ARTICLE

Measuring the Impact of Pharmacist Intervention: Results of Patient Education about Osteoporosis after Fragility Fracture

Clarene Ho, Ann Cranney, and Anna Campbell

ABSTRACT

Background: Fragility fractures are physical manifestations of osteoporosis, yet studies show undertreatment of osteoporosis after such fractures.

Objective: To determine the impact of pharmacist-initiated patient education on osteoporosis knowledge, modification of risk factors, and prescribed therapy after fragility fractures.

Methods: A pilot educational intervention was prospectively evaluated over a 5-month period at Kingston General Hospital, Kingston, Ontario. Patients older than 45 years who had recently sustained a fragility fracture (n = 23) were contacted 12 to 14 weeks after an educational intervention to determine if their osteoporosis knowledge had improved, if they had modified their risk factors, and if discussion with the family physician had led to bone mineral density assessment and/or osteoporosis treatment. Postdischarge reviews of the subjects' charts were used to determine if patients with fragility fracture were routinely assessed for osteoporosis at the study hospital.

Results: The proportion of patients who had discussed osteoporosis with their physicians increased (p = 0.024), which led to greater use of antiresorptive agents (p < 0.001). Osteoporosis knowledge also improved (p < 0.001). Changes in modifiable risk factors, including inadequate calcium intake, smoking, and caffeine ingestion, were statistically insignificant after the educational intervention. The chart reviews indicated that patients with fragility fracture are not routinely assessed or treated for osteoporosis while receiving treatment for the fracture.

Conclusions: Pharmacists can improve a patient's knowledge of osteoporosis, stimulate discussion with their family physician, and influence treatment rates. However, single teaching sessions do not influence modifiable osteoporosis risk factors, so continuous encouragement may be necessary.

Key words: osteoporosis, pharmacist intervention, patient education, fragility fractures

RÉSUMÉ

Historique : Les fractures de fragilité osseuse sont une manifestation physique de l'ostéoporose; malgré ce fait, les études montrent que le traitement de l'ostéoporose est insuffisant à la suite de telles fractures.

Objectif : Déterminer l'impact d'une intervention éducative entreprise par le pharmacien auprès des patients sur la connaissance de l'ostéoporose, la modification des facteurs de risque et le traitement prescrit par suite d'une fracture de fragilité.

Méthodes : Une intervention éducative pilote a été évaluée de façon prospective sur une période de cinq mois au Kingston General Hospital, à Kingston, en Ontario. De 12 à 14 semaines après l'intervention éducative, on a communiqué avec les patients de plus de 45 ans qui avaient souffert récemment d'une fracture de fragilité (n = 23) pour déterminer s'ils avaient une meilleure connaissance de l'ostéoporose, s'ils avaient modifié leurs facteurs de risque et s'ils avaient subi une évaluation de la densité minérale osseuse et (ou) reçu un traitement contre l'ostéoporose après avoir consulté leur médecin de famille. L'examen des dossiers des patients ayant subi une fracture de fragilité a servi à déterminer après leur congé s'ils avaient fait systématiquement l'objet d'une évaluation relative à l'ostéoporose à cet hôpital.

Résultats : La proportion de patients qui avaient discuté d'ostéoporose avec leur médecin avait augmenté (p = 0,024), ce qui a entraîné une plus grande utilisation d'inhibiteurs de la résorption osseuse (p < 0,001). La connaissance qu'avaient les patients de l'ostéoporose était également supérieure (p < 0,001). Les changements des facteurs de risque modifiables, y compris la carence en calcium, le tabagisme et la consommation de caféine, après l'intervention éducative étaient statistiquement non significatifs. L'examen des dossiers médicaux des patients ayant subi une fracture de fragilité indique l'absence d'évaluation systématique et de traitement pour l'ostéoporose durant la prise en charge de leur fracture.

Conclusions : Les pharmaciens peuvent améliorer la connaissance qu'ont les patients de l'ostéoporose, favoriser leurs discussions avec leur médecin de famille et exercer une influence sur les taux de traitement. En revanche, les séances d'information uniques n'ont aucun effet sur les facteurs de risque modifiables de l'ostéoporose; un soutien suivi peut donc être nécessaire.

