Osteoporos Int (2001) 12:617–622

Osteoporosis International

Original Article

A Prospective Evaluation of the Awareness, Knowledge, Risk Factors and Current Treatment of Osteoporosis in a Cohort of Elderly Subjects

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Abstract. This was a prospective cohort study of 145 seniors attending a senior's clinic and social day program using a self-administered questionnaire. Its objective was to evaluate the awareness, knowledge, risk factors and current treatment of osteoporosis in our two patient groups. A secondary objective was to determine differences between the two cohorts, and between men and women. Participants included 39 men and 106 women, with an average age of 76 years. Of these, 89% were aware of osteoporosis and 61% gave the correct definition. Awareness and accurate definition were less in men compared with women ($p < 0.01$, and $p < 0.05$) and clinic compared to day program groups ($p < 0.01$). Only 54% of men knew osteoporosis could affect them. Television, newspapers and friends were identified as the main source of information. Physicians ranked as fifth as a source of information. In all, 84% knew diet was important. Prevalence of risk factors other than age were < 20%, except for senescence (38%) and alcohol use (40%). Utilization of specific therapies for osteoporosis was only 18% overall with a rate of 3% in men ($p < 0.01$). In women, 50% and were taking calcium supplements compared with 15% men ($p < 0.001$) and for multivitamins the figures were 57% and 33% respectively ($p < 0.05$). These results show a high level of awareness and correct definition of osteoporosis in this cohort of patients. Specific therapy for prevention or treatment of osteoporosis was inappropriately low in the face of high risk. This study highlights the care gap in osteoporosis in seniors and the need for increased physician involvement in patient education and treatment. Proactive treatment requests from patients need to be encouraged, especially with the future demographic shift.

Keywords: Awareness; Care gap; Elderly; Knowledge; Osteoporosis; Risk factors

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Introduction

It is estimated that 1.4 million Canadians suffer from osteoporosis [1], and that the majority of these are seniors. The proportion of seniors in the Canadian population is expected to double by 2020 [2] and so it can be assumed that the prevalence of osteoporosis will also rise accordingly. One serious outcome of osteoporosis is hip fracture, which results in huge fiscal consequences (over $7 billion annually in the USA [3]) and significant long-term morbidity [4] and mortality [5].

The literature is extensive on the many potential strategies to prevent osteoporosis and treat established disease, but this has not necessarily been translated into clinical practice resulting in an increasing care gap. Physician education has been one means of increasing awareness of osteoporosis and appropriate initiation of treatment strategies. In addition to physician education, a suggested strategy to increase appropriate evaluation, prevention and treatment of osteoporosis has been the education of women [6]. This has primarily focused on perimenopausal women. No studies have been performed to evaluate the awareness and knowledge of elderly women. Osteoporosis in men has received even less attention [7] and there are no studies evaluating their

knowledge of this disease. The baseline level of knowledge and awareness of osteoporosis in these groups needs to be determined.

The purpose of this study was to evaluate the knowledge of osteoporosis in a seniors population; to identify the sources of their information; to evaluate the prevalence of osteoporotic risk factors; and to assess the prevalence of osteoporosis treatment.

Methods

This was a prospective, cohort study undertaken at the University of Alberta Hospital, Edmonton, Canada, which is a tertiary care referral facility. Patients attending the seniors' clinic are referred equally from the emergency room and from the community. All consecutive seniors attending the University of Alberta Seniors' Clinic (over a 6-month period) were invited to complete a self-administered or nurse-assisted questionnaire. The questionnaire consisted of 28 questions: six on background knowledge; nine on osteoporotic risk factors; four on gynecologic history (women only); seven on treatment and investigations; one on level of education; and one on desire to learn more. The average completion time per questionnaire was 15 minutes. There were 102 participants in this group. Excluded were those younger than 65 years of age, those unable to read or write English without anyone to interpret, those with dementia or delirium, and those too frail to complete the questionnaire.

