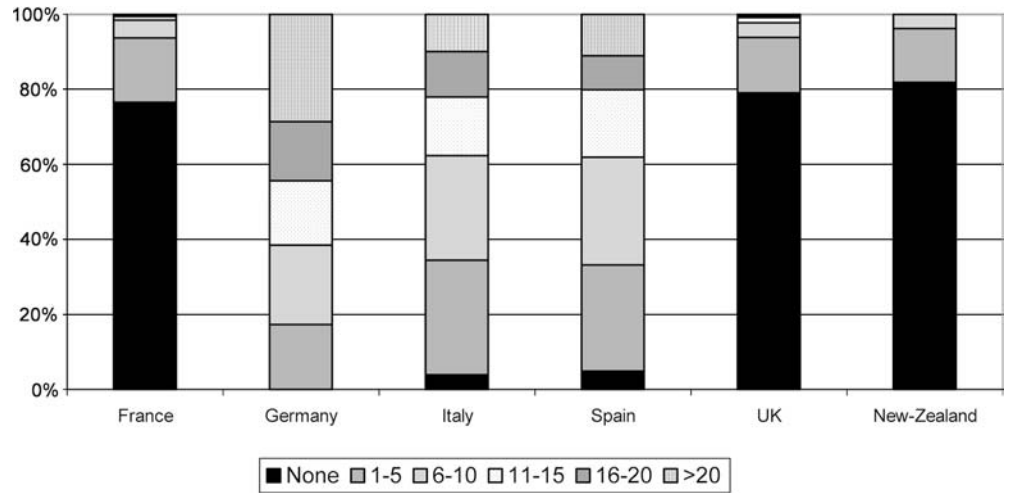


Fig. 4 Access to bone mineral densitometry facilities in hospital or town (QCT quantitative computer assisted tomography)

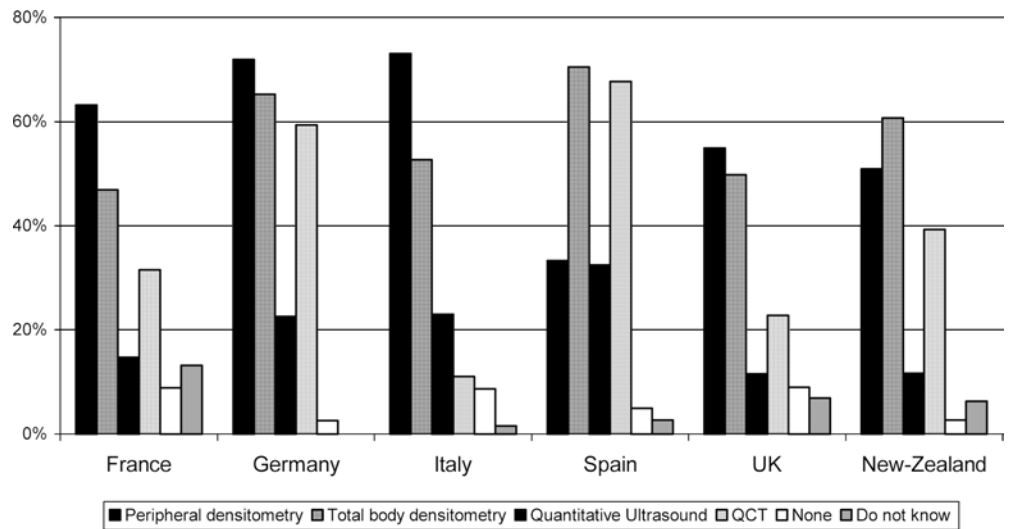


Fig. 5 Responsibility for initiation of assessment of osteoporosis in patients with fragility fractures