Mots clés : ostéoporose, intervention du pharmacien, éducation du patient, fractures de fragilité

Can J Hosp Pharm 2006;59:184-93

INTRODUCTION

Osteoporosis has become a condition of considerable concern as the proportion of the population over 65 years of age increases and the risk of fracture rises accordingly. Osteoporosis is defined by the US National Institutes of Health as "a skeletal disorder characterized by compromised bone strength and predisposing a person to an increased risk of fracture."[1] Osteoporosis afflicts approximately 1 in 4 women and 1 in 8 men in Canada.[1] Despite the high incidence, osteoporosis often progresses unnoticed because there are few associated symptoms until a fragility fracture occurs. Even then, vertebral fractures may be asymptomatic.[1]

Fragility Fractures

Fractures are considered the most clinically significant physical manifestation of osteoporosis.[2] The World Health Organization (WHO) defines a fragility fracture as "a fracture caused by injury that would be insufficient to fracture normal bone: the result of reduced compressive and/or torsional strength of bone."[1] In the clinical context, fractures resulting from minimal trauma, such as a fall from standing height or less, are classified as fragility fractures.[1]

Fragility fractures usually occur at the distal forearm, hip, and vertebrae.[1,3,4] However, fractures at any site are more prevalent among people with low bone density, and adults who have sustained a fracture are more than twice as likely to have another fracture regardless of the site of the initial fracture.[2,4,5]

Outcomes of Fractures

Hip fractures are associated with an increased rate of mortality and morbidity.[6] About 40% of patients are unable to walk independently even as long as 1 year after hip fracture, and 27% of patients require nursing home care during that time.[3] Patients with hip fracture are also at increased risk of a second hip fracture.[1,3] The mortality rate in the first year after a hip fracture has been estimated at 20% higher than the overall mortality rate.[1] In Canada, the number of hip fractures is expected to quadruple by the year 2041.[7]

Patients with distal forearm fractures are at greater risk of future osteoporotic fractures, including hip fractures.[8] In many patients, a fracture of the distal forearm precedes a vertebral or hip fracture by 10 to 15 years. Vertebral fractures are associated with shortened stature and back pain and are predictors for future hip fractures. They are the most common form of fragility fractures and often go unnoticed by the patient. Multiple vertebral fractures can result in kyphosis.[6]

The 2002 Canadian Clinical Practice Guidelines for the Diagnosis and Management of Osteoporosis identified 4 key factors for predicting if a fracture is related to osteoporosis: low bone mineral density (BMD), prior fragility fracture, age, and family history of osteoporosis.[1] A prior fragility fracture is considered a significant predictor of osteoporosis.[1] Therefore, it is important that patients who have experienced a fragility fracture be targeted for osteoporosis education and screening.

The importance of identifying osteoporosis in patients who have suffered fragility fractures is evident, but studies show undertreatment of osteoporosis in patients who have experienced hip, vertebral and distal forearm fractures.[8-15] Smith and others[13] reported that of 218 patients treated for fractures possibly related to osteoporosis, only 32% subsequently underwent BMD testing and only 39% were offered treatment for osteoporosis within 18 months of their fracture. Calcium supplementation alone accounted for 60% of these treatments.[13] Although no studies were found citing the incidence of osteoporosis screening after a vertebral fracture, it has been reported that vertebral fractures are often undiagnosed, presumably because of the subtlety of symptoms.[16] Gardner and others[17] suggested that strategies to raise physician awareness of the necessity for screening and treating osteoporosis in patients with hip fracture resulted in an increase in the rate of treatment over a period of 4 years. However, the improved rate of treatment, 29%, is still not ideal.[17] A study evaluating patients' decision-making process to accept treatment for osteoporosis after hip fracture indicated that most women were not ready to accept pharmacological treatment for osteoporosis. This was attributed to a lack of awareness of the disease.[18] It is evident that a care gap exists between treating a fragility fracture and managing osteoporosis.

Pharmacist's Role

Several potential barriers exist to receiving pharmacological treatment for osteoporosis, including patients' lack of knowledge about osteoporosis (patients may attribute their fragility fractures to factors other than fragile bones, such as "falling the wrong way"). Upon learning that they have osteoporosis, patients may be further deterred from accepting therapy by the cost of treatment, concerns about side effects, and uncertainty about efficacy.[19] Another compliance issue arises because the positive effects of the treatment cannot be subjectively felt, yet adverse effects may occur.

