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Original Article

The Influence of Osteoporotic Fractures on Health-Related Quality of Life in Community-Dwelling Men and Women across Canada

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Abstract. Health-related quality of life (HRQL) was examined in relation to prevalent fractures in 4816 community-dwelling Canadian men and women 50 years and older participating in the Canadian Multicentre Osteoporosis Study (CaMos). Fractures were of three categories: clinically recognized main fractures, subclinical vertebral fractures and fractures at other sites. Main fractures were divided and analyzed at the hip, spine, wrist/forearm, pelvis and rib sites. Baseline assessments of anthropometric data, medical history, therapeutic drug use, spinal radiographs and prevalent fractures were obtained from all participants. The SF-36 instrument was used as a tool to measure HRQL. A total of 652 (13.5%) main fractures were reported. Results indicated that hip, spine, wrist/forearm, pelvis and rib fractures had occurred in 78 (1.6%), 40 (0.8%), 390 (8.1%), 19 (0.4%) and 125 (2.6%) individuals, respectively (subjects may have had more than one main fracture). Subjects who had experienced a main prevalent fracture had lower HRQL scores compared with non-fractured participants. The largest differences were observed in the physical functioning (−4.0; 95% confidence intervals (CI): −6.0, −2.0) and role-physical functioning domains (−5.8; 95% CI: −9.5, −2.2). In women, the physical functioning domain was most influenced by hip (−14.9%; 95% CI: −20.9, −9.0) and pelvis (−18.1; 95% CI: −27.6, −8.6) fractures. In men, the role-physical domain was most affected by hip fractures (−35.7; 95% CI: −60.4, −11.1). Subjects who experienced subclinical vertebral fractures had lower HRQL scores than those without prevalent fractures. In conclusion, HRQL was lower in the physical functioning domain in women and the role-physical domain in men who sustained main fractures at the hip. Subclinical vertebral fractures exerted a moderate effect on HRQL.

Keywords: Hip; Osteoporosis; Pelvis and rib fractures; Quality of life; SF-36; Vertebral; Wrist/forearm

Introduction

The burden of osteoporosis has largely been assessed in terms of bone mineral density and incident fracture rates [1,2]. Nonetheless, the usual emphasis on bone loss or incident fractures is an incomplete representation of the effects of osteoporosis on the lives of individuals [3]. For instance, the physical, psychological and social con-

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sequences of osteoporotic fractures can profoundly influence health-related quality of life (HRQL) and should be considered when quantifying the impact of this disease. Despite the growing number of individuals who have osteoporosis [4], only a few studies have attempted to quantify osteoporotic fracture-related impairments with disease burden and most participants have been selected from tertiary care settings [5–9]. Furthermore, epidemiologic data documenting whether or not prevalent low-trauma fractures affect HRQL in population-based national cohorts have, until now, been unavailable.

The Canadian Multicentre Osteoporosis Study (CaMos) is a national, random sample of the population which provides substantial data regarding osteoporosis, fractures and quality of life. Using CaMos data, we performed a cross-sectional cohort study to determine the impact of osteoporotic fractures on HRQL in community-dwelling men and women from nine sites across Canada.

Subjects and Methods

Study Cohort

Details regarding subject recruitment for the CaMos have been reported elsewhere [10]. Briefly, CaMos involves nine sites across Canada (Vancouver, Calgary, Saskatoon, Hamilton, Toronto, Kingston, Quebec City, Halifax and St John's). The study population represents an age-, sex- and region-specific sample of the population of Canada and consists of non-institutionalized individuals who reside within 50 km of each study center, including 6538 women and 2885 men aged 25 years and older. CaMos participants were recruited from a list of random telephone numbers from all postal codes within 50 km of each study center. An introductory letter and informational brochure were sent to each household, followed by a telephone call. A household enumeration identified all household members eligible for the cohort; from this household enumeration, the interviewer selected a cohort participant by means of a random number table designed precisely for the number of eligible subjects in the household. Informed consent was obtained from each individual and the study received approval by the institutional review boards at each participating center.

CaMos participants 50 years and older were eligible for inclusion in the current study. Subjects were excluded if they had fallen in the past month, as it was felt that this would adversely affect the HRQL scores.