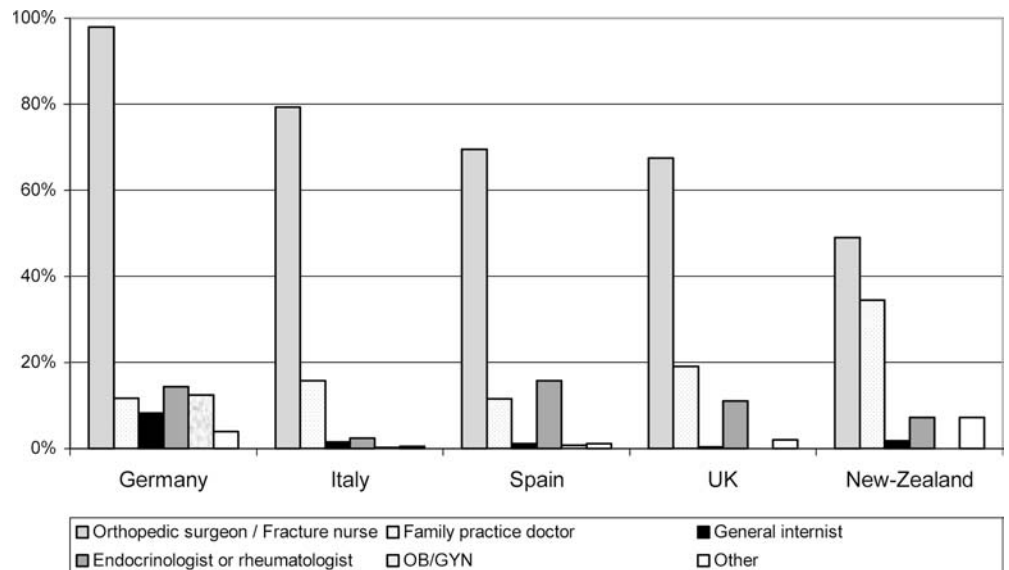
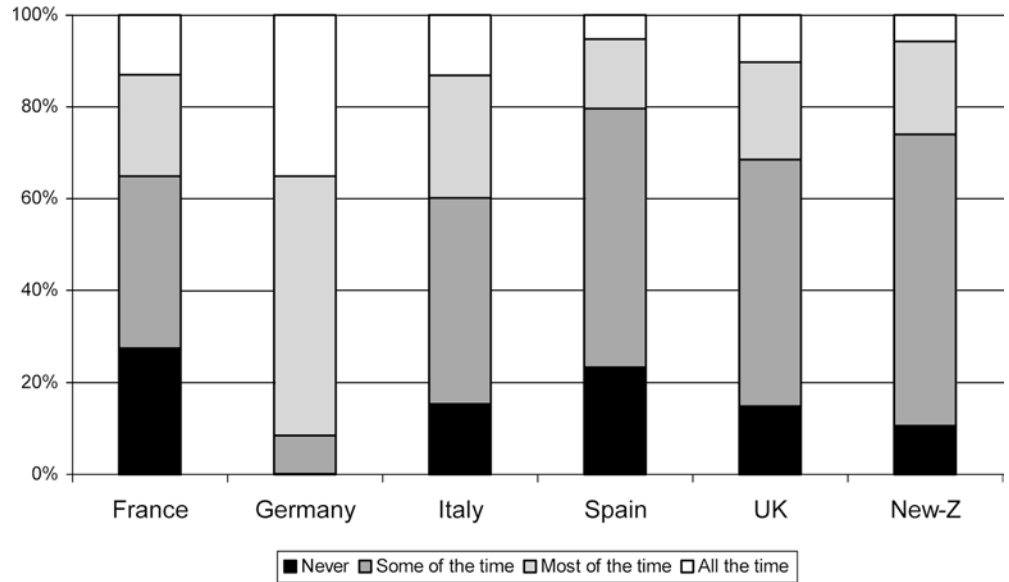


Fig. 6 Frequency of patient referral for a bone density test after surgical treatment of a fragility fracture



that the vast majority of their fracture patients are always (30%) or most of the time (60%) referred for a bone density test (Fig. 6).

If osteoporosis is suspected in a patient, most surgeons in France, the UK and New Zealand would refer the patient to an osteoporosis specialist or general practitioner [GP], while more than 80% of the surgeons in Germany and Italy would initiate a bone density test themselves (Fig. 7). If a patient comes to a surgeon with a bone density test showing osteoporosis, treatment will be started by most of the surgeons in Germany, Italy and Spain while the vast majority of surgeons in France, the UK and New Zealand will refer the patient to their GP or osteoporosis specialist (Fig. 8).

Approximately 25% of the orthopedic surgeons in France, the UK and New Zealand felt knowledgeable about managing osteoporosis, compared to more than 80% in Germany and Spain (Fig. 9). Only every second orthopedic surgeon in France and Italy knows about the importance of some of the recognized external risk fac-

tors for hip fractures (cataract, poor lighting, uneven carpet, poor balance); in addition, there were also a lot of misconceptions in countries such as Germany and Spain, where surgeons felt they were knowledgeable about osteoporosis.

The majority of surgeons in our survey recommended a baseline bone density test for a woman aged 50 years without risk factors or fracture, indicating a clear lack of knowledge about the current indications for BMD-testing; BMD determination should be targeted towards patient with risk factors – those with the highest 10-year absolute fracture probability. While more than 90% of the surgeons in Germany, Italy and Spain are in favor of such a procedure, in France (29%), New Zealand (34%) and the UK (39%) a large number would not recommend densitometry in such a case.

