

# Osteoporosis screening for men

## Are family physicians following the guidelines?

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### ABSTRACT

**OBJECTIVE** To determine rates of screening for osteoporosis among men older than 65 years and to find out whether family physicians are following the recommendations of the Osteoporosis Society of Canada's 2002 Clinical Practice Guidelines for the Diagnosis and Management of Osteoporosis in Canada.

**DESIGN** Chart audit.

**SETTING** The Family Medicine Centre at Hotel Dieu Hospital in Kingston, Ont.

**PARTICIPANTS** All male patients at the Family Medicine Centre older than 65 years for a total of 565 patients associated with 20 different physicians' practices.

**MAIN OUTCOME MEASURES** Rates of screening with bone mineral density (BMD) scans for osteoporosis, results of BMD testing, and associations between results of BMD testing and age.

**RESULTS** Of the 565 patients reviewed, 108 (19.1% of the study population) had received BMD testing. Rates of screening ranged from 0% to 38% in the 20 practices. Among 105 patients tested (reports for 3 patients were not retrievable), 15 (14.3%) were found to have osteoporosis, 43 (41.0%) to have osteopenia, and 47 (44.8%) to have normal BMD results. No significant association was found between BMD results and age. Screening rates were higher among men older than 75 years than among men aged 65 to 75 and peaked among those 85 to 89 years old.

**CONCLUSION** On average, only about 20% of male patients older than 65 years had been screened for osteoporosis, so most of these men were not being screened by BMD testing as recommended in the guidelines. Considering the relatively high rates of osteoporosis and osteopenia found in this study and the known morbidity and mortality associated with osteoporotic fractures in this population, higher rates of BMD screening and more widespread treatment of osteoporosis could prevent many fractures among these patients. Family physicians need to become more aware of the risk factors indicating screening, and barriers to screening and treatment of osteoporosis in men need to be identified and addressed.

### EDITOR'S KEY POINTS

- Many family physicians remain unaware of the prevalence and complications of osteoporosis among men. They are also unaware of the guidelines for screening for osteoporosis in men.
- This study shows that most male patients older than 65 years (80.9%) in these academic family practices were not being screened as recommended by the Osteoporosis Society of Canada's 2002 Clinical Practice Guidelines for the Diagnosis and Management of Osteoporosis in Canada.
- There were large variations in screening rates among the different practices, and even the most successful practices achieved screening rates of only 30% to 40%.

\*Full text is available in English at [www.cfp.ca](http://www.cfp.ca).

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# Dépistage de l'ostéoporose chez l'homme

## Les médecins de famille suivent-ils les directives?

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### RÉSUMÉ

**OBJECTIF** Déterminer le taux de dépistage de l'ostéoporose chez les hommes de plus de 65 ans et voir si les médecins de famille suivent les directives de pratique clinique de 2002 pour le diagnostic et le traitement de l'ostéoporose de la Société de l'ostéoporose du Canada.

**TYPE D'ÉTUDE** Revue de dossier.

**CONTEXTE** Le Family Medicine Center de l'Hôtel-Dieu de Kingston, Ont.

**PARTICIPANTS** Tous les patients mâles de plus de 65 ans du Family Medicine Center, soit un total de 565 clients de 20 bureaux médicaux différents.

**PRINCIPAUX PARAMÈTRES ÉTUDIÉS** Taux de dépistage de l'ostéoporose par ostéodensimétrie (ODM), résultats de l'ODM et association entre les résultats de l'ODM et l'âge.

**RÉSULTATS** Sur les 565 patients étudiés, 108 (19,1%) avaient subi une ODM. Les taux de dépistage variaient de 0% à 38% dans les 20 établissements. Sur les 105 patients testés (les résultats manquaient pour 3 patients), 15 (14,3%) présentaient de l'ostéoporose, 43 (41,0%) de l'ostéopénie et 47 (44,8%) des résultats normaux. Il n'y avait pas d'association significative entre les résultats de l'ODM et l'âge. Les taux de dépistage chez les plus de 75 ans étaient plus élevés que chez les patients de 65 à 75 ans; ce taux était maximal dans le groupe des 85 à 89 ans.