Data Source

Subject data collected at cohort entry were extensive. For the current study, information was gathered from two questionnaires:

The CaMos Instruments. This is an interviewer-administered questionnaire that addresses the following subject areas: sociodemographic and anthropometric information, past medical and fracture history, family history of osteoporotic, therapeutic drug use, reproductive and obstetric history, dietary intake, current leisure time and occupational physical activity, active and passive tobacco smoke exposure, and sunlight exposure.

The Medical Outcomes Trust 36-item Health Survey (SF-36). This self-administered generic HRQL instrument is derived from the RAND health insurance experiment [11,12]. The questionnaire consists of 36 items and measures three aspects of health: functional ability, well-being and overall health. These are quantified using eight multi-item domains (physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional and mental health) and two summary scales (physical and mental component) [13]. For each domain, the item scores are coded, summated and transformed on to a scale from 0 (worst possible health) to 100 (best possible health).

Measurements

At study entry, specific data including sex, age, height, center, co-morbidities, medications, fracture type, number of years since last fracture, type of employment, activity levels (strenuous, vigorous and moderate activities) and the length of time engaged in the activity were analyzed. The total number of kilocalories expended per week for all combined activities and body mass index were calculated for each individual.

This study analyzed HRQL in four participant groups based on prevalent fracture status:

Group I: individuals who experienced a main fracture that was most likely attributable to osteoporosis. Main fractures must have occurred after the subjects turned 50 years of age; as a result of minimal trauma; and included hip, clinically recognized vertebral, wrist/forearm, pelvis and rib fractures. These fractures were evaluated on the basis of the participants' response to an item (''Have you ever fractured any bones?'') from the CaMos questionnaire.

Group II: subjects who have sustained a morphometric, subclinical vertebral fracture (not clinically recognized) that was systematically assessed on the basis of the CaMos radiograph. Group II subjects did not have main fractures but may have had other fractures.

Group III: individuals who sustained other fractures. Other fractures were defined as any fracture that occurred other than a main (group I) or a subclinical vertebral fracture (group II). These fractures may have included hip, vertebral, wrist/forearm, pelvis or rib fractures that were sustained prior to the age of 50 years and/or as a result of severe trauma or bone disease.

Group IV: participants who did not report prevalent fractures or did not have vertebral deformities on radiography.

Spinal radiographs were used to verify the existence of vertebral fractures for all subjects. Radiography was carried out under standardized conditions with a fixed film focus of 40 inches (100 cm). The thoracic radiograph was centered on T7 and the lumbar spine film was centred on L3. Original spinal radiographs were quantitatively assessed for vertebral deformities using a digital graphics tablet. Vertebral bodies were evaluated by measuring the anterior (HA), middle (HM) and posterior (HP) heights of latral thoracic and lumbar spine radiographs. The vertebral heights were utilized to calculate four height ratios (HA/HP, HM/HP, HP/HP lower, and HP/HP upper) and these ratios were used to determine the existence of fractures [14].

The SF-36 instrument was used as an outcome measure for HRQL. This questionnaire has been extensively evaluated in both healthy and diseased populations, and has demonstrated both validity and reliability [11,13,15,16]. HRQL scores were determined for each domain and the two summary scales.

Statistical Analysis

Our primary objective was to determine the effect of main fractures on HRQL. Correlation matrices and multiple regression analyses were performed to explain the relationship between fractures and the eight subscales and the two summary scales of the SF-36. From multiple regression analyses, regression coefficient parameter estimates (which represent differences between fractured and non-fractured subjects in SF-36 scores), as well as 95% confidence intervals (CI) of the different scores, were determined while controlling for possible confounding effects of other variables. The variables controlled in the analysis included sex, age, sex by age interaction, height, body mass index, center, time spent walking each week, physical demand of paid employment, regular activity or exercise program status, caloric expenditure per week for all activities, number of sedentary hours per week, co-morbidities (including osteoporosis, arthritis, breast cancer, heart attack, stroke, neuromuscular disease, uterine cancer and prostate cancer) and medications (including calcitonin and oral or injectable corticosteroids). A simple regression analysis was conducted for the categorical variable of years since last fracture (classified as 0 to 1, 2 to 3, 4 to 5, 6 to 9, and 10+ years ago since last fracture) in order to determine this variable's impact on HRQL.

All statistical analyses were performed on Sun Workstations using SAS/STAT (version 7.0; SAS Institute, Cary, NC) and Splus (version 5.0; (MathSoft, Seattle, WA) software packages.