Calcium and vitamin D are used most often for treating patients with osteoporosis, especially in Germany (>90%), but by only approximately half of the surgeons in France, the UK and New Zealand (Fig. 10).

Fig. 7 Action initiated for a patient with suspected osteoporosis

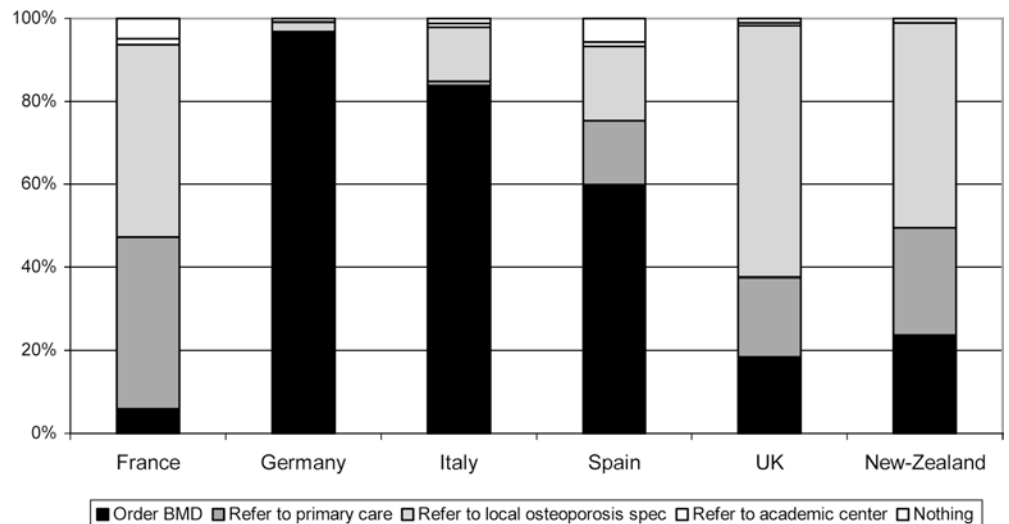


Fig. 8 Action initiated for a patient with a bone density test report showing osteoporosis and requesting treatment

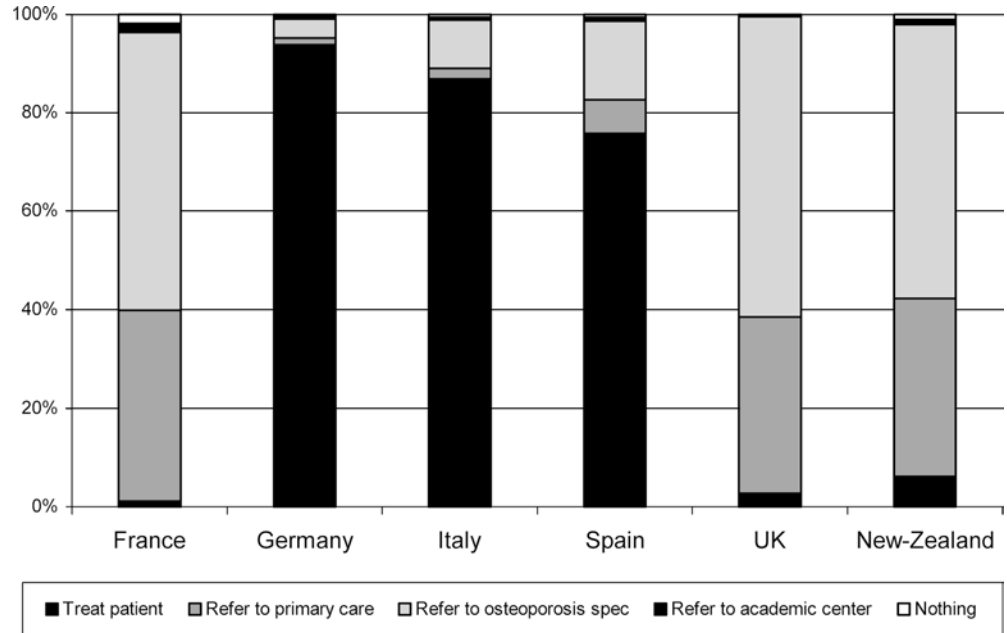
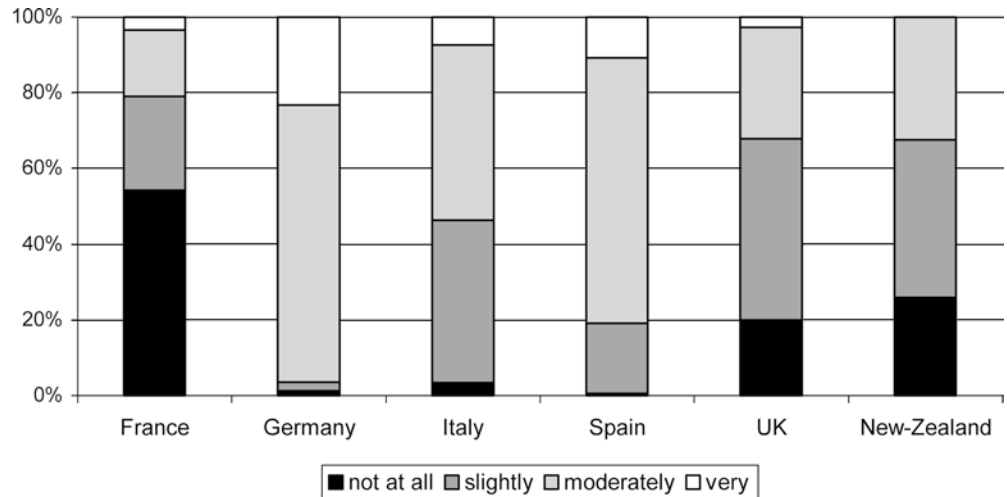


