

The human cost of fracture

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Abstract In this population-based, observational study, we document the personal burden of fracture and utilization of community and health services for women during the 12-month period following a fracture. Participants were 598 women (aged 35–92 years) with incident fracture in the years 1994–1996 who were enrolled in the Geelong Osteoporosis Study. Almost all hip fracture cases and 27% of nonhip fracture cases were hospitalized. Homes were modified in 14% of cases, and 32% of the women purchased or hired equipment to assist with activities of daily living. Three-quarters of women with hip, pelvis, or lower limb fractures were confined to the home, had to walk with a walking aid, or could walk only short distances for several weeks. After a year, nearly one-half had not regained prefracture mobility. One-seventh of women with upper-limb fractures did not venture outside the home for at least 6 weeks. Nearly half of all fracture cases needed help with personal care and housework during the first 6 weeks. After 6 months, 3.4% of all patients and 19.6% of hip, 12.8% of humeral, and 4.7% of spine fracture patients required assistance with bathing and showering. After a year, more than half of the hip fracture cases remained restricted regarding housework, gardening, and transport. These findings have important implications for rehabilitation therapy. A fracture, regardless of site, had a major impact on a woman's lifestyle and well-being. Most women were restricted in their activities of daily living and suffered loss of confidence and independence. Short-term morbidity was common for all fractures, with varying degrees of prolonged morbidity often extending to at least a year postfracture.

Keywords Fracture · Health services · Home modifications · Mobility · Morbidity · Women

Introduction

The increased morbidity and mortality generated by fractures impose clinical and welfare costs on the community [1]. Site-specific fracture rates for Australian women, expressed per 10,000 person-years, are estimated as hip 28, spine 21, wrist 18, and humerus 11, accounting for 63% of all fractures in women [2]. These rates are expected to increase as the population ages, placing increasing demands on the health system [3]. Estimates of the financial costs associated with fracture have been documented [1, 4–8], but there is a paucity of data concerning the human cost.

The short- and long-term impact of fracture on mobility and lifestyle is likely to depend on the fracture site, modulated by frailty and other comorbidities. The disabling consequences of hip and vertebral fractures have been widely documented [9–13], but there are few data on the sequelae of other fractures.

The aim of this study was to document the ways fractures adversely influence women's lives during the year following fracture, including restrictions to mobility, independence, and activities; modifications to homes; acquisition of equipment; and the use of community and health services.

Materials and methods

Participants

As part of the Geelong Osteoporosis Study, all women resident in the Barwon Statistical Division and aged 35 years and older who sustained a fracture during the 2-year period commencing 17 February 1994 were identified using radiological reports [2]. Fractures were

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identified prospectively by a computerized keyword search of all x-ray reports from the two radiological centers in the region. This comprehensive method for ascertaining incident fracture cases was validated before the study began [14]. Of the 1,082 eligible women with fractures, 832 were enrolled in the Geelong Osteoporosis Study for assessment [15]. Of these 832, 39 died within 12 months of the fracture and were thus unable to participate in this study. A postfracture questionnaire, documenting the consequences of fracture for the 12-month period following the fracture event, was completed by 598 participants. Ages were determined for the date of radiological diagnosis of the fracture. Participants were younger than nonparticipants [median (interquartile range, IQR) 66.8 (55.5–74.3) vs. 77.6 (70.3–83.4) years, $p < 0.001$], and hip fracture cases were underrepresented among participants ($p < 0.001$). Written informed consent was obtained from all participants. The study was approved by the Barwon Health Human Research and Ethics Advisory Committee.

