

The burden of osteoporotic fractures beyond acute care: the Canadian Multicentre Osteoporosis Study (CaMos)

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Abstract

Background—the burden associated with osteoporotic fractures has commonly been reported in terms of utilisation of acute care. However, individuals with fractures suffer lasting deficits in quality of life and the burden of care extends well beyond the initial acute care period. The burden of fractures related to post-acute health care utilisation, and informal care giving, has not been sufficiently addressed. We examine the use of formal and informal post-acute care in men and women 50 years and older who sustained fractures.

Methods—the study sample consisted of 1,116 men and women from the Canadian Multicentre Osteoporosis Study (CaMos) who sustained a fracture. We assessed utilisation of post-acute care including rehabilitative and home care services, as well as informal care in persons with a hip, vertebral, or non-hip-non-vertebral fractures.

Results—use of rehabilitative and home care services was reported by 37.1% and 18.2% of men and women, respectively. Persons with hip fracture were more likely to report use of these services compared with persons with non-hip-non-vertebral fractures; those with vertebral fracture were less likely to report using these services. Use of informal care was reported by 47.2% of

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Conflicts of interest

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Authors' contributions

All authors participated in the design of the study. P.R. secured the funding and provided guidance with analysis and interpretation of the data. S.K. carried out the data analysis and wrote the manuscript draft. All authors revised the manuscript for important intellectual content.

participants. Individuals with multiple fractures made more extensive use of post-acute resources compared with those with single fractures.

Conclusions—use of post-acute care in individuals with fracture is extensive and the contribution of use of these resources to the overall burden of fractures cannot be ignored. Our findings have implications for future economic analyses and policy-making related to care of osteoporotic fractures.

Keywords

osteoporosis; resource utilisation; post-acute care; informal care; osteoporotic fracture

Introduction

Fractures in older adults are recognised as an important public health concern [1]. Up to 50% of women and 22% of men over the age of 50 will experience at least one fragility fracture in their lifetime [2, 3]. The majority of fractures in men and women aged 50 years or older are believed to be associated with osteoporosis [4, 5]. Fractures are associated with significant burden related to both formal care (e.g. hospitalisations, rehabilitative and long-term care) and informal care in addition to lower quality of life and increased mortality [2, 6–9].

Examining healthcare utilisation patterns is necessary in estimating disease burden. However, most utilisation studies to date have focused on acute care costs of fractures. Yet, hospitalisations for fractures, particularly hip fractures, represent only a portion of the burden of fractures [1]. In one of the first longitudinal Canadian studies assessing patterns of healthcare utilisation for persons with hip fracture, Wiktorowicz *et al.* reported that nursing home, rehabilitation and chronic care, and home care accounted for 69% of 1-year costs post fracture, while initial hospitalisation represented 27% of total costs [10]. Similarly, Bouee *et al.* reported that in five European countries (France, Spain, UK, Belgium and Italy) the mean unit cost associated with rehabilitation for hip fracture constituted as much as 59% of all costs [11]. These costs were largely attributed to stays at nursing homes and rehabilitation centres, as well as out-patient and home physical therapy sessions. Therefore, a sole focus on acute care of fractures could underestimate healthcare utilisation and the burden related to fractures.

Hip fractures have been by far the most frequently studied fracture type [7, 8, 12]. Healthcare utilisation related to fractures other than the hip and spine such as wrist, forearm, ribs and pelvis has been less commonly documented. While up to 96% of older adults with hip fractures are hospitalised, hospitalisation rates for other fractures such as pelvic and wrist fractures are lower. As a result, post-acute care such as physiotherapy and home care may be more intensive and costly for these individuals [11, 13]. Furthermore, even for hip fractures, post-acute care is becoming more prominent as patients are discharged from the hospital earlier and the focus of fracture management shifts from lengthy hospitalisations to rehabilitation in the community.

Informal care, that is care delivered by friends and relatives, is increasingly being considered as a valuable substitute and complement for costly formal care. Informal care plays an important role in the total care provided for individuals with fracture and although not reimbursed by public or private insurance, it is associated with costs. This includes, among others, opportunity costs of caring for a loved one (foregone earnings of the informal caregiver) [14, 15]. Thus, to assess the burden of fractures more accurately, studies must also consider post-acute and informal care used during fracture rehabilitation [16]. Despite the important role of informal care, there is a dearth of reports on informal care related to fractures.