Results

A total of 3581 women and 1235 men 50 years and over participated in the cross-sectional study. Table 1 presents subject characteristics at study entry for individual with fractures versus those without fractures.

The number of subjects by gender who sustained fractures is shown in Table 2. Fractures were reported in

Table 1. Baseline characteristics of subjects with prevalent fractures and those without fractures

	Fractured subjects (%)	Non-fractured subjects (%)
No. of subjects	1950	2866
Men	466 (23.9)	769 (26.8)
Women	1484 (76.1)	2097 (73.2)
Age (years)		
50–59	253 (13.0)	959 (33.5)
60–69	676 (34.7)	1147 (40.0)
70–79	765 (39.2)	657 (22.9)
80+	256 (13.1)	103 (3.6)
Co-morbidities[a]		
Osteoporosis	311 (15.9)	155 (5.4)
Arthritis[b]	788 (40.4)	975 (34.0)
Breast cancer	80 (4.1)	76 (2.7)
Heart attack	180 (9.2)	148 (5.2)
Stroke	118 (6.1)	89 (3.1)
Neuromuscular disease	67 (3.4)	56 (2.0)
Uterine cancer	44 (2.3)	40 (1.4)
Prostate cancer	24 (1.2)	27 (0.9)
Medications		
Calcitonin	6 (0.3)	1 (0.0)
Corticosteroids[c]	214 (11.0)	256 (8.9)

[a] The number of subjects who responded with either a yes or a no for these conditions on the CaMos questionnaire.
[b] Included subjects who have either rheumatoid arthritis or osteoarthritis.
[c] Subjects who have taken either oral or injectable corticosteroids for more than 1 month.

Table 2. Prevalent fracture distribution by gender

	Women (n = 3581)	Men (n = 1235)
Group I[a]: no. (%), $\bar{x}$		
Hip	68 (1.9) 75.9	10 (0.8) 72.7
Spine	37 (1.0) 71.9	3 (0.2) 68.3
Forearm/wrist	348 (9.7) 71.7	42 (3.4) 70.6
Pelvis	18 (0.5) 76.3	1 (0.0) 77.0
Rib	87 (2.4) 72.1	38 (3.1) 68.1
Years since last main fracture: no., (%)		
0–1	85 (2.4)	13 (1.1)
2–3	97 (2.7)	18 (1.5)
4–5	61 (1.9)	17 (1.4)
6–9	89 (2.5)	15 (1.2)
10+	179 (5.0)	27 (2.2)
Group II: no., (%)	887 (24.8)	349 (28.3)
Group III: no., (%)	84 (2.3)	26 (2.1)

[a] Subjects may have experienced more than one main fracture.
No., number of patients with fractures; (%), percent of patients; $\bar{x}$, mean age of the patients at the time when the fractures were experienced.

41.4% of women (n = 1484) and 37.7% of men (n = 466), respectively. In group I, the average number of years (± standard deviation) since the last fracture was 8.0 ± 7.2 and 6.9 ± 6.0 for women and men, respectively. Multiple fractures, at the same site, occurred in 4, 1, 31 and 15 women at the hip, spine, wrist/forearm and ribs, whereas 2 and 4 men experienced multiple fractures at the wrist/forearm and the ribs.

Fractures and HRQL

Main Fractures. Unadjusted HRQL scores were lower in subjects in group I compared with individuals in group IV (Table 3). The difference between groups in the SF-36 physical functioning, role-physical, bodily pain, vitality, social functioning and physical component summary scale persisted even after the analysis was adjusted for the other confounding variables (Table 4). The largest differences between the two groups occurred in the physical functioning and role-physical domains of the SF-36.

In women, multiple regression analysis reveal that physical functioning was most influenced by hip (−14.9; 95% CI: −20.9, −9.0) and pelvis (−18.1; 95% CI: −27.6, −8.6) fractures. In men, due to the small number of vertebral and pelvis fractures, only hip, forearm and rib fractures were included in the multiple regression analysis. Results indicated that the role-physical domain was most affected by hip fractures (−35.7; 95% CI: −60.4, −11.1) (Table 5).

A simple regression analysis involving main fracture types demonstrated that the number of years since last fracture did not correlate highly with any of the SF-36 domains, nor with the component summary scales.