Fracture sites

Of the 598 women with fracture, 28 sustained at least one more fracture from another event within 12 months of the baseline fracture and were thus excluded, leaving 570 eligible for analysis. All 570 women were included in analyses for any fracture: 51 hip, 103 wrist, 49 humerus, 72 ankle, 48 forearm, 96 spine, 17 pelvis, 48 tibia/fibula, 17 toe, 39 tarsal/metatarsal, seven patella, three femur, 28 ribs, three clavicle, two scapula, 12 metacarpal, seven carpal, 17 finger, and six facial. For site-specific analyses, 36 women with multiple fractures from the first fracture event were excluded, leaving the following numbers of women with these site-specific fractures only: 50 hip, 95 wrist, 39 humerus, 48 ankle, 45 forearm, 90 spine, 15 pelvis, 34 tibia/fibula, 16 toe, 33 tarsal/metatarsal, six patella, two femur, 20 ribs, two clavicle, one scapula, 11 metacarpal, six carpal, 16 finger, and five facial. Detailed subgroup analyses were performed for women with fractures of the hip, wrist, humerus, ankle, forearm, spine, pelvis, tibia/fibula, and rib. Fractures of the hip, wrist, and spine are common sites for fragility fractures due to osteoporosis.

Questionnaire

Self-reported consequences of fracture were documented by questionnaire for sick leave, loss of confidence, restrictions to mobility and functional impairment, home modifications, acquisition of equipment, and use of community and health services.

Admission to hospital was defined as a stay exceeding 1 day, and discharge destinations included home (or the home of a friend or relative), acute rehabilitation center, special accommodation, or nursing home. Use of community services such as Home Help (domestic help

services), Meals on Wheels, or district nursing was also documented.

Statistics

The percentage of women with positive responses to questions concerning changes resulting from the fracture were calculated. Medians and ranges for the subsequent durations were calculated in weeks for the positive responses where provided. Ages for site-specific fractures were compared using a Kruskal–Wallis analysis. All statistical analyses were performed using Minitab software (release 13, Minitab, State College, PA, USA).

Results

Age, employment, and recreation

Median age was 66.4 years (range 35–92). The distribution per fracture site is shown in Fig. 1. Among the site-specific groups, women with hip fractures were the oldest and tibia/fibula the youngest [median age (IQR): 76.8 (71.1–85.6) vs. 58.3 (47.7–70.3) years, $p < 0.001$]. Following the fracture, 16.3% took time off work. Loss of work time was most pronounced for fractures of the ankle, rib, and tibia/fibula, fractures generally associated with younger women (Table 1). In 8.0% of cases, family members took time off work for a median time of 0.6 weeks (range 0.1–26.0). Caregivers were mainly offspring (49%) and husbands (40%). Loss of confidence was reported in 59.4% and was high across all fracture sites: hip 71.4%, wrist 62.0%, humerus 70.3%, ankle 64.6%, forearm 57.8%, spine 51.7%, pelvis 73.3%, tibia/fibula 61.8%, and rib 52.6%. Inability to continue sporting activities ranged from 18.0% for hip fractures

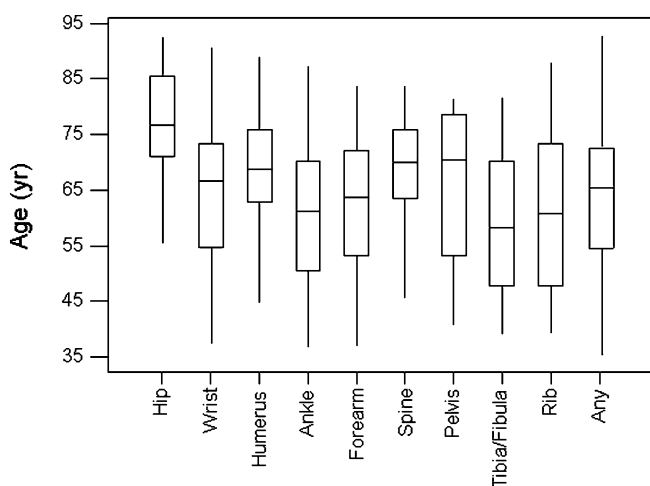


Fig. 1 Boxplot showing women's ages at the time of fracture. The median age and interquartile range are represented in each box, together with an indication of the range of values for each specific fracture site

Table 1 Consequences of fracture. The proportion of fracture cases (by site) who were limited in the following activities (expressed as %) as a result of the fracture and either duration (and range) of the limitation (expressed in weeks). The last three entries indicate number of visits (range)