Using data from the Canadian Multicentre Osteoporosis Study (CaMos), we aimed to address some of the noted gaps in the literature with a specific focus on both formal and informal post-acute care related to all major categories of osteoporotic fractures.

Methods

CaMos is an ongoing prospective cohort study of the Canadian population that was initiated in 1996. The study population consists of an age-stratified and sex- and region-specific sample consisting of 9,423 non-institutionalised individuals (6,539 women and 2,884 men) from nine study centres across Canada (St John's, Halifax, Quebec City, Kingston, Toronto, Hamilton, Saskatoon, Calgary and Vancouver). CaMos participants were recruited over an 18 month period from a randomly selected list of residential phone numbers from all postal codes within 50 km of each study centre. Informed consent was obtained from each individual and the study received ethics approval from the institutional review boards at each participating centre [17].

The CaMos instrument at baseline consisted of an interviewer-administered questionnaire that collected socio-demographic and anthropomorphic data as well as past medical and fracture history and physical measures, including lumbar and thoracic X-rays and bone mineral density testing (BMD). Data related to fractures, hospitalisations and the use of prescription bone medications that occurred during the previous year were collected through the annual follow-up questionnaire. Participants who reported fractures on the annual questionnaire completed a detailed fracture questionnaire that collected data on the type of fracture, treatments received for the fracture and related healthcare utilisation. Radiographic verification of incident fractures was obtained when information was available.

Fractures were considered to be osteoporotic where the fracture type is known to be associated with a decreased BMD [3]. Fractures were categorised into three groups: hip, vertebral and non-hip-non-vertebral fractures (NHNV). NHNV fractures included fractures of the pelvis, humerus, clavicle, wrist, femur, lower leg, ankle, forearm, ribs and sternum. We used data from 10 years of follow-up in this study.

Post-acute care was defined as any services used after the initial treatment of the fracture at a hospital or physician's office (e.g. surgery, cast). This included use of physiotherapy, occupational therapy, home visits by a nurse and homemaker services. Formal post-acute care was categorised into two groups: rehabilitative care (physiotherapy and occupational

therapy) and home care (nurse home visits and homemaker services). Home maker services consisted of such services as preparation and delivery of meals, housekeeping and personal hygiene. Post-acute care was taken as a binary variable with 1 representing reported use of the post-care and 0 representing no use of the care. Data on informal care included the number of days the individual received help from a relative or friend, whether or not the helper had a paying job, and number of days off from work the helper had to take as a result of the participant's fracture.

Data analysis

We used data from 10 years of follow-up and included community-dwelling CaMos participants who sustained a fracture and were 50 years or older at the time of their fracture. Multivariable logistic regression analyses were carried out to determine whether individuals with the three fracture types differed in their utilisation of rehabilitative care, home care or informal care. Regression models were adjusted for additional factors that could affect healthcare utilisation. These included age, gender, access to health care (urban or rural residence), living arrangement (alone or not alone), number of comorbidities, number of previous fractures and province of residence. We also examined the use of *any* of the two types of resources (i.e. rehabilitative care or home care). Finally, we compared utilisation of post-acute care in individuals who sustained multiple fractures in the same year versus persons who reported a single fracture. To be included in the analysis, all fractures for a person with multiple fractures had to belong to one of the three fracture categories of interest (hip, vertebral, NHNV). All analyses were conducted using SAS (version 9.1; SAS Institute, Inc., Cary, NC, USA).

Results

A total of 1,116 CaMos participants (907 women and 209 men) were included in this analysis. The characteristics of the study population are shown in Table 1. The mean age for men was 70.2 (SD = 7.8) years and for women, 74 (SD = 7.2) years. Hip fractures represented 9.8% of fractures in women and 12.9% of fractures in men. Vertebral fractures composed 13.3% and 11.3% of fractures in women and men, respectively; 76.7% and 75.7% of fractures were classified as NHNV fractures in women and men, respectively.

For 1,116 individuals who returned home after the acute treatment of their fracture, information on use of rehabilitative services (physiotherapy or occupational therapy) was available for 1,088 participants. Four hundred and four individuals (37.1%) reported using rehabilitative services. Seventy-one individuals (6.5%) reported using both physiotherapy and occupational therapy and 54 (29%) used rehabilitative services, but no home care services. Of 715 participants for whom data regarding home care were available, 130 (18.2%) reported receiving home care (nurse home visits or homemaker services). These services (rehabilitative and home care services) were used by 438 individuals (40.2%). Eighty-seven (8%) reported using home care services but no rehabilitation services; 96 individuals (8.8%) used both rehabilitative and home care services. Table 2 provides a descriptive summary of formal post-acute care by fracture type.