Pharmacists have an excellent opportunity to intervene in the care of patients with fragility fracture and to reduce the care gap. They can educate patients about the risk factors for osteoporosis and suggest pharmacotherapy for general bone health, such as calcium and vitamin D. Pharmacists can also be instrumental in the selection of appropriate prescription treatments for osteoporosis, such as bisphosphonates or raloxifene, and can help to individualize therapies according to the patient's risk profile and potential for adverse events. Once therapy has been selected, the pharmacist can discuss expectations of the medication with the patient. In addition, a medication review might identify drugs that increase the risk of falls, such as sedatives or hypnotics. Patients should be educated about avoiding or decreasing the use of these medications where possible. Through the provision of pharmaceutical care, pharmacists can help to achieve the following treatment goals of osteoporosis (among others):

- Improving patient understanding of osteoporosis so that they can be involved in decision-making
- Educating patients about medication and assisting with adherence
- Preventing future fractures
- Stabilizing or achieving an increase in bone mass
- Relieving symptoms of fractures and skeletal deformity
- Maximizing physical function and preventing falls

The purpose of this study was to determine if pharmacists could improve patients' knowledge of osteoporosis and motivate them to reduce their risks for osteoporosis and future fragility fractures.

METHODS

Study Design

This study was a nonrandomized prospective evaluation of an educational intervention by a pharmacist. It was piloted as a residency project at Kingston General Hospital to determine the impact of pharmacist-initiated patient education on osteoporosis knowledge, lifestyle modification, and prescribed therapy after a fragility fracture. This study was approved by the Queen's University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board.

Eligibility Criteria and Recruitment

Study subjects were selected prospectively from a group of inpatients and outpatients being followed for recent fractures (within 6 months) by the orthopedic service. Inpatients were being treated in hospital for their fractures, whereas outpatients had been discharged from the hospital and were receiving follow-up care at the Fracture Clinic. Participants were included if they were 45 years of age or older, had suffered a recent fragility fracture, defined as a fall from standing height or less, and had given written consent to be enrolled in the study. Patients with cognitive impairment were included if a caregiver (friend or relative) was available to receive education on their behalf. Since the educational intervention was conducted in English, patients were excluded if they could not speak or understand English and did not have a translator. Patients were also excluded if they had a terminal illness with a predicted survival of less than 1 year, because it might not have been appropriate to attempt to contact these patients 12 to 14 weeks after fracture treatment. Patients with pathological fractures were also excluded. Eligibility was determined by inpatient or outpatient chart review or by direct questioning of subjects. All eligible patients were invited to participate in the study.

Data Collection and Intervention

Patients were enrolled during a 1-month period from February 10 to March 14, 2003. Data were extracted from chart reviews, patient interviews, and an osteoporosis knowledge questionnaire (OPQ), a validated instrument shown to have an acceptable difficulty and discrimination index.[20]

Study Measures

Demographic information about the participants was obtained from their medical charts. Patients were interviewed by a pharmacy resident (C.H.) to identify their risk factors for osteoporosis and to ascertain whether they were taking active measures to prevent or treat the condition. Participants were also asked to fill out the OPQ before the educational intervention.

Educational Intervention

A 20- to 30-min presentation on osteoporosis was given after the interview and questionnaire were completed. Using a pictorial flipchart, the following topics were presented to each participant:

- the process and consequences of osteoporosis
- modifiable risk factors (e.g., smoking, alcohol intake, weight-bearing exercises) and nonmodifiable risk factors (e.g., genetics)
- sources of calcium and vitamin D and their role in bone health
- prescription therapy options
- suggestions for preventing falls

Patients were encouraged to speak to a physiotherapist about appropriate weight-bearing exercises after recovery. They were also encouraged to see the family physician as soon as possible to assess the risk factors for osteoporosis. To supplement the presentation, participants also received written information (from the Osteoporosis Society of Canada) about osteoporosis, risk factors, treatment options, calcium, vitamin D, and fall prevention.[21-25]

Although the orthopedic physicians were aware that the study was being conducted, no active measures were taken to inform them of which patients were enrolled in the study. After patient discharge, a chart review was performed by the pharmacy resident to determine if patients had been assessed for osteoporosis in hospital after their fragility fracture.