Fig. 9 Self-estimation of knowledge in managing patients with osteoporosis



Bisphosphonates are used by most surgeons in Germany (87%), Italy (92%) and Spain (72%), but by a much smaller number in the UK (38%), New Zealand (44%) and France (36%). Raloxifene (SERMs) is frequently used by orthopedic surgeons in Germany (53%), and calcitonin in Spain (44%) and France (30%). In the remaining countries those medications have no major impact (<20%). Most of the surgeons in Germany, Italy and Spain felt competent in prescribing calcium/vitamin D and bisphosphonates, compared to fewer than 50% of their colleagues in France, the UK and New Zealand.

The majority of orthopedic surgeons in all countries was interested in learning more about the diagnosis and management of osteoporosis-related fractures. Most of the respondents preferred seminars, journals, CD-ROMs and website-based information. E-based learning was most popular in France. There was very little interest

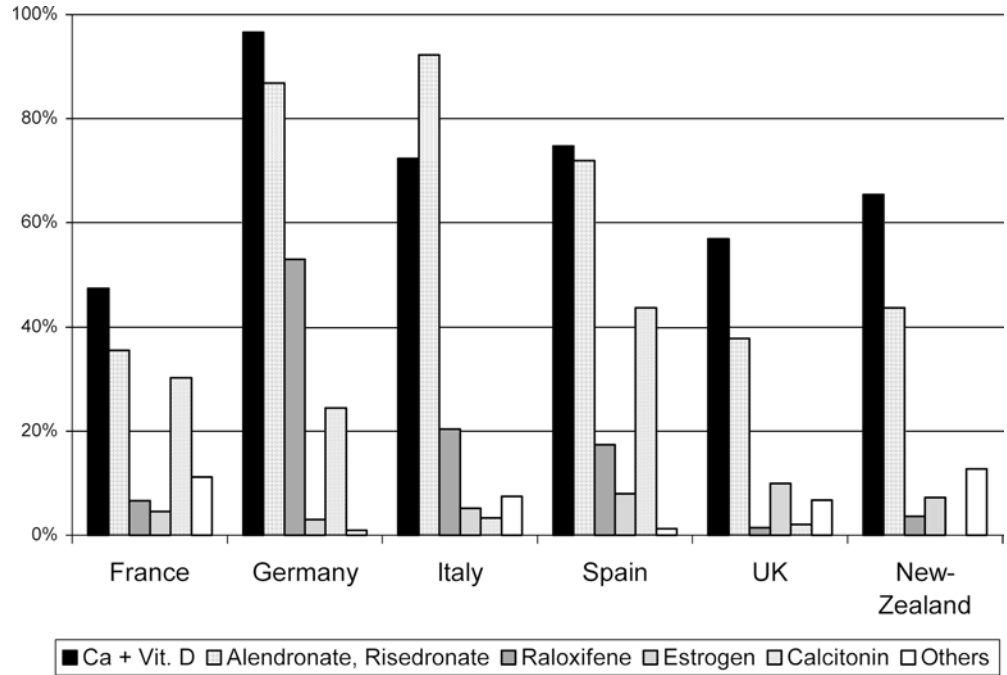
by the participants in all countries in direct information from pharmaceutical representatives (<15%).

The national osteoporosis societies and the services they offer were only well known in two of the six countries (Germany and the UK).