**CONCLUSION** En moyenne, seulement 20% des patients mâles de plus de 65 ans avaient subi un dépistage de l'ostéoporose, la plupart n'ayant donc pas eu de dépistage par ODM tel que préconisé par les directives. Étant donné les taux relativement élevés d'ostéoporose et d'ostéopénie observés dans cette étude, et connaissant la morbidité et la mortalité associées aux fractures ostéoporotiques dans cette population, on croit qu'un plus fort taux de dépistage et un traitement plus agressif de l'ostéoporose pourraient prévenir plusieurs fractures chez ces patients. Le médecin de famille devrait mieux connaître les facteurs de risque qui incitent au dépistage; il faudrait aussi cerner les facteurs qui nuisent au dépistage et au traitement de l'ostéoporose chez l'homme.

### POINTS DE REPÈRE DU RÉDACTEUR

- Plusieurs médecins de famille ignorent la prévalence et les complications de l'ostéoporose chez l'homme ainsi que les principes directeurs concernant le dépistage de cette maladie chez l'homme.
- Cette étude montre que la plupart des clients de plus de 65 ans (80,9%) de ces établissements universitaires de médecine familiale n'avaient pas subi le dépistage recommandé par les directives de pratique clinique de 2002 pour le diagnostic et le traitement de l'ostéoporose de la Société de l'ostéoporose du Canada.
- Le taux de dépistage varie beaucoup d'un établissement à un autre, et même les plus performants atteignent à peine un taux de 30 à 40%.

\*Le texte intégral est accessible en anglais à [www.cfp.ca](http://www.cfp.ca).

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Osteoporosis causes a great deal of morbidity and mortality worldwide. About 1 in 8 men in Canada have osteoporosis, compared with 1 in 4 women.<sup>1,2</sup> Goeree et al estimated that there were more than 21 000 osteoporosis-related hip fractures in Canada in 1993 and that the total cost of acute care for osteoporosis in Canada (including hospital stays, outpatient care, and drug therapy) was higher than \$1.3 billion.<sup>3</sup> An Ontario study estimated that by 2010, the annual number of hip fractures will be double the number in 1990.<sup>4</sup> By 2041, researchers estimate that 25% of the population will be older than 65 years.<sup>5</sup> Considering these facts, as well as the difficulty of accessing endocrinologists, geriatricians, and internists, management of osteoporosis will fall increasingly into the hands of family physicians.<sup>5</sup> This trend is made clear by the fact that 80.1% of bone mineral density (BMD) scans were ordered by family physicians in 2000 while only 47.3% were ordered by them in 1992.<sup>6</sup> Unfortunately, many family physicians remain unaware of the prevalence and complications of osteoporosis and of the guidelines for screening for osteoporosis in men.

In the past, diagnosis and treatment of osteoporosis largely focused on women, particularly postmenopausal women. There is, however, a growing body of literature highlighting the prevalence and complications of osteoporosis and the usefulness of treating it in men. Men suffer nearly 30% of all hip fractures,<sup>7</sup> 19% of men older than 50 years have osteoporosis as defined by BMD testing, and men older than 50 years have a 5% to 6% lifetime risk of hip fractures and a 13% lifetime risk of fragility fractures.<sup>8,9</sup> Male nursing home residents are 5 to 10 times more likely than men who live in the community to have fractures.<sup>10</sup> Men are twice as likely as women to die in hospital after hip fractures and have substantially higher 1-year mortality rates from hip fractures (31% to 40% of men vs 17% to 20% of women).<sup>11-14</sup>

In a case-control study in the United Kingdom, Pande and Francis found that male patients had an 8-fold increase in mortality after hip fractures and that mortality continued to increase after 2 years of follow-up.<sup>15</sup> A study by Kiebzak et al of 363 patients admitted for atraumatic (low-energy) hip fractures revealed that more than 30% of surviving male patients required the aid of a walker or wheelchair after the fracture and that the number of male patients participating in recreational activities dropped by 50% after fractures.<sup>11</sup>