In addition, all seniors attending a local community day program (social/exercise drop-in program) on a single day were invited to complete the same questionnaire, with the same exclusion criteria. In this group there were 43 seniors.

Data were collected and tabulated for the cohort as a whole, by patient status and by gender. Statistical analysis was done using Microsoft Excel software. (Chi-square analysis with Fisher's exact test where appropriate). Ethical approval for this study was obtained from the Health Research Ethics Administration Board of the University of Alberta and from the Capital Health Regional Research Group.

Results

There were a total of 145 completed questionnaires by 39 men and 106 women. The average age was 77.7 years in the seniors' clinic group and 72.6 years in the day program group. In both groups the educational levels ranged from grade 6 to postgraduate, but there were a higher percentage of postgraduates in the day program group (63% vs 36%).

Table 1 shows the results of awareness and understanding of osteoporosis, and the sources of information. Of the seniors' clinic group 85% and of the day program group 98% had heard of osteoporosis, and the difference between the groups was highly statistically significant ($p < 0.001$). However, only 61% of each group had the correct definition, (strictly defined as knowledge of bone thinning, or loss of bone calcium or loss of bone architecture) although again the groups were statistically different ($p < 0.01$). Women had a greater awareness of osteoporosis and a higher percentage of them were able to define correctly the disease when compared with men. (67% vs 43.6%, $p < 0.05$) This is probably not surprising as most of the advertising and public education about osteoporosis is directed at women at the time of menopause. Nonetheless, 77% of men had at least heard of the disease. Most subjects obtained their information from multiple sources. The seniors' clinic group accessed fewer sources of information per person than the day program group. Both groups relied almost equally on television, newspapers, books, and friends for their information. Family physicians ranked only fifth as a source of information. Interestingly, in spite of the average age of 73 years in the day program group, 7% of them accessed the internet for information. The numbers

Table 1. Awareness and source of osteoporosis information (%)

	Total ($n = 145$)	Seniors' clinic ($n = 102$)	Day program ($n = 43$)	Men ($n = 39$)	Women ($n = 106$)
Awareness of osteoporosis					
Yes	88.9	5.3	97.7***	76.9	93.4**
No	11.2	14.6	2.3	23.1	5.1
Correct definition	60.7	60.8	60.5**	43.6	67.0*
Sources of information on osteoporosis					
Television	31.0	19.6	58.1***	30.8	31.1 NS
Newspapers	29.7	17.6	58.1***	30.8	29.2 NS
Friends	28.3	17.6	53.5***	33.3	26.4 NS
Books	27.6	16.7	60.5***	20.5	30.2 NS
Family Doctor	26.2	17.6	46.5***	23.1	27.4 NS
Readers Digest	12.4	7.8	23.2*	12.8	12.3 NS
Family	4.8	5.9	2.3 NS	12.8	1.9**
Internet	2.1	0.0	6.9**	0.0	2.8 NS

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; NS: not significant.

accessing each source differed, and were statistically different between the seniors' clinic and day program group for all information sources except family. The sources of information were similar in men and women except that men relied more heavily on information from their family (usually wives) (12.8% vs 1.9%, $p < 0.01$).

The majority of participants understood that osteoporosis can affect men (see Table 2). However, when comparing male versus female respondents, 83% of women and 53.8% of men understood that osteoporosis could affect men ($p < 0.001$). More women than men also knew about the importance of diet and that it was in part related to dietary calcium ($p < 0.01$). Although more than half felt it was preventable, interestingly, only one third felt they would get osteoporosis. With all responses the day program group were more knowledgeable than the clinic group, and women more knowledgeable than men, and this reached statistical significance in most cases (Table 2).