Follow-up Assessment

All patients were asked to participate in a follow-up telephone interview within 12 to 14 weeks after the educational intervention. Questions were asked to determine whether the participant had discussed osteoporosis with the family physician, if a BMD scan had been ordered, and if the participant had taken any active measures to prevent or treat osteoporosis, including diet modifications. Participants were also asked to answer the OPQ again.

Outcome Measures

Primary Outcomes

The 3 primary outcome measures for this study were as follows:

- overall reduction of modifiable osteoporosis risk factors (inadequate calcium intake [supplements or dietary sources] and vitamin D supplementation, smoking, medications, and alcohol and caffeine consumption)
- proportion of patients whose OPQ score increased after the educational intervention
- proportion of patients who discussed osteoporosis with the physician 12 to 14 weeks after the fracture and who, as a result, started prescription therapy and/or were assessed with a BMD scan.

Secondary Outcome

The secondary outcome measure was the proportion of patients who underwent assessment for osteoporosis in hospital after their fragility fracture, defined as BMD scan ordered in hospital, prescription for antiresorptive medications given on discharge, or referral to the family physician for osteoporosis assessment.

Data Analysis

All data collected were entered into an Excel spreadsheet and imported into a statistical program (SPSS version 11.0.1, SPSS Inc, Chicago, Illinois) for analysis. Descriptive statistics were generated for all variables, including frequency tables for dichotomous and categorical variables and means, standard deviations (SDs), standard errors, and ranges for continuous data.

Paired *t* tests were used to compare scores on the OPQ before and after the educational intervention. To analyze the number of patients who took measures to decrease modifiable risk factors for osteoporosis, patient proportions (percentages) were calculated for the presence of each outcome measure before and after intervention. Paired *t* tests were used to test the significance of the changes for continuous data such as calcium and caffeine intake. Chi-square tests were used to assess the significance of the change in proportions for dichotomous and categorical variables. Statistical significance was defined as a *p* value of 0.05 or less.

The same approach was used to examine the number of patients who had consulted their family physician regarding osteoporosis by 12 to 14 weeks after fracture.

RESULTS

Over the study period, 59 patient charts were reviewed for eligibility. Twenty-two patients were excluded because of traumatic or pathological fracture, age less than 45 years, or cognitive impairment without a caregiver to receive the intervention on their behalf. Of the 37 eligible patients, 23 (62%) provided consent to participate. Follow-up was completed for all of these patients, but one patient declined to answer the follow-up OPQ.

Demographic Data

The patients' characteristics are presented in Table 1. All of the patients were white, most were female (83%), and all of the female patients were postmenopausal. The mean weight was 70.8 kg (range 45.5 to 105 kg, SD 16.9) and the mean height 164.9 cm (range 147.3 to 187.9 cm, SD 10.6). Body mass index ranged from 17.5 to 37.5 kg/m^2 (mean 26.0, SD 5.5). Two patients (9%) had a prior diagnosis of osteoporosis, and 8 (35%) had had at least one previous fracture, not necessarily a fragility fracture. Details of previous fractures and current fragility fractures are given in Table 1. Eighteen patients (78%) were taking medications that

Table 1. Baseline Characteristics of Patients Seen at Kingston General Hospital for Fragility Fracture (*n* = 23)