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Unfortunately, there is little evidence of screening for osteoporosis among men who have not had fractures. Unlike women, who are often diagnosed with osteoporosis through BMD screening, men are frequently diagnosed when they present with fractures.<sup>16,17</sup> Jaglal et al found that of the 244 515 BMD tests billed in Ontario in 1998, only 13 579 (5.5%) were ordered for men.<sup>18</sup> Even once they have had fractures, men are less likely than women to be diagnosed and treated. Johnson et al conducted BMD testing and implemented osteoporosis treatment plans for 126 patients attending an orthopedic surgery clinic after they had suffered fractures and found that 41% had osteopenia and 20% had osteoporosis.<sup>19</sup> Only 12.7% of patients had undergone BMD testing before the study. Kiebzak et al found that only 4.5% of men were treated for osteoporosis at discharge for atraumatic fracture compared with 27% of women. At the 5-year follow-up point in this study, only 27% of male patients were receiving treatment for osteoporosis compared with 71% of female patients.<sup>11</sup> Feldstein et al conducted a study of 1171 male patients older than 65 years enrolled in a large health maintenance organization who had sustained at least 1 fracture.<sup>20</sup> They found that only about 7% had been treated for osteoporosis during the 3 years following their fractures.

The 2002 Clinical Practice Guidelines for the Diagnosis and Management of Osteoporosis in Canada<sup>21</sup> and the 2006 update from the Canadian Consensus Conference on Osteoporosis<sup>22</sup> outline major and minor risk factors for osteoporosis. They recommend that all postmenopausal women and all men older than 50 be screened for risk factors and that patients with 1 major or 2 minor risk factors undergo BMD screening by central dual-energy x-ray absorptiometry (grade A recommendation) with consideration for repeat BMD testing every 2 to 3 years to monitor changing risk.<sup>21</sup> The 2006 guidelines emphasized that the 5 most important risk factors are advanced age, low BMD, family history of fractures (particularly maternal hip fractures), history of fragility fractures, and use of glucocorticoids for longer than 3 months.<sup>22</sup> Khan et al further clarified the importance of specific risk factors in men and found that fragility fractures, systemic glucocorticoid use, and being older than 65 are key risk factors for osteoporosis in men, independent of their BMD.<sup>23</sup>

### Research objective

Despite the prevalence of osteoporosis in men and the high rates of morbidity and mortality after fractures, few men are being diagnosed or treated for osteoporosis. There is no literature on the prevalence of BMD screening among older men; however, based on the low rates of screening and diagnosis among men who have sustained fractures, the prevalence is expected to be low. The purpose of this study was to determine the rates of BMD screening among men older than 65

to see whether screening was being done as recommended by the 2002 Clinical Practice Guidelines for the Diagnosis and Management of Osteoporosis in Canada. We intended to break the rates down by age group to determine whether there was any identifiable relationship between age and rates of screening or BMD results.

## METHODS

The study, a retrospective cross-sectional chart audit, was carried out at the Family Medicine Centre (FMC) at Hotel Dieu Hospital in Kingston, Ont. The FMC has 20 full- and part-time physicians organized into 8 teaching practices (each with 2 to 3 faculty and 2 residents) who care for a total of approximately 9000 patients. The FMC uses an electronic health record system (CIS by P&P Systems) that includes a complete, searchable patient registry. All male patients enrolled at the FMC who were born before June 1, 1940, were included in the study. This cutoff date was chosen to allow a buffer period of 1 year for BMD testing to be done after patients turned 65 years old.