Subclinical Vertebral Fractures. Unadjusted HRQL scores were lower in subjects in group II compared with individuals in group IV (Table 3). After controlling for confounding variables, differences persisted in the physical functioning, role-physical and bodily pain domains and in the physical components summary scale of the SF-36 (Table 4). No differences were found between women and men in any of the SF-36 domains or summary scales (data not shown).

Other Fractures. Following the adjustment of confounding variables, no differences were found between subjects in group III and those in group IV in any of the SF-36 domains or summary scales (Table 4).

Table 4. Adjusted regression coefficient parameter estimates and 95% confidence intervals that explain the eight subscales and two summary scales of the SF-36 for subjects with and without prevalent fractures[a]

	Group I (n = 446)	Group II (n = 1130)	Group III (n = 101)
Physical functioning	−4.0	−2.5	−1.1
	−6.0, −2.0	−3.8, −1.1	−4.8, 2.6
Role−physical	−5.8[b]	−3.3	0.1
	−9.5, −2.2	−5.8, −0.8	−6.7, 7.0
Bodily pain	−2.7	−1.9	0.0
	−4.9, −0.4	−3.4, −0.3	−4.2, 4.2
General health	−1.1	−0.8	0.7
	−2.8, 0.6	−2.0, 0.3	−2.6, 3.9
Vitality	−2.5	−0.5[c]	−1.0
	−4.3, −0.7	−1.7, 0.8	−4.4, 2.4
Social functioning	−2.4[b]	−0.9	2.3
	−4.4, −0.4	−2.2, 0.5	−1.5, 6.0
Role−emotional	−1.3	−0.6	2.0
	−4.4, 1.9	−2.8, 1.6	−4.1, 8.0
Mental health	0.5	0.2[c]	−2.1
	−1.0, 2.0	−0.8, 1.3	−5.0, 0.7
Mental component	0.1[b]	0.3[c]	−0.0
	−0.8, 1.0	−0.3, 0.9	−1.7, 1.6
Physical component	−1.8[b]	−1.1[c]	0.0
	−2.7, −0.9	−1.7, −0.5	−1.6, 1.7

[a] Regression coefficient parameter estimates were calculated based on differences between the three fractured groups and the non-fractured group (reference level: group IV). The variables adjusted for in the analysis include sex, age, sex by age interaction, height, body mass index, center, time spent walking each week, physical demand of paid employment, regular activity or exercise program status, caloric expenditure per week for all activities, number of sedentary hours per week, co-morbidities (including osteoporosis, arthritis, breast cancer, heart attack, stroke, neuromuscular disease, uterine cancer and prostate cancer) and medications (including calcitonin and oral or injectable corticosteroids).
[b] Due to missing values n = 445.
[c] Due to missing values n = 1129.

Table 3. Unadjusted domain scores (standard deviation) of the eight subscales and two summary scales of the SF-36 for men and women with or without prevalent fractures[a]

	Physical functioning	Role-physical	Bodily pain	General health	Vitality	Social functioning	Role-emotional	Mental health	Mental component	Physical component
Women										
Group I	61 (28)	64 (42)	66 (25)	70 (20)	58 (22)	82 (24)	81 (35)	78 (16)	54 (9)	42 (11)
Group II	69 (25)	69 (40)	69 (25)	72 (19)	62 (19)	86 (21)	82 (33)	79 (15)	54 (9)	44 (11)
Group III	71 (26)	69 (42)	72 (22)	75 (18)	63 (19)	89 (17)	84 (31)	77 (17)	54 (9)	46 (11)
Group IV	78 (21)	78 (35)	73 (23)	76 (17)	66 (19)	88 (19)	85 (31)	78 (15)	53 (9)	48 (9)
Men										
Group I	70 (29)	71 (39)	76 (22)	70 (19)	65 (22)	87 (21)	89 (26)	83 (13)	56 (6)	45 (11)
Group II	76 (22)	73 (38)	74 (23)	73 (20)	69 (17)	88 (19)	88 (26)	82 (13)	55 (8)	46 (10)
Group III	78 (25)	84 (32)	74 (22)	72 (16)	66 (13)	94 (9)	97 (9)	81 (11)	56 (5)	47 (9)
Group IV	82 (19)	82 (32)	78 (22)	75 (17)	70 (17)	90 (17)	89 (27)	82 (13)	55 (7)	49 (9)

[a] Statistical analyses were not conducted using unadjusted domain scores.