Characteristic	No. (%) of Patients*	Characteristic	No. (%) of Patients*
Age (years)		Site of fragility fracture	
45–55	7 (30)	Hip	11 (48)
56–65	0 (0)	Wrist	3 (13)
66–75	5 (22)	Ankle	6 (26)
75–85	7 (30)	Hip and wrist	1 (4)
> 85	4 (17)	Wrist and vertebrae	1 (4)
Mean (SD)	69.8 (13)	Femur	1 (4)
Sex		No. of previous fractures†	
Male	4 (17)	0	15 (65)
Female	19 (83)	1	4 (17)
Mean weight (SD) (kg)	70.8 (16.9)	2	3 (13)
Mean height (SD) (cm)	164.9 (10.6)	>2	1 (4)
Ethnic background		Site of previous fractures	
White	23 (100)	Hip	1 (4)
Other	0	Wrist	1 (4)
Education level		Other	3 (13)
Less than grade 9	3 (13)	Wrist and other	1 (4)
Grade 9–13	9 (39)	Vertebrae and other	1 (4)
Trade or professional certificate	6 (26)	Hip and vertebrae	1 (4)
Some university education	1 (4)	Family history of fractures†	3 (13)
University degree	4 (17)	Medications§	
Comorbitidies		Antihypertensives	15 (65)
Hearing impairment	4 (17)	Sedatives	3 (13)
Visual impairment	1 (4)	Narcotic analgesics	2 (9)
Rheumatoid arthritis	0 (0)	Anticholinergic medications	2 (9)
Osteoarthritis	5 (22)	Total no. of patients	18 (78)
Osteoporosis‡	2 (9)	Regular family physician	23 (100)
Hyperthyroidism	0 (0)	Regular community pharmacy	
Gastrointestinal disorder	5 (22)	Yes	19 (83)
Cognitive impairment	2 (9)	No	2 (9)
Stroke or TIA	4 (17)	No response	2 (9)
Hypertension	12 (52)		
Hyperparathyroidism	0 (0)		
Hypogonadism	0 (0)		

TIA = transient ischemic attack.
*Except where indicated otherwise.
†Any cause.
‡Previously diagnosed.
§Medications that increase propensity to fall. Some patients were taking more than one such medication.

could increase their propensity to fall (antihypertensives, narcotic analgesics, anticholinergics, sedatives).

Primary Outcomes

Risk Factor Assessment

By virtue of their fragility fractures occurring after age 40 (the inclusion criteria for this study), all of the patients had at least one major risk factor for osteoporosis. At baseline, 6 patients (26%) had 2 or 3 risk factors and 17 (74%) had 4 or more risk factors (Table 2), as defined by the 2002 Clinical Practice Guidelines for the Diagnosis and Management of Osteoporosis.[1] One person who had 6 risk factors at baseline had 7 risk factors at follow-up because calcium intake fell below the recommended daily amount. Another patient had 2 risk factors at baseline but only 1 risk factor at follow-up because calcium intake had increased to the recommended daily amount. The mean number of risk factors was 4.0 at baseline and 3.8 at follow-up (Table 2) (p = 0.30).

At baseline, 7 patients (30%) were consuming at least the recommended daily intake of calcium

Table 2. Risk Factors for Osteoporosis (*n* = 23)

Risk Factor	Mean Quantity (SD) or No. (%) of Patients				
	At Initiation of Study		At Follow-up		*p* Value
Calcium					
From dietary sources (mg/day)	802.4	(675.7)	855.3	(384.5)	0.70
Total (mg/day)	1085.9	(836.7)	1173.6	(589.1)	0.58
No. with calcium < 1500 mg/ day	16	(70)	18	(78)	0.62
Vitamin D					
As supplement (units/day)	243.5	(335.5*)	861.4	(2071.1*)	0.14
<800 units/day	20	(87)	19	(83)	0.06
Alcohol consumption (mean no. of drinks/wk)	0.87	(2.9)	0.22	(0.6)	0.23
Mean no. of risk factors for osteoporosis†	4.0		3.8		0.30
Total no. of risk factors (including fragility fracture)					
1	0	(0)	1	(4)	
2	3	(13)	2	(9)	
3	3	(13)	6	(26)	
4	10	(43)	7	(30)	
5	5	(22)	6	(26)	
6	2	(9)	0	(0)	
7	0	(0)	1	(4)	
Smoker	5	(22)	5	(22)	NA
Heavy caffeine ingestion (> 4 cups coffee/day)	6	(26)	2	(9)	0.06
Antiresorptive medications					<0.001
Bisphosphonates	4	(17)	7	(30)	
Hormone replacement therapy	4	(17)	4	(17)	
Raloxifene	1	(4)	1	(4)	
Calcitonin	0	(0)	0	(0)	
Total	9	(39)	12	(52)	
Long-term anticonvulsant medication	1	(4)	1	(4)	NA
Systemic glucocorticoids > 3 months	1	(4)	1	(4)	NA
Discussed osteoporosis with family physician	4	(17)	10	(44)	0.024
Most recent BMD scan					
In 1999	1	(4)	1	(4)	
In 2000	1	(4)	1	(4)	
In 2001	3	(13)	2	(9)	
In 2002	0	(0)	0	(0)	
In 2003	1	(4)	2	(9)	
Scheduled to be performed	0	(0)	5	(22)	
Total	6	(26)	11	(48)	
Total since fragility fracture	NA		7	(30)	

SD = standard deviation, BMD = bone mineral density, NA = not applicable.
*These data are not normally distributed, but because the median value at both times was 0, the mean and SD are considered to be more informative.
†Modifiable and nonmodifiable.