The prevalence of some osteoporotic risk factors in both groups were evaluated. (Table 3). A family history of osteoporosis and/or fragility fracture was reported in approximately 20% but was more frequently reported in women than men, though there was no statistically significant difference. Fragility fractures were defined as clinically apparent fractures occuring in the last 5 years. In this study, fragility fractures will have been underreported as no radiographic assessment was made to look for 'asymptomatic' fractures. Of the total cohort 16% had had a fragility fracture with the greater percentage being in the seniors clinic group (which might be anticipated due to their frailty) although this did not reach statistical significance. Fracture rates for men compared with women showed a significant difference (2.8% vs 18.9%, $p < 0.05$). Only 6% of the participants currently smoke although 26% had a smoking history. This is presumably a reflection of decreasing societal acceptance of smoking in Canada, increasing cigarette prices and increased awareness of smoking-related health problems. There was a big difference in smoking history between men and women (82% vs 6%) possibly a reflection of previous societal norms where predominantly men smoked, although there was no statistical significance in the number of current smokers between men and women. Likely related to the smoking patterns, the prevalence of steroid use for chronic obstructive

Table 2. Background knowledge of osteoporosis (%)

	Total ($n = 145$)	Seniors' clinic ($n = 102$)	Day program ($n = 43$)	Men ($n = 39$)	Women ($n = 106$)
Does osteoporosis affect men?					
Yes	75.2	65.7	97.7***	53.8	83.0***
Is osteoporosis preventable?					
Yes	56.6	50.0	72.1 NS	41.0	62.3*
Is diet important?					
Yes	83.4	78.4	95.3**	69.2	88.7**
Will you get osteoporosis?					
Yes	33.1	27.5	46.5***	17.9	38.7*

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; NS: not significant.

Table 3. Risk factors for osteoporosis (%)

	Total ($n = 145$)	Seniors' clinic ($n = 102$)	Day program ($n = 43$)	Men ($n = 39$)	Women ($n = 106$)
Family history					
Osteoporosis	20.7	15.7	32.5*	7.6	25.4*
Fractures	19.3	15.7	27.9 NS	10.3	22.6 NS
Recent fracture (within 5 years)	15.8	19.6	6.9 NS	2.8	18.9*
Smoking history					
Current	6.2	8.8	0*	5.1	1.3 NS
Past	26.2	16.7	48.8	82.1	5.7
Regular exercise	61.4	50.0	88.4***	59.0	62.3 NS
Alcohol consumption (regular)	40.0	32.4	58.1**	53.8	34.9*
Prednisone therapy	14.5	18.6	4.7*	20.5	12.3 NS
Previous bone mineral densitometry	26.0	18.0	42.0**	2.6	35.0***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; NS: not significant.

airways disease was higher in men, although it did not reach statistical significance (p =0.2). The day program group had a higher rate of exercise but this was not surprising as it was an exercise-oriented program ($p <$ 0.001). Participation in regular exercise was equivalent in men and women. Regular alcohol consumption was higher in men than women ($p < 0.05$), and higher in the day program group ($p < 0.01$).

No additional risk factors for osteoporosis other than advanced age were reported in 31 participants. One additional risk factor occurred in 41, two in 49, three in 13, four in 8 and five in 3 participants. None of the participants had more than five other risk factors. Of those with additional risk factors, the most frequent were lack of regular exercise (39%), previous smoking (26%) and alcohol consumption (40%). However, alcohol consumption was probably overestimated as this was counted even in those reporting 'occasional' consumption. (Self-reporting of the amount of alcohol intake is notoriously unreliable so no effort was made to try and quantitate the alcohol consumption in this study).

The use of bone mineral densitometry in seniors remains controversial and access to dual-energy X-ray absorptiometry (DXA) varies across different geographic areas of Canada. Previous bone mineral densitometry (BMD) measurement in our cohort was extremely low in spite of the test being readily available in this part of Canada (at no cost to the patient) with a physician referral. It had been performed in 18% of seniors' clinic group and 42% of the day program group ($p < 0.01$); 2.6% of the men and 35% of the women ($p < 0.001$) had had a BMD measurement.