Table 5. Adjusted regression coefficient parameter estimates and 95% confidence intervals that explain the eight subscales and two summary scales of the SF − 36 for men and women with prevalent fractures[a]

Variables	Physical functioning	Role − physical	Bodily pain	General health	Vitality	Social functioning	Role − emotional	Mental health	Mental component	Physical component
Women										
Hip	− 14.9	− 10.2	− 3.7	− 0.0	− 1.5	− 6.5	− 4.7	4.6	1.7	− 4.7
	− 20.9, − 9.0	− 21.4, 0.9	− 10.5, 3.1	− 5.2, 5.1	− 7.0, 4.1	− 12.7, − 0.3	− 14.7, 5.4	− 0.1, 9.3	− 1.0, 4.5	− 7.3, − 2.0
Spine	− 7.0	0.4	− 10.0	− 6.0	− 2.4	0.7	7.1	1.0	2.0	− 3.5
	− 14.4, 0.4	− 13.7, 14.5	− 18.5, − 1.6	− 12.4, 0.5	− 9.3, 4.5	− 7.2, 8.5	− 5.4, 19.5	− 4.9, 6.8	− 1.5, 5.4	− 6.9, − 0.1
Forearm/wrist	− 0.1	− 2.9	− 0.7	0.8	− 1.4	− 0.6	− 0.3	− 0.1	− 0.2	− 0.3
	− 2.6, 2.3	− 7.4, 1.7	− 3.5, 2.1	− 1.4, 2.9	− 3.7, 0.9	− 3.2, 1.9	− 4.4, 3.8	− 2.0, 1.8	− 1.3, 1.0	− 1.4, 0.8
Pelvis	− 18.1	− 3.2	− 8.6	− 9.0	− 6.7	3.1	− 6.4	− 4.1	0.0	− 5.2
	− 27.6, − 8.6	− 21.1, 14.7	− 19.5, 2.3	− 17.3, − 0.7	− 15.6, 2.3	− 6.9, 13.0	− 22.5, 9.7	− 11.6, 3.4	− 4.4, 4.4	− 9.5, − 0.9
Rib	− 3.8	− 9.0	− 3.4	− 4.3	− 6.2	− 1.4	− 1.4	0.5	− 0.1	− 2.5
	− 8.8, 1.1	− 18.4, 0.4	− 9.1, 2.2	− 8.6, 0.0	− 10.8, − 1.5	− 6.6, 3.8	− 9.8, 7.0	− 3.4, 4.4	− 2.4, 2.2	− 4.8, − 0.3
Men										
Hip	− 9.1	− 35.7	− 0.0	3.2	0.8	− 10.9	− 15.4	10.5	1.8	− 5.3
	− 22.9, 4.6	− 60.4, − 11.1	− 16.1, 16.0	− 9.6, 16.0	− 11.4, 13.1	− 23.8, 1.9	− 35.2, 4.4	0.7, 20.3	− 3.7, 7.2	− 11.6, 0.9
Forearm/wrist	− 0.1	6.8	0.7	− 2.9	− 2.2	4.1	10.9	3.2	2.3	− 0.6
	− 6.8, 6.6	− 5.2, 18.8	− 7.1, 8.5	− 9.1, 3.4	− 8.2, 3.8	− 2.2, 10.3	1.2, 20.6	− 1.5, 8.0	− 0.4, 4.9	− 3.7, 2.4
Ribs	− 5.3	0.5	− 0.3	− 2.7	0.8	− 1.0	− 0.5	2.5	1.1	− 1.5
	− 11.9, 1.4	− 11.4, 12.4	− 8.1, 7.4	− 8.9, 3.5	− 5.1, 6.8	− 7.3, 5.2	− 10.0, 9.1	− 2.2, 7.2	− 1.5, 3.7	− 4.6, 1.5

[a] Regression coefficient parameter estimates were calculated based on differences between fractured subjects and non-fractured subjects (reference level: group IV). The variables adjusted for in the analysis include age, height, body mass index, center, time spent walking each week, physical demand of paid employment, regular activity or exercise program status, caloric expenditure per week for all activities, number of sedentary hours per week, co-morbidities (including osteoporosis, arthritis, breast cancer, heart attack, stroke, neuromuscular disease, uterine cancer and prostate cancer), medications (including calcitonin and oral or injectable corticosteroids) and fracture type (including hip, spine pelvis, forearm/wrist and ribs for women, and hip, forearm/wrist and ribs for men).