(> 1500 mg/day) from diet and supplements, and 5 (22%) patients were consuming the equivalent amount at follow-up (p = 0.62).[26] At baseline, the mean total daily calcium was 1085.9 mg (range 0 to 3050 mg) and the mean dietary calcium was 802.4 mg (range 0 to 2550 mg). At follow-up, the mean total daily calcium was 1173.6 mg (range 300 to 2699 mg) and the mean dietary calcium intake was 855.3 mg (range 150 to 1671 mg). Even though 2 patients had dropped below the threshold of recommended daily intake, the mean total and mean dietary calcium intake increased overall. However, neither was statistically significant (p = 0.58 and p = 0.70, respectively).

At baseline, 3 (13%) of the patients were consuming 800 units or more of vitamin D as supplements. At follow-up, 2 of the patients who had been taking less than 800 units per day at baseline had increased their vitamin D supplementation to 800 units or more per day, but one patient who had been taking at least 800 units at baseline had dropped below this level at follow-

up. In total, 4 (17%) of the patients were consuming 800 units of vitamin D supplementation at follow-up. The mean total daily vitamin D was 243.5 units at baseline and 861.4 units at follow-up ($p = 0.14$).

Five (22%) of the patients were smokers at baseline. None of these smokers had quit by the time of follow-up.

Six (26%) of the patients, classified as heavy caffeine consumers, had an intake of caffeine equivalent to 4 or more cups of coffee per day at baseline,[27] but only 2 (9%) of the patients had this level of caffeine intake at follow-up ($p = 0.06$).

The mean number of alcoholic drinks per week decreased from 0.87 (range 0 to 14) at baseline to 0.22 (range 0 to 2) at follow-up. This decline was not statistically significant ($p = 0.23$) primarily because a large proportion of patients did not drink at either time point.

At both baseline and follow-up, 1 patient (4%) had been receiving systemic glucocorticoid therapy for more than 3 months and 1 patient (4%) was receiving long-term anticonvulsant therapy. The first of these 2 patients saw her physician after discharge and discussed osteoporosis, but no plans were made for a BMD scan. The other patient did not see her doctor after the fracture, and no plans were in place at the time of follow-up to assess for osteoporosis.

Osteoporosis Knowledge

Of the 23 patients who completed the OPQ at baseline, 22 also completed it at follow-up. One patient declined to do so because he could not remember having had the educational intervention while in hospital. The osteoporosis knowledge assessment scores based on intention-to-treat patient numbers ($n = 23$) are presented in Table 3.

At baseline, 22 patients (95%) had heard of osteoporosis. Most had heard of the condition from friends, family, and the media, but only 4 (17%) had discussed osteoporosis with their doctor or another health care professional. At baseline, 18 patients (78%) knew the correct definition of osteoporosis, whereas 21 (91%) knew the definition at follow-up ($p = 0.04$). At baseline, 16 patients (70%) knew that adequate calcium and vitamin D intake were needed to maintain healthy bones, and 22 (96%) knew this at follow-up ($p = 0.12$).

The mean score increased from 7.3 out of 20 (range 0 to 17, SD 4.98) at baseline to 11.6 out of 20 (range 6 to 20, SD 4.92) at follow-up ($p < 0.001$).

Attempt to Identify and Manage Osteoporosis

Before the educational intervention, only 4 patients (17%) remembered having had a discussion with their physician or another health care professional about osteoporosis, whereas 10 patients (43%) discussed their risks for osteoporosis with a physician after the intervention ($p = 0.024$). Of these 10 patients, 7 went on to have a BMD scan performed or scheduled. Four of the 7 patients were undergoing BMD scanning for the first time. All of the scans were ordered by the family physician. Two patients who had a scan performed or scheduled were also started on osteoporosis drug therapy. Of the 3 patients who spoke to their physician but did not have a BMD scan performed or scheduled, one had started osteoporosis treatment. In total, 9 patients (39%) were receiving antiresorptive medications for osteoporosis management or prevention at baseline and 12 (52%) patients were receiving such therapy at follow-up ($p < 0.001$, chi-square test).