In Kingston, BMD testing is centralized at 2 sites, and both sites agreed to participate in this study. Data were collected on the dates and results of BMD testing for all study patients as well as the ages of the patients at the time of testing and the names of their family physicians. One site provided a list of BMD results for patients seen at their facility. Results from the second site were obtained by searching their computerized hospital charts. Results of all BMD testing conducted before June 1, 2006, were included in the analysis. Data were entered into Microsoft Excel spreadsheets and subsequently imported into STATA version 7.0 software<sup>24</sup> for statistical analysis. The project was reviewed and approved by the Health Sciences Research Ethics Board at Queen's University in Kingston.

## RESULTS

There were 589 male patients at the FMC older than 65 years; 24 of these patients were subsequently found to have died before June 1, 2006, and were thus excluded from the study, leaving 565 patients. A total of 108 patients (19.1% of all eligible patients, 95% confidence interval 15.9% to 22.6%) had received BMD testing before June 1, 2006. Unfortunately, 3 BMD reports were missing from the records, leaving us with 105 patients with available BMD T-scores (Table 1). The Osteoporosis Society of Canada uses the T-scores derived by the World Health Organization to

**Table 1. Bone mineral density results: N = 105.**

PATIENTS	NORMAL	OSTEOPENIA	OSTEOPOROSIS
No. of patients	47	43	15
% of patients tested (95% confidence interval)	44.8 (35-54.8)	41.0 (31.5-51)	14.3 (8.2-22.5)

define normal bone mass (-1 to +1), low bone mass (or osteopenia) (-2.5 to -1), and osteoporosis (-4 to -2.5).<sup>21</sup> T-scores are used to compare patients' bone density with the average bone density of young healthy adults of the same sex and are based on standard deviations above or below the mean BMD for the reference population. No significant association was found between BMD results and age ( $P = .0705$ ).

To determine whether rates of screening were higher among older patients, results were analyzed according to age group (Table 2). While rates of BMD screening increased after the age of 75 years, with a peak proportion of 30% screened among those 85 to 89 years old, the differences were not statistically significant. Only 2 of 14 patients older than 90 received BMD testing (15%). Owing to the small number of patients, this age group was combined with the 85 to 89 age group, giving a combined screening proportion of 25.9%.

Results were also analyzed by physician to illustrate differences in physicians' rates of screening (Figure 1). On average, 20% of male patients older than 65 years had been screened; rates ranged from 0% to 38% (standard deviation 12%). Screening rates were not related to the size of the eligible patient population in each practice.