	Hip n = 50	Wrist n = 95	Humerus n = 39	Ankle n = 48	Forearm n = 45	Spine n = 90	Pelvis n = 15	Tibia/fibula n = 34	Rib n = 20	Any n = 570	
	%Yes	%Yes	%Yes	%Yes	%Yes	%Yes	%Yes	%Yes	%Yes	%Yes	
	Time	Time	Time	Time	Time	Time	Time	Time	Time	Time	
Employment and recreation											
Time off work	-	17.0 (0.3-15.0)	21.6 (0.4-26.0)	33.3 (1.0-52.0)	18.2 (1.0-52.0)	3.6 (1.0-52.0)	4.3 (1.0-13.0)	20.0 (8.0-26.0)	24.2 (1.0-43.3)	26.3 (4.0-13.0)	16.3 (0.1-52.0)
Sports restrictions	18.0 (8.7-52.0)	36.2 (2.0-52.0)	23.1 (13.0-52.0)	31.9 (13.0-52.0)	31.8 (4.3-52.0)	22.7 (6.0-52.0)	39.0 (2.5-52.0)	40.0 (26.0-52.0)	18.2 (3.0-39.0)	20.0 (6.0-52.0)	28.2 (1.0-52.0)
Unable to drive	20.0 (4.0-52.0)	63.8 (1.0-52.0)	46.2 (4.0-52.0)	63.8 (4.0-52.0)	59.1 (2.0-52.0)	15.7 (3.0-39.0)	7.3 (2.0-52.0)	60.0 (4.3-52.0)	55.0 (1.0-52.0)	10.8 (2.0-52.0)	44.3 (0.3-52.0)
Unable to care for children	14.0 (8.7-52.0)	9.7 (2.0-8.0)	15.4 (6.0-52.0)	17.4 (6.0-52.0)	20.9 (2.0-8.7)	13.8 (2.0-52.0)	39.0 (1.0-52.0)	13.3 (4.3-13.0)	10.0 (6.0-17.3)	6.5 (4.3-8.7)	8.7 (0.1-52.0)
Limited ability—crafts/handwork	6.0 (13.0-52.0)	54.3 (1.0-52.0)	46.2 (3.0-52.0)	8.5 (3.0-52.0)	59.1 (2.5-13.0)	21.6 (3.0-52.0)	26.0 (1.0-52.0)	13.3 (2.0-13.0)	10.0 (13.0-17.3)	15.2 (1.0-52.0)	9.0 (1.0-52.0)
Mobility											
Confined to wheelchair	22.9 (0.3-52.0)	-	2.6 (1.0-1.0)	14.6 (1.0-13.0)	-	3.4 (52.0-52.0)	52.0 (5.0-6.0)	13.3 (1.0-6.0)	31.4 (23.8-39.0)	-	6.5 (0.3-52.0)
Walk only with assistance	45.8 (0.3-52.0)	2.2 (2.0-2.0)	7.9 (2.0-3.0)	12.5 (1.0-7.0)	-	6.8 (2.0-52.0)	6.0 (2.0-52.0)	40.0 (2.0-52.0)	8.7 (8.0-52.0)	5.0 (2.0-2.0)	12.1 (0.3-52.0)
Confined to house	64.6 (1.0-52.0)	23.4 (0.6-8.7)	36.8 (0.3-52.0)	58.3 (1.0-34.7)	27.3 (2.0-8.7)	20.5 (1.0-52.0)	5.2 (4.0-13.0)	53.3 (4.0-13.0)	7.0 (1.0-52.0)	35.0 (1.0-2.0)	10.0 (0.3-52.0)
Walk with walking aid	87.5 (2.0-52.0)	-	10.3 (2.0-8.0)	87.5 (2.0-8.0)	4.5 (1.0-52.0)	20.5 (2.0-52.0)	8.7 (1.0-52.0)	73.3 (3.0-52.0)	6.0 (0.3-52.0)	4.3 (4.3-4.3)	37.3 (0.3-52.0)
Walk short distances only	83.3 (4.3-52.0)	12.9 (2.0-52.0)	46.2 (2.0-52.0)	77.1 (2.0-52.0)	11.4 (3.0-8.7)	38.2 (3.0-8.7)	21.7 (1.0-52.0)	60.0 (3.5-52.0)	8.3 (2.0-52.0)	30.0 (1.0-13.0)	45.2 (0.4-52.0)
Daily living restrictions											
Eating	6.0 (1.0-6.0)	38.9 (0.6-23.0)	41.0 (1.0-52.0)	6.3 (1.0-52.0)	44.2 (0.4-17.3)	6.0 (0.4-13.0)	-	6.7 (5.0-5.0)	-	-	17.3 (0.3-52.0)
Dressing	48.0 (2.0-52.0)	57.9 (0.3-52.0)	69.2 (1.0-52.0)	18.8 (1.0-52.0)	65.9 (0.4-17.3)	11.2 (1.0-52.0)	13.0 (1.5-52.0)	53.3 (1.0-8.0)	3.5 (2.0-13.0)	30.0 (0.4-13.0)	35.6 (0.3-52.0)
Toileting	30.0 (0.4-21.7)	17.9 (0.3-13.0)	13.2 (1.0-52.0)	12.5 (1.0-52.0)	11.4 (0.2-3.0)	4.5 (3.0-13.0)	5.2 (4.3-6.0)	33.3 (2.0-6.0)	4.5 (0.3-52.0)	5.0 (4.3-4.3)	14.0 (0.3-52.0)
Bathing/showering	62.0 (1.0-52.0)	41.1 (0.1-15.2)	71.1 (0.2-52.0)	47.9 (2.0-52.0)	34.1 (0.3-13.0)	16.9 (1.0-8.7)	8.7 (2.0-52.0)	66.7 (3.0-52.0)	6.0 (1.0-52.0)	15.0 (4.3-8.7)	38.7 (0.1-52.0)
Cooking	50.0 (2.0-52.0)	59.6 (1.0-52.0)	65.8 (2.0-52.0)	52.1 (2.0-52.0)	47.7 (0.4-13.0)	21.3 (2.0-13.0)	13.0 (2.0-52.0)	60.0 (1.1-52.0)	7.0 (1.0-26.0)	40.0 (1.0-13.0)	44.7 (0.4-52.0)
Housework	70.0 (4.0-52.0)	64.2 (1.0-52.0)	82.1 (2.0-52.0)	75.0 (2.0-52.0)	63.6 (1.0-52.0)	37.5 (2.0-52.0)	52.0 (1.0-52.0)	80.0 (3.0-52.0)	8.0 (2.0-52.0)	65.0 (1.0-52.0)	8.0 (1.0-52.0)
Gardening	52.1 (4.7-52.0)	53.3 (2.0-52.0)	51.4 (2.0-52.0)	58.3 (2.0-52.0)	38.1 (1.4-52.0)	36.8 (2.0-52.0)	52.0 (1.0-52.0)	53.3 (4.0-52.0)	8.0 (2.0-52.0)	31.6 (13.0-52.0)	46.4 (1.0-52.0)
Transportation	46.0 (4.7-52.0)	63.4 (1.0-52.0)	59.5 (2.0-52.0)	62.5 (2.0-52.0)	54.5 (3.0-39.0)	27.6 (3.0-39.0)	52.0 (1.0-52.0)	53.3 (6.0-52.0)	8.0 (1.0-52.0)	55.0 (2.0-52.0)	7.0 (0.4-52.0)
Community and health services											
Home Help	44.9 (1.0-52.0)	15.8 (0.1-52.0)	25.6 (4.0-52.0)	29.2 (3.5-52.0)	22.2 (2.0-52.0)	23.3 (2.0-52.0)	52.0 (4.3-52.0)	35.7 (3.0-13.0)	7.0 (0.3-52.0)	15.8 (26.0-52.0)	24.2 (0.1-52.0)
Meals on Wheels	16.3 (1.0-52.0)	4.2 (3.0-7.5)	12.8 (4.0-52.0)	6.3 (4.0-52.0)	4.4 (1.0-13.0)	8.9 (2.0-17.3)	8.7 (4.3-52.0)	14.3 (4.0-13.0)	2.9 (26.0-26.0)	5.3 (3.0-3.0)	7.4 (1.0-52.0)