Table 3. Osteoporosis Knowledge Scores at Baseline and Follow-up among 23 Patients with Fragility Fracture

	Knowledge Score*			
Time Point	Minimum	Maximum	Mean†	SD
Baseline	0	17	7.3	4.98
Follow-up	6	20	11.6	4.92

SD = standard deviation.
*Maximum possible score = 20.
†Mean scores were significantly different ($p < 0.001$).

Secondary Outcome

Because all participants had a clinically defined fragility fracture, they met the criteria of the 2002 Canadian clinical practice guidelines for assessment of osteoporosis.[1] During the hospital visit, no patients were investigated for osteoporosis with a BMD scan or any other method (Table 4). For 4 patients (17%), osteoporosis treatment was ordered in hospital as a continuation of home therapy, but none had new osteoporosis treatment initiated. No patients were referred for osteoporosis assessment upon discharge. Only one patient had calcium and vitamin D ordered in the hospital as a continuation of home therapy. No patients left the hospital with a new diagnosis of osteoporosis.

DISCUSSION

Even though osteoporosis is a condition with significant implications, it often goes undiagnosed because it is not associated with obvious symptoms until a fragility fracture occurs. Even then, many patients with fragility fractures are not investigated for osteoporosis.[7,9-15]

Table 4. Hospital Assessment for Osteoporosis (*n* = 23)

Assessmention Action	No. (and %) of Patients
Bone mineral density test ordered	0
Recommendation in dictation notes for osteoporosis assessment by family physician	0
Referral to osteoporosis clinic	0
Antiresorptive medications ordered in hospital	4 (17)
Antiresorptive medications initiated in hospital	0
Calcium ordered in hospital	1 (4)
Vitamin D ordered in hospital	1 (4)

This study has demonstrated that pharmacists can have a positive impact in educating patients about osteoporosis and can prompt or encourage them to speak to their physicians about it.

In 2001, Smith and others[13] reported that 39% of patients with fragility fractures of the hip and wrist were receiving osteoporosis treatment; in 60% of these cases, the treatment was calcium alone. Khan and others[28] reported that only 38% of patients were taking either calcium or antiresorptive medication after fragility fractures of the wrist. In the current pilot study at KGH, 52% of patients were receiving antiresorptive medications at follow-up, an increase of 13 percentage points from baseline. Raising patients' awareness of osteoporosis may motivate them to ask their physicians about the need for treatment, leading to a higher proportion of patients being treated.

Although the pharmacist intervention in this study had a positive impact on the proportion of patients using antiresorptive medication, there were no statistically significant changes in modifiable risk factors. Dietary and total calcium intake trended upward at follow-up, but the proportion of patients actually attaining the required daily intake for calcium decreased. There was an increase in mean daily vitamin D intake after the intervention, but this was not significant. Perhaps patients need more than 12 to 14 weeks to modify their risk factors. However, these results may also indicate an ongoing need for reinforcement by all health care professionals to encourage adequate calcium and vitamin D intake. When a patient presents with a fragility fracture, the orthopedic surgeon, hospital pharmacist, nurse, and other members of the health care team should collaborate to promote bone health. Primary care physicians and community pharmacists are well positioned to continually emphasize the importance of calcium and vitamin D and to follow up on recommendations made to patients.

The educational intervention in this study did not have a statistically significant impact on caffeine consumption or smoking cessation. Again, it is imperative that health care workers act as a team to provide ongoing encouragement to reduce these risk factors. Weight-bearing exercise, another modifiable risk factor, was not assessed in this study because of the long recovery time for fractures and the short follow-up period of the study.