The prevalence of prevention or treatment therapies for osteoporosis in the groups was documented and is shown in Table 4. In spite of 61% of the participants correctly defining the disease, 33% thinking they may suffer from osteoporosis, and a high prevalence of risk factors, the use of any form of prevention or treatment therapy was unacceptably low. Of the 106 women in the study, 29% were receiving regular hormone replacement therapy (HRT) and there was a statistically significant difference between the seniors' clinic and day program group (21% vs 47%, $p < 0.01$). In the group as a whole, the use of specific therapies (defined as HRT, bisphosphonates, raloxifene or calcitonin) was also disappointingly low, with patients in the day program group once again faring better than the other subgroup ($p < 0.01$). The use of both calcium and vitamin D supplementation at any dose was more widely used in both groups, although less so in men than women ($p < 0.001 - p <$ 0.05). As a dietary history was not obtained the dose of either calcium or vitamin D may have been suboptimal.

Virtually all the participants had a regular family doctor (82% men and 86% of women), so lack of a regular family doctor does not seem to be the reason for lack of treatment. Although, almost half the family doctors had apparently spoken to their patients about osteoporosis (although this was much less for men alone at 2.6%) this discussion does not seem to have translated into the initiation of an appropriate preventative, diagnostic or treatment regime.

Discussion

An extensive literature exists on the treatment and prevention of osteoporosis in the elderly, and guidelines to treatment have been established [8]. Risk factors are also well documented [9]. Studies have shown that physician attitudes reflect their management of osteoporosis [10] but there are very few studies that have evaluated patient knowledge and awareness to see how this might influence osteoporosis management. Those studies that have been done focus mainly on younger woman, [11,12], or culturally distinct groups [13]. A Norwegian study [14] showed, that there was a high degree of general knowledge of osteoporosis and its consequences in their population group, similar to our observations. However, their study did not assess the prevalence of risk factors or current osteoporosis treatment. In our study, as in the Norwegian study, men seemed to be less knowledgeable than woman (77% vs 94%, $p < 0.01$) but our subgroup of men was small (n=39) and so these results may not be representative across Canada. These observations may reflect the fact that most patient education worldwide is directed towards women.

The sources of information about osteoporosis were more varied in the day program group than in the seniors' clinic group and this was reflected in greater awareness ($p < 0.001$) and ability to define the disease correctly ($p < 0.01$). The sources of information were varied in men too, although they were more reliant on their family (usually wives) than were women. Doctors

Table 4. Osteoporosis Treatment (%)

	Total (n = 145)	Seniors' clinic (n = 102)	Day program (n = 43)	Men (n = 39)	Women (n = 106)
Hormone replacement therapy (women only)	—	21.0	47.0 **	—	29.0
Specific treatment for osteoporosis	18.3	13.7	32.5**	2.6	23.6**
Calcium supplementation (any dose)	40.0	36.3	48.8 NS	15.4	49.1***
Multivitamin supplementation	50.3	47.1	58.1 NS	33.3	56.6*
Vitamin D supplementation	17.9	17.6	18.6 NS	2.6	23.6**

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; NS: not significant.

fared poorly (ranked fifth) as information sources in spite of the majority of participants having a regular family doctor. This is a cause for some concern, as the reliability of information provided in the media and on the internet is highly variable and may not be accurate. A Canadian study [15] showed that some medical advice columns in Canadian newspapers give inappropriate information, and that in 28% this could have been dangerous and potentially life threatening. Our study is the first to evaluate the source of patient information on osteoporosis and it suggests that physicians need to play a more active role as an accurate information source. The day program group had a higher level of education, which may have influenced the number of information sources accessed and hence the knowledge outcome.