Discussion

Every second woman and every third man over age 50 will suffer from an osteoporosis-related fracture in their lifetime. Patients with a low-energy fracture of the wrist, hip, proximal humerus or ankle have a nearly four-times greater risk of future fractures than individuals who have never experienced a low-energy fracture [3]. Furthermore, randomized controlled trials have shown up to a 50% fracture reduction, after pharmacological interventions, in patients with a prior fracture.

Fig. 10 Medication used most often for treating patients with osteoporosis



Orthopedic surgeons manage most of these fragility fractures. Indeed, the orthopedic surgeon is usually the first, and often the only, physician seen by the fracture patient. However, recent reports [7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17] suggest that many orthopedic surgeons still neglect to identify, assess and treat such patients for osteoporosis.

The present survey reflects the current status of orthopedic approaches to osteoporosis in patients with fragility fractures in different countries and healthcare systems. In summary, this survey reflects surgeons who each month are (a) treating between 54,000 and 140,000 fragility fractures in their unit, (b) treating between 35,000 and 57,000 fractures themselves, and (c) prescribing osteoporosis medication for 29,000 to 46,000 patients. We are aware of the selection bias, since only one in four European orthopedic surgeons responded to the survey. Additionally, the surgeons who responded have probably already positively selected themselves—therefore, the real lack of knowledge about osteoporosis is most likely underestimated.

Obviously heterogeneous practice patterns exist in the different countries. While most of the orthopedic surgeons in five of the countries focus their professional attention mainly on surgical fracture intervention, in Germany a large segment of the orthopedic community works outside the hospital setting, treating patients with musculoskeletal conditions non-operatively and referring surgical cases to orthopedic clinics within hospitals. In France, New Zealand and the UK the non-operative segment of patient care for musculoskeletal conditions is dominated by general practitioners and rheumatologists, while in Spain and Italy many orthopedic surgeons also take care of pharmaceutical intervention. This is reflected in the present survey in the different number of

patients seen with fragility fractures and the heterogeneous pattern with respect to medical treatment. Most of the orthopedic surgeons in Germany, Italy and Spain (98%, 77% and 57%, respectively) believe that they should treat patients with osteoporosis; however, only a few do so in the UK, France and New Zealand (16%, 7% and 6%). In those countries responsibility for treatment is that of family-practice doctors, rheumatologists and endocrinologists.

The majority of respondents in all countries stated that the orthopedic surgeon should identify and initiate the assessment of osteoporosis in patients with fragility fractures. However, only 10% indicated that they always ensure that a patient with a fragility fracture is referred for a bone density test. This is concordant with some other current reports.

Despite the evidence in support of assessing and treating patients for osteoporosis after they have sustained a fragility fracture, up to 95% of fracture patients are discharged without adequate determination of the cause of the fracture. Some recently published reports [7, 9, 10, 11, 12, 13, 16, 17] indicate that the majority of patients with recent fractures have not been assessed for low BMD.

A survey of 56 Danish orthopedic surgery departments revealed that only seven (13%) referred their patients with a low-energy fracture for a bone density scan [19]. Gardner et al. retrospectively analyzed 300 randomly selected patients with femoral neck fractures—no patient underwent a bone density scan while in the hospital [10]. Harrington and colleagues reviewed hip fracture patients of four US hospitals: bone densitometry was performed in 12%, 12%, 13%, and 24%, respectively [12]. Freedman and coworkers assessed 1,164 women who had sustained a fracture of the distal

radius and found that only 2.8% had undergone bone density testing [9]. Although the National Osteoporosis Foundation guidelines do indicate that individuals older than 70 years who have a fragility fracture can be treated for osteoporosis without undergoing a dual-energy X-ray absorptiometry (DEXA) scan, the current recommendation is to perform a DEXA scan at the start of treatment, in order to assess changes in bone mineral density over the next 1 to 2 years.

In the past the question of whether there is a sufficient number of bone density facilities has been raised; however, our survey indicates that nearly all of the responding surgeons had access to BMD testing facilities in their hospital or neighborhood. If availability is not a problem, awareness and responsibility of the treating surgeon is of fundamental importance for the optimal care of the patient.

Initiating interventions soon after a fragility fracture occurs may significantly reduce the incidence and severity of subsequent fractures. These interventions are based on three components: (1) prevention of falls, (2) injury site protection, and (3) pharmaceutical treatment of osteoporosis. Non-pharmacological interventions, such as individually tailored exercise programs and fall prevention programs, have been shown to reduce falls among the elderly [20, 21, 22]. Trochanteric padding and hip protectors have been shown to reduce hip fractures among those at highest risk [23]. Therapeutic agents, which reduce the risk of future fracture by as much as 50% in patients with existing fractures, should be considered [5, 6, 24, 25, 26, 27]. However, evidence shows that orthopedic surgeons still neglect to treat patients with fragility fractures for osteoporosis.