During the study, orthopedic surgeons at KGH were made aware of the study but no measures were taken to inform them of which patients were involved. Awareness of the study might have influenced the assessment rates for osteoporosis; however, it was determined that patients with fragility fracture were not being assessed for osteoporosis at KGH, nor were they being referred to their family physicians for such assessment. This lack of assessment suggests that general awareness of the study did not influence behaviour; it also highlights the large gap in care between acute and community care settings. When a patient presents with a fragility fracture, it is important to take the opportunity to discuss risk factors for osteoporosis. This study has shown that educating patients alone is insufficient to significantly increase the proportion of patients being assessed for osteoporosis. Only 30% of the patients in this study went on to have a BMD scan within 3 months of their fracture. This demonstrates a need for greater physician education about the criteria for osteoporosis assessment. Action should be initiated while the patient is in hospital. A request from the orthopedic surgeon to the family physician for an osteoporosis assessment or an order for BMD scanning in hospital ensures some degree of patient follow-up. At the very least, all patients should be assessed for adequate calcium and vitamin D intake. Calcium and vitamin D initiated in the hospital may be more likely to be continued at home.*

Because of limited resources and time constraints, this study was conducted as a pilot. The limitations of this study are the lack of a control arm, potential bias among subjects and investigators, the short follow-up period, and the small sample size. In addition, those who declined to participate (38% of those who were approached) may have different characteristics from those who did participate. Definitive statements about the influence of the pharmacist intervention cannot be made because of the lack of a control arm and potential

*Note added in proof: As of April 2006, the hospital has included calcium, vitamin D and a letter to the family physician as part of osteoporosis management in preprinted postoperative orders for fractured hip.

subject and investigator bias. The accuracy of the results is limited by the subjective nature of self-reported data. In addition, investigator bias may have limited the accuracy of the study because the same investigator was responsible for conducting interviews, providing the educational sessions, and interpreting the follow-up data. If the study had been extended for a longer follow-up time, higher numbers of patients might have been assessed for osteoporosis by their family physicians and antiresorptive therapy might have been initiated for more patients. However, a longer follow-up time might also have negatively affected the number of patients taking antiresorptive therapy because of discontinuation due to intolerance or side effects. Follow-up to at least 6 months or 1 year would allow a clearer assessment of modifiable risk factors, osteoporosis screening, and initiation of appropriate therapy. It would also be worthwhile to conduct a similar trial on a larger scale. A larger sample size would allow randomization to control (standard care) and experimental (educational intervention) arms. This would allow the true effects of the educational intervention to be discerned. To eliminate investigator bias in future studies, the tasks should be divided up, such that one investigator collects the data, another conducts the educational session, and another inputs data for statistical analysis. Given the current pharmacist shortage, group educational sessions instead of individual sessions may be more practical. This trial suggests that knowledge alone may not be enough to influence a person's decision to modify risk factors. Future trials should also examine how ongoing reinforcement by health care providers may influence patients' decisions to modify osteoporosis risk factors through the transtheoretical model of behaviour change: pre-contemplation, contemplation, preparation, action, and maintenance.[29]

It is recommended that a BMD scan and calcium supplementation for patients with inadequate calcium intake (about 70% of patients) become the minimum standard of care at KGH after a fragility fracture. Vitamin D supplementation should also be encouraged since this population is often vitamin D deficient.[30]

CONCLUSIONS

Pharmacists have an important role in educating patients about the risk factors and treatment options for osteoporosis. This study demonstrated that pharmacists can increase patients' knowledge about osteoporosis and encourage them to speak to their family physician about the need for treatment and prevention. However, a single teaching session was not enough to motivate patients to decrease modifiable risk factors. Continual encouragement to modify these risk factors is needed from all health care professionals, especially pharmacists, who are well positioned to intervene and provide follow-up. This study confirmed the results of previous studies in other institutions showing that patients with fragility fracture are not being assessed for osteoporosis, nor are they being referred for assessment after discharge. It is recommended that a BMD scan and an assessment for osteoporosis therapy become the standard of care after a fragility fracture.

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Clarene Ho, BscPharm, was pursuing a pharmacy residency at the Kingston General Hospital in Kingston, Ontario, at the time this project was completed. She is now a Staff Pharmacist there.

Ann Cranney, MSc, MD, is an Associate Professor with the Department of Medicine, University of Ottawa, Ottawa, Ontario.

Anna Campbell, BA, BscPharm, is a Pharmacist with the Kingston General Hospital, Kingston, Ontario.

Address correspondence to:
Clarene Ho
Pharmacy Services
Kingston General Hospital
76 Stuart Street
Kingston ON
K7L 2V7

e-mail: hocl@kgh.kari.net

Acknowledgements
The authors would like to thank Wilma Hopman for her help in statistical analysis and John McBride for his editorial assistance.

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