District nursing	22.4	19.5	5.3	6.0	33.3	6.0	14.6	4.3	4.4	4.5	10.0	52.0	21.4	4.3	14.7	5.3	-	12.5	6.0
		(2.0-52.0)		(2.0-8.0)		(0.6-52.0)		(0.1-13.0)		(3.0-6.0)		(3.0-52.0)		(4.0-6.0)		(0.3-52.0)			(0.1-52.0)
Hospitalization	96.0	1.8	18.9	0.4	25.6	0.5	35.4	1.0	24.4	0.4	14.4	1.3	66.7	1.5	38.2	1.4	40.0	33.0	1.1
		(0.4-5.0)		(0.2-5.0)		(0.3-17.3)		(0.4-18.0)		(0.3-2.0)		(0.3-3.0)		(0.4-5.0)		(0.3-5.0)		(0.6-8.7)	(0.2-18.0)
Family doctor	46.0	4.0	72.6	2.0	84.6	3.0	68.8	2.0	66.7	2.0	50.0	3.0	53.3	3.5	70.6	3.0	80.0	65.8	2.8
		(1-20)		(1-24)		(1-20)		(1-10)		(1-15)		(1-12)		(1-28)		(1-12)		(1-5)	(1-28)
Orthopedic specialist	74.0	3.0	45.3	2.0	38.5	5.0	62.5	3.0	42.2	4.0	14.4	2.0	66.7	2.0	50.0	4.0	15.0	41.9	3.0
		(1-18)		(1-6)		(1-20)		(1-12)		(1-12)		(1-10)		(1-6)		(1-20)		(1-15)	(1-30)
Physiotherapist	49.0	12.0	37.6	5.0	60.5	8.8	50.0	6.0	28.9	6.0	15.6	6.0	35.7	6.0	44.1	10.0	10.0	33.7	6.0
		(1-104)		(1-117)		(2-155)		(2-52)		(1-12)		(1-50)		(3-180)		(1-48)		(2-12)	(1-180)