Discussion

Studies that rely solely on bone mineral density and fracture rates as outcome measures may inadequately assess the burden of osteoporosis. The physical, emotional and psychological disabilities, and increased pain resulting from hip, spine, wrist/forearm, pelvis and rib fractures are outcomes of osteoporosis that can adversely influence HRQL [17]. Following a hip fracture, nearly 33% of patients become dependent on others to carry out basic activities of daily living [18]. The functional impairment caused by vertebral fractures can also be substantial [1]. Individuals with these fractures often have a reduced ability to perform daily household and self-care activities such as cooking, vacuuming, bathing and dressing [19]. During the acute period after a wrist/forearm fracture, individuals may often develop substantial pain and movement may be limited [20]. Furthermore, individuals with wrist/forearm fractures may experience restricted activity, chronic pain and loss of function [21]. Osteoporotic pelvis and rib fractures have been studied less frequently than hip, spine and forearm/wrist fractures; thus, their impact on quality of life is not as well defined.

It should be recognized that fractures are likely to be only one of the many medical conditions that influence HRQL. Osteoporotic fractures generally affect people later in life and a substantial proportion of these individuals may have clinically relevant co-morbidities. After adjusting for confounding factors, our findings indicate that HRQL was significantly lower in participants who have experienced prevalent main fractures attributable to osteoporosis as compared with subjects without fractures. The largest differences were observed in the phsyical functioning and role-physical domains.

Not all osteoporotic fractures are alike. Osteoporotic fractures may vary in their impact on quality of life. Our study is the first to examine a wide variety of fracture types, including pelvis, rib and subclinical vertebral fractures, on quality of life in a group of women and men. Findings indicated that the most clinically relevant impact on quality of life occurred in the physical functioning and role-physical domains in women who sustained hip and pelvis fractures, and in men who developed hip fractures, respectively. These results are similar to those found in a study conducted by Randell et al. [6]. In this study, the investigators showed, using the disease-targeted Osteoporosis Assessment questionnaire (OPAQ), that OPAQ scores demonstrated a trend towards hip fracture patients recording the lowest, vertebral fracture patients intermediate and wrist fracture patients the highest quality of life. Furthermore, our data document that subclinical vertebral fractures have a modest affect on HRQL and that multiple vertebral fractures did not have a cumulative impact on quality of life.

Although some recovery of quality of life may occur over time, in this data set, the time since last fracture was not highly related to any of the domains or summary scales of the SF-36. This was also evident when hip and pelvis fractures were examined separately. This implies that HRQL impairment persists in the long term.

One barrier to the meaningful use of the SF-36 in research is the lack of information necessary to translate scores. For instance, are statistically significant differences between groups clinically relevant? Although studies have been conducted to determine clinically important differences in domain scores for the SF-36 [22], further research is required to more precisely classify meaningful differences in osteoporotic subjects. As HRQL instruments play an increasingly prominent role in evaluating individuals with osteoporosis, the demand to define relevant changes in scores for these tools will increase.

The strengths of the study are numerous. The CaMos participants were selected at random from the population and represent an age-, sex- and region-specific sample of the Canadian population. Several different osteoporotic fracture types were examined. Radiographs were systematically performed and quantitatively evaluated to document subclinical vertebral fractures. To prevent potentially biased HRQL data, subjects were excluded from the study if they had fallen in the past month. Furthermore, our analysis adjusted for several factors such as co-morbidities, medications and activity levels that may influence quality of life. Thus, we believe that the differences that were found between the fractured and non-fractured participants were primarily due to the osteoporotic fractures. Nonetheless, our study is not without limitations and our results should be interpreted in the context of its design. prospective trials will need to be conducted to confirm the influence of fracture type and time since last fracture on HRQL. In men, due to the small number of fractures, it was impossible to determine the effect of spine and pelvis fractures on HRQL and the hip fracture data are variable and should be interpreted with caution. Furthermore, it is possible that other conditions such as abnormal spinal alignment, back muscle weakness and inflexibility may have contributed to a reduced quality of life in individuals with vertebral fractures.

In conclusion, this large population-based study demonstrated that HRQL was lower in the physical functioning domain in women and the role-physical domain in men who sustained main fractures at the hip. Subclinical vertebral fractures exerted a modest effect on HRQL. In the future, prospective data from CaMos will assist in determining the effect of incident fractures on HRQL.

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