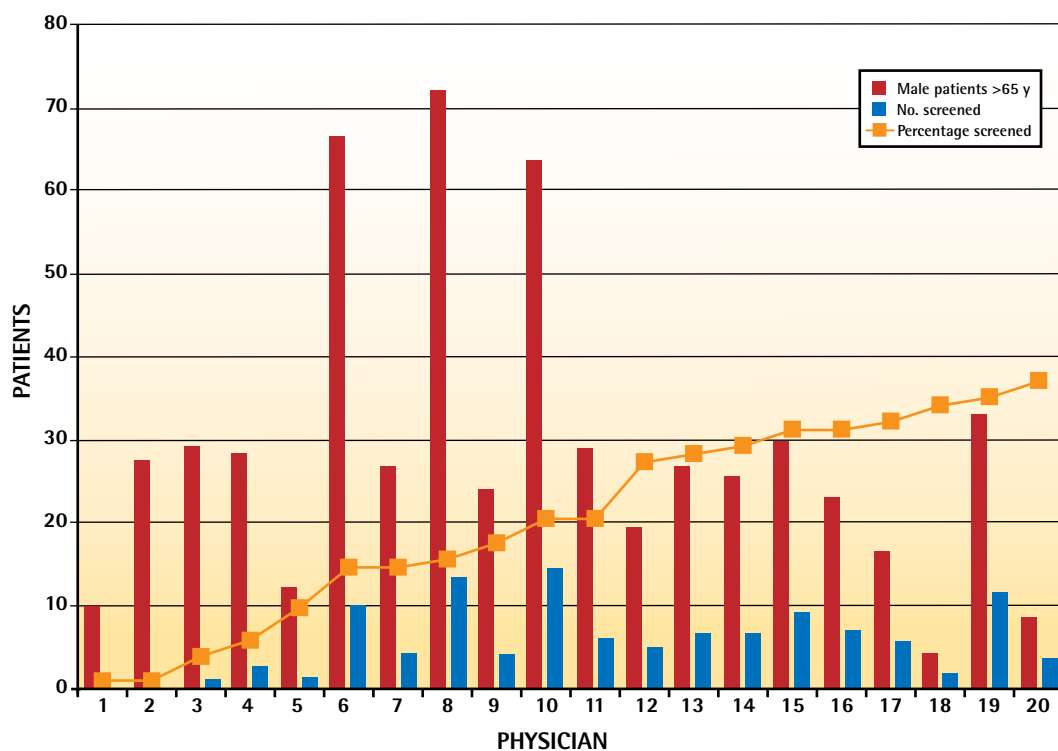
## DISCUSSION

This study shows that most male patients older than 65 years in these academic practices were not being screened as recommended by the Osteoporosis Society of Canada's 2002 Clinical Practice Guidelines for the Diagnosis and Management of Osteoporosis in Canada.<sup>21</sup> The prevalence of osteoporosis found in this study was 14.3%, which is close to the Canadian Multicentre Osteoporosis Study's estimate of 1 in 8 men.<sup>2</sup> Considering the substantial prevalence of osteoporosis in older men and the high rates of morbidity and mortality related to osteoporotic fractures in this population, physicians should try to achieve higher rates of BMD screening among these patients so that they can be treated and many more fractures can

**Table 2. Patients screened in each age group**

PATIENTS	65-69 Y	70-74 Y	75-79 Y	80-84 Y	≥ 85 Y
No. of patients	171	140	122	78	54
No. of patients screened	29	22	28	15	14
% of patients screened (95% confidence interval)	17.0 (11.1-23.4)	15.7 (10.1-22.8)	23.0 (15.8-31.4)	19.2 (11.2-29.7)	25.9 (15-39.6)

Figure 1. Physicians' rates of screening male patients older than 65 years for osteoporosis



be prevented. Family physicians need to become familiar with the risk factors that identify people who should be assessed for osteoporosis.

The original World Health Organization definitions for osteoporosis were developed for postmenopausal women.<sup>25</sup> There is still debate over the reference group to be used to derive T-scores for men; however, it is generally agreed that men with T-scores lower than -2.5 are at substantially increased risk of osteoporotic fractures and should be treated.<sup>17,21</sup> The World Health Organization is currently developing a method of estimating a 10-year absolute risk of fracture based on BMD, age, sex, and other risk factors gleaned from several large databases.

It is possible that some physicians are aware of the risk factors that indicate screening for osteoporosis but are deliberately choosing not to screen or perceive barriers to implementing fracture-prevention strategies. McKercher et al conducted a study on management of osteoporosis in long-term care patients and found that commonly cited barriers to screening and treatment included the perceived cost of investigations and treatment, the unknown benefit of treatment, and concerns about prescribing medications to elderly patients (eg, side effects and polypharmacy).<sup>26</sup> Jaglal et al did a survey of family practitioners and found similar barriers, along with the findings that limited time and competing demands during appointments hampered physicians'

ability to provide preventive care, that there was a perception that some patients were not keen on health promotion because they were preoccupied with existing illnesses, and that physicians had difficulty keeping up with current literature.<sup>6</sup> Some of these barriers might be overcome with research, educating physicians and patients, using physician reminders, and developing clear and succinct evidence-based clinical practice guidelines. Access to medications is improving, as demonstrated by the fact that the Ontario Drug Benefit Plan formulary has recently (as of July 12, 2007) eliminated the requirement of a failed trial of etidronate before providing coverage for other bisphosphonates with better proven clinical benefit in prevention of fractures, such as alendronate and risedronate.