Adjusted odds ratios for use of formal post-acute services are presented in Table 3. Individuals with hip fracture were considerably more likely to report use of formal post-acute care compared with those with NHHV fractures. In contrast, persons with vertebral fractures were less likely to report using rehabilitative care.

In addition, while 438 (40.2%) of individuals with a single fracture reported using formal post-acute care, 68 (85%) of persons with multiple fractures reported using these services. Those sustaining multiple fractures were more likely to use post-acute care compared with those with single fractures (adjusted OR = 2.11, 95% CI = 1.11–4.15).

Of the 821 participants for whom data about utilisation of informal care were available, 388 (47.2%) reported receiving informal care. Twenty-eight percent of men and 50% of women reported receiving informal care. Among persons with a hip fracture, 64.3% reported receiving informal care in comparison with 38.7% of those with vertebral fractures and 44.8% of individuals with NHHV fractures. Participants with hip fracture were significantly more likely to report receiving informal care compared with persons with NHHV fractures (adjusted OR = 2.85, 95% CI = 1.83–4.43). The mean number of days of informal care received was 37 (SD = 26, median = 21). Thirty-six percent reported that the informal caregiver had a paying job; 25% of the caregivers were reported to have taken at least 1 day off their job to care for their relative with fracture.

Discussion

With a specific focus on post-acute care of fractures, this study's results indicate that post-acute care utilisation after fractures is indeed extensive among individuals with all types of fragility fractures. We found that hip fractures were associated with a considerably greater utilisation of post-acute resources compared with non-vertebral fractures even after adjustment for age, gender and comorbidity. This finding is consistent with numerous other studies reporting that hip fractures incur the greatest burden on the health-care system in terms of both acute and post-acute resource utilisation [12, 18–25]. It is likely that the majority of individuals who sustain hip fractures undergo surgery for treatment of their fracture accounts for the considerably higher use of post-acute resources in this group. In our study population, 88% of persons with a hip fracture underwent surgery (internal/external fixation or joint replacement). We also found that persons with vertebral fractures reported lower use of post-acute care compared with those with NHHV fractures. Vertebral fractures are associated with severe pain and functional limitations but are less overtly severe. The type of formal post-acute care required by those with vertebral fractures compared with those with hip or non-vertebral fractures differ. The lower use of post-acute resources reported by our study participants with vertebral fractures may indicate a gap in formal post-acute care provided to persons with vertebral fractures.

Another notable finding of this study was the observation that participants with multiple fractures made especially extensive use of post-acute care resources compared with those who sustained a single fracture. While it may be evident that individuals with multiple fractures will require more care resources, this study is important in providing empirical evidence that individuals who sustain multiple fractures do in fact utilise more healthcare

resources, which again highlights the need for implementation of strategies to prevent these fractures.

Another important finding of the present study relates to the examination of informal care as a post-acute resource used by individuals with fracture. Although informal care has been recognised as part of the intangible costs associated with the burden of osteoporotic fractures, only a handful of studies have included it in their analyses [10, 12]. A significant proportion of participants of this study who sustained fractures reported receiving help from a family member or friend. This demonstrates the important role of informal care giving in the total care provided for the individual with a fracture. In addition to loss of productivity for caregivers, there is growing evidence that informal care-giving can have an adverse effect on the caregivers' well-being and quality of life [15, 26]. Furthermore, when informal caregivers are older adults providing care for their spouse, caregiver burden may be particularly great. In a Canadian study, Wiktorowicz *et al.* reported that 26% of participants in their study received informal care from their spouse, and 54% from their children; 71% of informal caregivers were 65 years or older [10]. These authors also estimated that the average 1-year cost of informal care for community-dwelling patients was \$1,099 which represented 3% of 1 year costs of hip fractures.

This study is not without limitations. With regard to healthcare utilisation, while the limitations of self-reported data and potential for recall bias still apply, a number of studies have demonstrated good to fair agreement between administrative data and patient self-report for a range of healthcare services suggesting that self-reports are a viable method for obtaining data on healthcare utilisation [27–30]. In the current study, self-report of healthcare utilisation is not believed to be a major limitation since the analyses were mainly based on whether or not the individual used the post-acute healthcare service (i.e. yes/no), rather than on duration or intensity of care received (i.e. number of visits/number of weeks of care received). The latter would be more prone to recall bias. The absence of an external control group consisting of individuals without a fracture is another limitation of this study. Here, healthcare utilisation was compared among individuals with different fracture types. This was because in CaMos, data on healthcare utilisation were collected only for individuals who sustained fractures, and as such, a comparison group consisting of individuals without a fracture was unavailable.