Clinic and day program seniors were knowledgeable about osteoporosis but, interestingly, only 33% of subjects felt they would get osteoporosis and the majority of those had already been diagnosed by their physicians. Men were less aware and knowledgeable about osteoporosis but this may not be surprising given the misconception that osteoporosis is exclusively a woman's disease and most education is directed towards them. This study did not specifically ask the subjects if they knew the various risk factors for osteoporosis as others have done [16,17], but rather tried to assess the prevalence of the risk factors. The major risk factors were age and lack of regular exercise, with a lower prevalence of current smoking and prednisone use. The prevalence of osteoporotic risk factors differed between the seniors' clinic and day program groups as might be expected. The clinic group being a more frail population had a higher prevalence of some risk factors including a higher use of prednisone therapy. Regular exercise was higher in the day program group as this was an integral part of the daily regime of the program. In both groups the large majority are now nonsmokers with a comparable number of ex-smokers, a reflection of societal attitude changes towards smoking in Canada.

The risk factor most likely to bring the subjects to medical attention is a previous fracture, so this group was analyzed separately. All these participants fulfilled the SCORE criteria for DXA evaluation [18]. However, only eight (34%) had had a BMD measurement. The overall low use of DXA in these patients is unlikely to be due to a lack of availability as DXA machines are prevalent in this region of Canada. Lack of diagnostic facilities in other regions of Canada may be more important in the lack of DXA evaluation of their seniors population. However, it is unclear why testing is not being done here other than the likely reason of lack of physician awareness (suggested by the lack of specific pharmacologic treatment). In those with a recent fracture (within 5 years) only 66% were taking calcium and 26% were taking specific osteoporosis treatment (HRT, calcitonin, raloxifene or bisphosphonates). The adequacy of treatment with calcium and vitamin D is probably overestimated as the data were not collected on dosage (because of lack of ability to verify this) or dietary intake. The low prevalence of treatment in this subset is a reflection that, in spite of adequate knowledge levels, physicians are not prescribing the osteoporosis treatment even in cases with an obvious risk factor such as a clinically apparent recent fracture. Some studies have shown that at least with HRT, patients would be willing to take the treatment had it been offered [19] although a Canadian study [20] showed that even in women after a fracture, only 38% would accept HRT. Our study and others [21] have shown that appropriate pharmaceutic agents are not being prescribed. The onus should therefore be on the physicians to be aware of the risk factors for osteoporosis, (particularly a previous fragility fracture) and to educate appropriately, counsel and treat their patients.

In conclusion, this study highlights the high degree of awareness and knowledge of osteoporosis in the elderly population studied. It also showed that there is an apparent difference between patients with differing education, with regard to knowledge about this condition and that this may translate into more of them receiving specific osteoporosis therapy. The prevalence of osteoporosis treatment of any kind was extremely low. Even in those patients with an obvious risk factor that would require a hospital visit or admission, there was no report that osteoporosis had been investigated or specifically treated. The frail elderly clinic group and men appear to be of particular concern. Why is there a care gap in osteoporosis in the elderly? Are the patients refusing treatment? This study suggests that treatment may not have even been discussed by the physicians. Are people in the front line therefore not translating literature evidence into practice? The challenge in the next few years therefore is to address this care gap for osteoporosis treatment in the elderly with structured education programs for both patients and physicians. In spite of there being well-published guidelines, physicians are still not managing this disease appropriately. Innovative educational programs customized to physicians' needs may be more successful. Patients also need to use their knowledge to be more proactive in requesting more information and treatment from their physicians. Although, these conclusions are based on a relatively small cohort of patients and might not necessarily be generalizable, they nonetheless raise challenging issues in the management of osteoporosis in seniors.

Acknowledgements. We thank L. McAuley and other nursing staff in the Seniors' Clinic at the University of Alberta Hospital for encouraging completion of the questionnaire. Thanks also to Ms V. Rivers for preparation of the manuscript. This project was made possible by an unrestricted grant in aid of clinical research provided by Merck Canada Inc.