On the other hand, there are situations in which screening is not indicated despite risk factors. The 2002 guidelines discuss the fact that treating patients for osteoporosis might not be indicated if there is an unfavourable risk-benefit ratio, and that screening should be done only if it will affect management.<sup>21</sup> For example, patients who are receiving palliative care or who have relatively short life expectancies would be unlikely to benefit from treatment of osteoporosis (which can take months to years for effect). Further investigation would be beneficial for clarifying the existence of barriers to screening and treatment, as well as how often BMD



testing is deliberately not done for sound clinical reasons. There also needs to be more research on why treatment response is different for women than for men.

This study showed a trend toward increased rates of screening in older men, but this trend was not statistically significant, likely owing to the small numbers of participants in each subgroup. This trend might have reflected a greater tendency toward screening because of advanced age or a higher prevalence of other risk factors for osteoporosis with age. A larger sample size would be needed to determine the nature of this relationship and whether there is actually a lower rate of screening among men older than 90.

No statistically significant relationship was found between BMD results and age, which was unexpected given the well-established increase in risk of osteoporosis with age. Because only 19% of the study population received screening, however, the sample size was not adequate to establish any relationship. This patient population likely had other risk factors aside from age that prompted screening and that would confound an age-related analysis of BMD results. A larger study would be required to determine accurately the influence of various risk factors on BMD and rates of screening.


### Limitations

This study took place in an academic centre where individual practices are relatively small compared with community practices and residents provide a large proportion of care under the supervision of preceptors. We do not know to what extent these results can be extrapolated to family practices in communities.

Some patients might have had BMD testing outside Kingston. Results of this testing would not have been included in this analysis, and this would have led to an underestimation of screening rates.

The sample size was limited by the size of the practices. This limited the power to analyze differences between subgroups of patients (by age, for example). A larger study would be required to know whether trends in screening rates were statistically and clinically significant.

### Conclusion

Despite the fact that this study was carried out at a single academic centre, there were large variations in screening rates among practices. Even the most successful practices achieved screening rates of only 30% to 40%. Primary care physicians need to increase their awareness of the prevalence of osteoporosis in men, of the seriousness of its consequences, and of the indications for screening and treatment. Future studies of barriers to screening and treatment, particularly of male patients, and specific research on the benefits of treating men with osteoporosis would help guide family physicians in the management of osteoporosis. 

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### Contributors

The study was designed and conducted by **Dr Cheng** under the supervision and guidance of **Dr Green**. This manuscript was written by **Dr Cheng** and revised by **Dr Green** with consideration of intellectual content. Both **Drs Cheng and Green** approved the final version of the article.