In conclusion, this study reports on extensive use of post-acute care by persons with osteoporotic fractures and demonstrates the importance of considering post-acute care, including informal care in studies of healthcare resource utilisation and burden of illness related to these fractures. There are implications for health planners and policy makers in allocating scarce healthcare resources to more effectively address the needs of this patient population. Ultimately, this study and other studies of burden of osteoporosis and fractures highlight the importance of implementing effective strategies to treat and prevent osteoporosis and fractures to alleviate burden on individuals, caregivers and the healthcare system.

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Key points

- The burden of osteoporotic fractures extends beyond acute care but post-acute care of fractures has not been addressed.
- Utilisation of formal (e.g. rehabilitative and home care) and informal post-acute care of fractures in a population of adults aged 50 years and older is examined in this study.
- A considerable proportion of participants reported using post-acute care resources. Individuals with hip fracture were more likely to use these resources. Post-acute resource utilisation was more extensive in those with multiple fractures compared with individuals with single fractures.
- Use of post-acute care in individuals with fracture is extensive and the contribution of these resources to the overall burden of fractures should not be ignored.

Table 1

Characteristics of the study population

Variable	Fracture type			
	Hip (<i>n</i> = 116)	Vertebral (<i>n</i> = 144)	NHNV (<i>n</i> = 856)	Total (<i>n</i> = 1,116)
Age group				
50–64	8 (6.5)	16 (11.1)	218 (25.5)	242 (21.6)
65–74	24 (21.0)	36 (25.0)	270 (31.5)	330 (29.5)
75–84	47 (40.6)	64 (44.4)	293 (34.2)	404 (36.2)
>85	37 (31.9)	28 (19.5)	75 (8.80)	140 (12.5)
Gender				
Men	17 (14.6)	9 (6.2)	183 (21.4)	209 (18.7)
Women	99 (85.4)	135 (93.8)	673 (78.6)	907 (81.2)
No. of previous fractures				
0	45 (38.8)	58 (40.3)	295 (34.5)	398 (35.6)
1	32 (27.6)	45 (31.2)	287 (33.5)	364 (32.6)
2 or more	39 (33.6)	41 (28.5)	274 (32.0)	354 (31.7)
Urban/rural residence				
Urban	101 (87.1)	132 (91.6)	802 (93.7)	1035 (92.7)
Rural	15 (12.9)	12 (8.3)	54 (6.3)	81 (7.2)
Living status				
Alone	45 (38.8)	52 (36.1)	348 (40.6)	445 (39.9)
Not alone	71 (61.2)	92 (63.9)	508 (59.4)	671 (60.1)

Table 2

Utilisation of rehabilitative care and home care by fracture type

Fracture type	Rehabilitative services		Homecare services		Rehabilitative or homecare services	
	Yes (n = 404)	No (n = 684)	Yes (n = 130)	No (n = 585)	Yes (n = 438)	No (n = 650)
Hip	75 (69.4)	33 (30.6)	38 (50.7)	37 (49.3)	83 (76.1)	26 (23.9)
Vertebral	36 (25)	108 (75)	14 (15.1)	79 (84.9)	42 (29.8)	99 (70.2)
NHNV	293 (35.0)	543 (65.0)	78 (14.3)	469 (83.7)	313 (37.3)	525 (62.4)

Table 3

Adjusted odds ratio estimates for use of formal post-acute care

Fracture type	OR ^a	95% CI	P-value
Rehabilitative care			
Hip	4.28	2.83–6.48	<0.001
Vertebral	0.57	0.39–0.84	<0.001
NHNV (reference)	1.00	—	—
Home care			
Hip	5.44	3.24–9.13	<0.001
Vertebral	0.76	0.41–1.43	0.395
NHNV (reference)	1.00	—	—
ANY formal care			
Hip	4.88	3.14–7.60	<0.001
Vertebral	0.64	0.44–0.93	0.018
NHNV (reference)	1.00	—	—

^aEstimates adjusted for age, gender, number of comorbidities and living status.