Only six of 56 Danish orthopedic surgery departments treated patients with a low-energy fracture for osteoporosis [19]. In an American study, 81% of 300 randomly selected patients with femoral neck fractures were discharged without medication targeting osteoporosis. Forty of those patients (13.3% of the overall group) received calcium and only 18 (6.0% of the overall group) received, at discharge, a medication to actively prevent bone resorption and treat osteoporosis [10]. In a different American study, Kiebzak et al. investigated 363 patients (110 men and 253 women) with a hip fracture: only 4.5% of the men and 27% of the women were discharged with any kind of treatment for osteoporosis [15]. Torgerson and Dolan also found that the majority of patients in the UK are not prescribed any pharmaceutical agent following an osteoporotic fracture. Only some patients (39%) with vertebral fractures received anti-resorptive medication; patients with hip fractures did not receive any medication. In the UK only vertebral fracture seems to be associated with an increase in the prescription of drugs for the secondary prevention of fractures, and even this was only seen in 39% of the cases studied [17]. In a retrospective analysis of 1,164 American women who had sustained a fracture of the distal radius only 22.9% were treated with at least one of the medications approved for established osteoporosis. There was a signif-

icant decrease in the rate of treatment for osteoporosis with increasing patient age at the time of the fracture [9].

In our survey, most orthopedic surgeons in Germany, Italy and Spain indicated that they will initiate treatment for osteoporosis themselves if a bone density test shows osteoporosis. Their colleagues in France, the UK and New Zealand would preferably refer these patients for further treatment. Independent of these national differences, it needs to be guaranteed that comprehensive treatment is initiated in patients with fragility fractures.

Thus, it is important that these patients receive appropriate operative treatment not only for the presenting fracture, but also for prevention of future fractures. Postmenopausal women and elderly men who present with an acute osteoporotic fracture are easy to target for assessment and initiation of treatment. Since the orthopedic surgeon is often the only physician seen by the fracture patient, the surgeon has a unique opportunity—and responsibility—to educate the fracture patient about the need to decrease the risk for future fractures [28, 29, 30, 31]. In a recent editorial in the *Journal of Bone and Joint Surgery (Br)* an extract of the results of this survey underlined the responsibility of orthopedic surgeons to prevent further fragility fractures [32].

Obviously, in this survey the majority of orthopedic surgeons questioned lacked sufficient training in osteoporosis. This is reflected, subjectively and objectively, by limited knowledge on osteoporosis management in most areas. Fortunately, the majority of orthopedic surgeons in all countries were interested in learning more about the management of osteoporosis. For this, focused educational opportunities need to be through articles, web-based learning and educational seminars. In addition, education about osteoporosis and related fractures needs to be appropriately integrated into the university curriculum and postgraduate training [33].

In addition, availability of both time and resources is limited for orthopedic surgeons. In a busy clinic, it is easy to dismiss the underlying cause and simply “treat the fracture” [34]. In such a setting, the concept of a fracture liaison nurse has been tried with much success in several countries. By playing a major coordinating role the nurse is able to ensure that the fragility fracture patient receives appropriate non-surgical treatment and care in addition to the fracture management [35]. This service will be different in different countries; it is, therefore, important to locally create a pathway for the assessment and treatment of osteoporosis, to guarantee the patient the best care. This pathway must make it easy and not time consuming for the orthopedic surgeon, to prevent the next fracture.

Until recently, appropriate intervention has also been hindered by the lack of a simple algorithm and an easy protocol for treating patients with fragility fractures. A recent report of the World Orthopaedic Osteoporosis Organisation (WOOO) has summarized “Recommendations for Care of the Osteoporotic Fracture Patient to Reduce the Risk of Future Fracture”, and developed a

clinical pathway to ensure optimal care is provided for patients with fragility fractures [36]. This provides a useful resource for national orthopedic associations to adapt for local use and implementation, as has already happened in countries such as the UK [37]. The WOOO Guidelines will further allow each hospital to develop an individualized “Fracture Care Pathway” involving all relevant parties, including the treating surgeon, and nursing and theatre staff, and also the general practitioner, social worker and physicians providing the local “Bone Treatment Service” and the “Falls Treatment Service”. Developing this Care pathway will have a profound public-health impact by decreasing the burden of future osteoporotic fractures. Several orthopedic organizations have begun to highlight this topic, including the BOA, which has recently published a “blue” book on “care of the fragility fracture patient”. Orthopedic associations in other countries are in the process of developing their own guidance, which leads us to believe that the future is encouraging for fragility fracture patients.