References

1. Scientific Advisory Board, Osteoporosis Society of Canada. Clinical practice guidelines for the diagnosis and management of osteoporosis. Can Med Assoc J 1996;155:1113–33.
2. Badley EM, Crotty M. An international comparison of the estimated impact of the aging of the population on the major

cause of disablement, musculoskeletal disorders. J Rheumatol 1992;22:1934–40.
3. Lewinnek GE, Kelsey J, White AA III, Kreiger NJ. The significance and a comparative analysis of the epidemiology of hip fractures. Clin Orthop 1980;152:35–43.
4. Magaziner J, Simonsick EM, Kashner TM, Hebel JR, Kenzora JE. Predictors of functional recovery one year following hospital discharge for hip fracture: a prospective study. J Gerontol 1990;45:M101–7.
5. Aharonoff GB, Koval KJ, Skorvon ML, Zucherman JD. Hip fractures in the elderly; predictors of one year mortality. J Orthop Trauma 1997;11:162–5.
6. McBean LD, Forgac T, Finn SC. Osteoporosis: visions for care and prevention: a conference report. J Am Diet Assoc 1994;94:668–71.
7. Ebeling PR. Osteoporosis in men. New insights into aetiology, pathogenesis, prevention and management. Drugs Aging 1998;13:421–34.
8. Scientific Advisory Board, Osteoporosis Society of Canada. Prevention and management of osteoporosis: consensus statement from the Scientific Advisory Board of the Osteoporosis Society of Canada. Can Med Assoc J 1996;155:921–65.
9. Melton LJ III, Kan SH, Wahner HW, et al. Lifetime fracture risk: an approach to hip fracture risk assessment based on bone mineral density and age. J Clin Epidemiol 1988;1:985–94.
10. Suarez-Almazor M, Homik JE, Messina D, Davis P. Attitudes and beliefs of family physicians and gynecologists in relation to the prevention and treatment of osteoporosis. J Bone Miner Res 1997;12:1100–7.
11. Kasper MJ, Peterson MG, Allegrante JP, Galsworthy TD, Gutin B. Knowledge, beliefs and behaviors among college women concerning the prevention of osteoporosis. Arch Fam Med 1994;3:696–702.
12. Swiers D. Women's knowledge of HRT and the prevention of osteoporosis. Nurs Stand 1996;10:35–7.
13. Matsumoto D, Pun KK, Nakatani M, et al. Cultural difference in attitudes, values and beliefs about osteoporosis in first and second generation Japanese American women. Women Health 1995;23:39–56.
14. Magnus JH, Joakimsen RM, Bernsten GK, Tollan A, Sogaard AJ. What do Norwegian women and men know about osteoporosis? Osteoporos Int 1996;6:31–6.
15. Molnar FJ, Man-Son-Hing M, Dalziel WB, et al. Assessing the quality of newspaper medical advice columns for elderly readers. Can Med Assoc J 1999;161:393–5.
16. Cook B, Noteloviz M. Rector C, Krischer JP. An osteoporosis patient education and screening program: results and implications. Pat Educ Counsel 1991;17:135–45.
17. Ailinger RL, Emerson J. Women's knowledge of osteoporosis. Appl Nurs Res 1998;11:111–14.
18. Lydick E, Cook K, Turpin J, et al. Development and validation of a simple questionnaire to facilitate identification of women likely to have low bone density. Am J Man Care 1998;4:37–48.
19. Sinclair HK, Bond CM, Taylor RJ. Hormone replacement therapy: a study of women's knowledge and attitudes. Br J Gen Pract 1993;43:365–70.
20. Papaioannou A, Parkinson W, Adachi J, et al. Women's decision about hormone replacement therapy after education and bone densitometry. Can Med Assoc J 1998;159:1253–7.
21. Torgerson DJ, Dolan P. Prescribing by general practitioners after an osteoporotic fracture. Ann Rheum Dis 1998;57:378–9.

Received for publication 3 August 2000
Accepted in revised form 20 December 2000