### Competing interests

None declared

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### References

- Hanley DA, Josse RG. Prevention and management of osteoporosis: consensus statements from the Scientific Advisory Board of the Osteoporosis Society of Canada. 1. Introduction. *CMAJ* 1996;155(7):921-3.
- Jackson SA, Tenenhouse A, Robertson L. Vertebral fracture definition from population-based data: preliminary results from the Canadian Multicenter Osteoporosis Study (CaMos). *Osteoporos Int* 2000;11(8):680-7.
- Goeree R, O'Brien B, Pettitt D, Cuddy L, Adachi J. An assessment of the burden of illness due to osteoporosis in Canada. *J Soc Obstet Gynaecol Can* 1996;18(Suppl):15-24.
- Jaglal SB, Sherry PG, Schatzker J. The impact and consequences of hip fractures in Ontario. *Can J Surg* 1996;39(2):105-11.
- McKercher HG. Family physicians and osteoporosis. Meeting the challenge [editorial]. *Can Fam Physician* 2003;49:405-7 (Eng), 412-4 (Fr).
- Jaglal SB, Carroll J, Hawker G, McIsaac WJ, Jaakkimainen L, Cadarette SM, et al. How are family physicians managing osteoporosis? Qualitative study of their experiences and educational needs. *Can Fam Physician* 2003;49:462-8.
- Cooper C, Campion G, Melton LJ 3rd. Hip fractures in the elderly: a worldwide projection. *Osteoporos Int* 1992;2(6):285-9.
- National Institutes of Health Consensus Development Panel on Osteoporosis Prevention, Diagnosis, and Therapy. Osteoporosis prevention, diagnosis, and therapy. *JAMA* 2001;285(6):785-95.
- Melton LJ 3rd, Atkinson EJ, O'Connor MK, O'Fallon WM, Riggs BL. Bone density and fracture risk in men. *J Bone Miner Res* 1998;13(12):1915-23.
- Elliott ME, Drinka PJ, Krause P, Binkley NC, Mahoney JE. Osteoporosis assessment strategies for male nursing home residents. *Maturitas* 2004;48(3):225-33.
- Kiebzak GM, Beinart GA, Perser K, Ambrose CG, Siff SJ, Heggeness MH. Undertreatment of osteoporosis in men with hip fracture. *Arch Intern Med* 2002;162(19):2217-22.
- Chrischilles EA, Butler CD, Davis CS, Wallace RB. A model of lifetime osteoporosis impact. *Arch Intern Med* 1991;151(10):2026-32.
- Amin S, Felson DT. Osteoporosis in men. *Rheum Dis Clin North Am* 2001;27(1):19-47.
- Forsén L, Sogaard AJ, Meyer HE, Edna T, Kopjar B. Survival after hip fracture: short- and long-term excess mortality according to age and gender. *Osteoporos Int* 1999;10(1):73-8.
- Pande I, Francis RM. Osteoporosis in men. *Best Pract Res Clin Rheumatol* 2001;15(3):415-27.
- Adler RA. The need for increasing awareness of osteoporosis in men. *Clin Cornerstone* 2006;8(Suppl 3):S7-13.
- Campion JM, Maricic MJ. Osteoporosis in men. *Am Fam Physician* 2003;67(7):1521-6.
- Jaglal SB, McIsaac WJ, Hawker G, Jaakkimainen L, Cadarette SM, Chan BT. Patterns of use of the bone mineral density test in Ontario, 1992-1998. *CMAJ* 2000;163(9):1139-43.
- Johnson SL, Petkov VI, Williams MI, Via PS, Adler RA. Improving osteoporosis management in patients with fractures. *Osteoporos Int* 2005;16(9):1079-85.
- Feldstein AC, Nichols G, Orwoll E, Elmer PJ, Smith DH, Herson M, et al. The near absence of osteoporosis treatment in older men with fractures. *Osteoporos Int* 2005;16(8):953-62.
- Brown JP, Josse RG; Scientific Advisory Council of the Osteoporosis Society of Canada. 2002 clinical practice guidelines for the diagnosis and

- management of osteoporosis in Canada. *CMAJ* 2002;167(10 Suppl):S1-34.  
Errata in: *CMAJ* 2003;168(4):400, *CMAJ* 2003;168(5):544, *CMAJ* 2003;168(6):676.
22. Brown JP, Fortier M; Osteoporosis Guidelines Committee. Canadian Consensus Conference on Osteoporosis, 2006 update. *SOGC Clin Pract Guidel* 2006;172:1-18. Available from: [www.sogc.org/guidelines/documents/JOGC-suppl-1eng-osteoporosis.pdf](http://www.sogc.org/guidelines/documents/JOGC-suppl-1eng-osteoporosis.pdf). Accessed 2008 May 22.
  23. Khan AA, Hodsman AB, Papaioannou A, Kendler D, Brown JP, Olszynski WP. Management of osteoporosis in men: an update and case example. *CMAJ* 2007;176(3):345-8.
  24. StataCorp 2001. *STATA statistical software: Release 7.0*. College Station, TX: Stata Corporation; 2001.
  25. Kanis JA; World Health Organization Study Group. Assessment of fracture risk and its application to screening or postmenopausal osteoporosis: synopsis of a WHO report. *Osteoporos Int* 1994;4(6):368-81.
  26. McKercher HG, Crilly RG, Klooseck M. Osteoporosis management in long-term care. Survey of Ontario physicians. *Can Fam Physician* 2000;46:2228-35.