Acknowledgment The BJD and the IOF are grateful for the cooperation and input of the national organizations that participated in the survey: British Orthopaedic Association (BOA); Deutsche Gesellschaft für Orthopädie und Orthopädische Chirurgie (DGOOC); La Société Française de Chirurgie Orthopédique et Traumatologie (SOFOT); New Zealand Orthopaedic Association (NZOT); Sociedad Española de Cirugía Ortopédica y Traumatología (SECOT); Società Italiana di Ortopedia e Traumatologia (SIOT). Special acknowledgment is due to Dr. John Kaufman and the Osteoporosis Interest Group of the American Academy of Orthopedic Surgeons for providing the survey questionnaire prototype, to the WOOO for developing the recommendations for fracture care, to Jan-Åke Nilsson for statistical consultation and to Sabrina Baumann and Agneta Jönsson for coordinating participating centers and support throughout the process. The study was funded by grants from the IOF and the BJD.

References:

- Marshall D, Johnell O, Wedel H (1996) Meta-analysis of how well measures of bone mineral density predict occurrence of osteoporotic fractures. *BMJ* 312:1254–1259
- Looker AC, Orwoll ES, Johnston CC, Jr., Lindsay RL, Wahner HW, Dunn WL, Calvo MS, Harris TB, Heyse SP (1997) Prevalence of low femoral bone density in older US adults from NHANES III. *J Bone Miner Res* 11:1761–1768
- Robinson CM, Royds M, Abraham A, McQueen MM, Court-Brown CM, Christie J (2002) Refractures in patients at least forty-five years old. A prospective analysis of twenty-two thousand and sixty patients. *J Bone Joint Surg Am* 84:1528–1533
- Klotzbuecher CM, Ross PD, Landsman PB, Abbott TA 3rd, Berger M (2000) Patients with prior fractures have an increased risk of future fractures: a summary of the literature and statistical synthesis. *J Bone Miner Res* 15:721–739
- Hochberg M (2000) Preventing fractures in postmenopausal women with osteoporosis. A review of recent controlled trials of antiresorptive agents. *Drugs Aging* 17:317–330
- Delmas PD (2002) Treatment of postmenopausal osteoporosis. *Lancet* 359:2018–2026
- Bellantonio S, Fortinsky R, Prestwood K (2001) How well are community-living women treated for osteoporosis after hip fracture? *J Am Geriatr Soc* 49:1197–1204
- Castel H, Bonneh DY, Sherf M, Liel Y (2001) Awareness of osteoporosis and compliance with management guidelines in patients with newly diagnosed low-impact fractures. *Osteoporos Int* 12:559–564
- Freedman KB, Kaplan FS, Bilker WB, Strom BL, Lowe RA (2000) Treatment of osteoporosis: are physicians missing an opportunity? *J Bone Joint Surg Am* 82:1063–1070
- Gardner MJ, Flik KR, Mooar P, Lane JM (2002) Improvement in the undertreatment of osteoporosis following hip fracture. *J Bone Joint Surg Am* 84:1342–1348
- Hajcsar EE, Hawker G, Bogoch ER (2000) Investigation and treatment of osteoporosis in patients with fragility fractures. *CMAJ* 163:819–822
- Harrington JT, Broy SB, Derosa AM, Licata AA, Shewmon DA (2002) Hip fracture patients are not treated for osteoporosis: a call to action. *Arthritis Rheum* 47:651–654
- Juby AG, De Geus-Wenceslau CM (2002) Evaluation of osteoporosis treatment in seniors after hip fracture. *Osteoporos Int* 13:205–210
- Khan SA, de Geus C, Holroyd B, Russell AS (2001) Osteoporosis follow-up after wrist fractures following minor trauma. *Arch Intern Med* 161:1309–1312
- Kiebzak GM, Beinart GA, Perser K, Ambrose CG, Siff SJ, Heggeness MH (2002) Undertreatment of osteoporosis in men with hip fracture. *Arch Intern Med* 162:2217–2222
- Simonelli C, Chen YT, Morancey J, Lewis AF, Abbott TA (2003) Evaluation and management of osteoporosis following hospitalization for low-impact fracture. *J Gen Intern Med* 18:17–22
- Torgerson DJ, Dolan P (1998) Prescribing by general practitioners after an osteoporotic fracture. *Ann Rheum Dis* 57:378–379
- Kaufman A (2000) A survey of orthopedic surgeons attitudes and knowledge of osteoporosis. AAOS annual meeting, poster exhibit 2000
- Eiken PA (1996) [Osteoporosis: assessment, prevention and treatment in Danish departments of orthopedic surgery]. *Ugeskr Laeger* 158:5790–5793
- Province MA, Hadley EC, Hornbrook MC, Lipsitz LA, Miller JP, Mulrow CD, Ory MG, Sattin RW, Tinetti ME, Wolf SL (1995) The effects of exercise on falls in elderly patients. A preplanned meta-analysis of the FICSIT trials. *Frailty and Injuries: Cooperative Studies of Intervention Techniques*. *JAMA* 273:1341–1347
- Gillespie LD, Gillespie WJ, Robertson MC, Lamb SE, Cumming RG, Rowe BH (2001) Interventions for preventing falls in elderly people. *Cochrane Database Syst Rev* 3:CD000340
- Carter ND, Kannus P, Khan KM (2001) Exercise in the prevention of falls in older people: a systematic literature review examining the rationale and the evidence. *Sports Med* 31:427–438
- Kannus P, Parkkari J, Niemi S, Pasanen M, Palvanen M, Jarvinen M, Vuori I (2000) Prevention of hip fracture in elderly people with use of a hip protector. *N Engl J Med* 343:1506–1513
- Black DM, Cummings SR, Karpf DB, Cauley JA, Thompson DE, Nevitt MC, Bauer DC, Genant HK, Haskell WL, Marcus R, Ott SM, Torner JC, Quandt SA, Reiss TF, Ensrud KE (1996) Randomised trial of effect of alendronate on risk of fracture in women with existing vertebral fractures. *Risk of Fracture Intervention Trial Research Group*. *Lancet* 348:1535–1541
- McClung MR, Geusens P, Miller PD, Zippel H, Bensen WG, Roux C, Adami S, Fogelman I, Diamond T, Eastell R, Meunier PJ, Reginster JY (2001) Effect of risedronate on the risk of hip fracture in elderly women. *Hip Intervention Program Study Group*. *N Engl J Med* 344:333–340
- Reginster J, Minne HW, Sorensen OH, Hooper M, Roux C, Brandi ML, Lund B, Ethgen D, Pack S, Roumagnac I, Eastell R (2000) Randomized trial of the effects of risedronate on vertebral fractures in women with established postmenopausal osteoporosis. *Vertebral Efficacy with Risedronate Therapy (VERT) Study Group*. *Osteoporos Int* 11:83–91