to 40.0% for pelvic fractures, with restrictions ranging up to a year for most sites (Table 1). Over half of the women with wrist, ankle, forearm, pelvic, tibia/fibula, and rib fractures were unable to drive for many weeks, sometimes extending to a year. Smaller proportions were unable to care for children or grandchildren, with site-specific percentages similar to the overall value of 13.8%. Over half of those with upper limb fractures (wrist, humerus, and forearm) were limited in their ability to pursue crafts and handiwork hobbies, extending to the full year for some patients. Other minor restrictions included inability to go dancing, horse riding, bicycle riding, or swimming; play cards or piano; visit friends; attend meetings; or go on recreational walks.

Restrictions to mobility

Most of the women with fractures of the hip, pelvis, and lower limb were limited to walking short distances only for median periods of 6–12 weeks, extending to longer periods for hip fracture cases (Table 1). About one-third of women with spine or rib fractures were limited to walking short distances only, with shorter recovery periods reported for women with rib fractures. Over one-third of the women with a hip, pelvic, ankle, or tibia/fibula fracture and one-seventh with an upper limb fracture were housebound for at least 6 weeks. Two-thirds of the women with hip, pelvic, or lower limb fractures required a walking aid for at least 1 month; after 1 year, nearly one-half had not regained prefracture mobility (Table 2). Recovery to former levels of mobility was reported for most (65–90%) of the women with fractures at other sites.

Restrictions to normal activities of daily living

Nearly half of all fracture cases needed help with personal care and housework during the first 6 weeks (Table 1). Among women with an upper-limb fracture, nearly one-half were restricted in eating, and nearly two-thirds needed help dressing for median periods of approximately 6 weeks. The proportions of women unable to bathe or shower independently at 1, 2, and 6 months are illustrated for each fracture site in Fig. 2. Almost one-quarter of the women with any fracture required short-term help with bathing and showering. Wrist, ankle, forearm, and rib fracture cases recovered relatively quickly, whereas women with hip or humeral fractures had prolonged restrictions extending to more than 6 months for 19.6% and 12.8%, respectively.