27. Neer RM, Arnaud CD, Zanchetta JR, Prince R, Gaich GA, Reginster JY, Hodsman AB, Eriksen EF, Ish-Shalom S, Genant HK, Wang O, Mitlak BH (2001) Effect of parathyroid hormone (1-34) on fractures and bone mineral density in postmenopausal women with osteoporosis. *N Engl J Med* 344:1434-1441
28. Bauer DC (2000) Osteoporotic fractures: ignorance is bliss? *Am J Med* 109:338-339
29. Johnell O, Kannus P, Obrant KJ, Jarvinen M, Parkkari J (2000) Management of the patient after an osteoporotic fracture: guidelines for orthopedic surgeons—consensus conference on treatment of osteoporosis for orthopedic surgeons, Nordic Orthopedic Federation, Tampere, Finland 2000. *Acta Orthop Scand* 72:325-330
30. Tosi LL, Lane JM (1998) Osteoporosis prevention and the orthopedic surgeon: when fracture care is not enough. *J Bone Joint Surg Am* 80:1567-1569
31. Rosier RN (2001) Expanding the role of the orthopaedic surgeon in the treatment of osteoporosis. *Clin Orthop* 385:57-67
32. Dreinhoefer KE, Féron JM, Hube R, Johnell O, Lidgren L, Miles K, Panarella L, Herrera A, Simpson H, Wallace A (2004) Orthopaedic Surgeons and fragility fractures. A survey by the Bone and Joint Decade and the International Osteoporosis Foundation. *J Bone Joint Surg Br* 2004 in press
33. Åkesson K, Dreinhöfer KE, Woolf AD (2003) Improved education in musculoskeletal conditions is necessary for all doctors. *Bull World Health Organ* 81:677-683
34. Stephen AB, Wallace WA (2001) The management of osteoporosis. *J Bone Joint Surg Br* 83:316-323
35. McClellan A, Fraser M, Brown J (2000) The osteoporosis-orthopaedic liaison nurse: a model for effecting secondary prevention of osteoporotic fractures in an orthopaedic and accident and emergency setting. *J Bone Miner Res* 18 [Suppl 1]:S439
36. Johnell O, Kaufman J, Cummings SR, Lane JM, Bouxsein ML (2003) Recommendations for care of the osteoporotic fracture patient to reduce the risk of future fractures. *J Am Acad Orthop Surg* (in press)
37. Marsh D, Simpson H, Wallace WA (2003) The care of fragility fracture patients. British Orthopaedic Association