In all groups, generally more than half needed assistance with cooking, housework, gardening, and transport for median periods of 6–9 weeks (Table 1). After a year, more than half of the hip fracture cases remained restricted regarding housework, gardening, and transport. Other minor complaints included inability to kneel;

Table 2 Proportion of fracture cases (%) with restricted mobility 12 months after the fracture event and for whom home modifications and acquisition of equipment occurred

	Hip n=50	Wrist n=95	Humerus n=39	Ankle n=48	Forearm n=45	Spine n=90	Pelvis n=15	Tibia/fibula n=34	Rib n=20	Any n=570
Restricted mobility:										
None (same as before)	10.2	89.5	64.9	75.0	86.7	66.3	66.7	70.6	70.0	69.6
Confined to wheelchair	4.1	-	-	-	-	3.4	-	-	-	1.1
Walk with assistance	8.2	-	-	2.1	-	2.2	6.7	-	-	1.4
Confined to house	24.5	-	2.7	-	-	3.4	-	2.9	-	3.2
Walk with walking aid	53.1	1.0	2.7	2.1	-	7.9	20.0	11.8	-	9.4
Walk short distances only	77.6	-	8.1	14.6	2.2	23.6	33.3	14.7	5.0	17.7
Home modifications and equipment:										
Ramps	12.0	1.1	-	4.2	-	4.4	-	5.9	5.0	3.3
Handrails	42.0	4.2	7.7	6.3	4.4	21.1	6.7	17.6	-	13.0
Bathboards	6.0	1.1	-	6.3	-	2.2	6.7	2.9	-	2.1
Shower seat	16.0	1.1	7.7	14.6	2.2	2.2	6.7	14.7	-	6.7
Toilet seat (or toilet frame)	22.0	2.1	7.7	10.4	-	2.2	6.7	11.8	-	6.5
Hand-held shower	2.0	3.2	2.6	-	2.2	4.4	20.0	5.9	-	2.8
Wheelchair	4.0	-	-	14.6	-	2.2	-	2.9	-	3.3
Walking frame	32.0	-	-	25.0	-	5.6	26.7	29.4	5.0	10.4
Crutches	6.0	1.1	-	41.7	-	-	6.7	55.9	-	11.2
Walking stick	38.0	-	-	8.3	2.2	5.6	13.3	17.6	-	7.9

difficulty standing for long periods, twisting, bending, walking up and down stairs, opening jars and turning faucets, carrying, and lifting; stiffness; loss of strength and dexterity; being frightened to go out in wet weather or to walk on uneven ground; being hurt while being assisted; and embarrassed to be socially dependent.

Home modifications and equipment

Following fracture, 14% of the women modified their homes, and 32% purchased or hired equipment (Table 2). Bathroom modifications were done for 9.4% of all fractures (3.9% of upper limb and 14.0% of hip, pelvis, and lower limb fractures). Handrails were installed in the homes of 13%, and this proportion rose to 42% with hip fracture. Steps were installed or modified for 1.1% of cases. Four women lived in homes previously modified for other family members, and one moved into a new home with appropriate fittings. Walking aids were required particularly by women with fractures of the hip, pelvis, and lower limb. Other requirements included braces, a change from a car with manual transmission to an automatic, raised easy chairs, shoes with support, specialized cooking and eating utensils, tongs for picking objects up off the floor, an exercise ball, a toe washer on a stick, a frame and a board for the bed, and a personal alarm.

Community and health services

Approximately one-third of the women required community services. Home Help was generally the most common, especially among hip fracture patients, with fewer requiring Meals on Wheels (Table 1). Mainly

women with a fracture of the humerus, hip, or pelvis used the district nursing service.

A third of the women were hospitalized, with a median stay of 1.1 weeks (range 0.2–18.0; Table 1). High admission rates occurred for hip (96.0%) and pelvis (66.7%), and more than one-third of rib, tibia/fibula, and ankle fracture cases were hospitalized. Surgical fixation was reported in one-fifth of fracture cases overall, specifically 82.0% hip, 13.7% wrist, 10.3% humerus, 22.9% ankle, 24.4% forearm, and 23.5% tibia/fibula. After discharge from the hospital, 84.0% women with fracture returned home (9.5% of these went to stay with friends or relatives), 15.4% went to a rehabilitation center, and 0.5% went to a nursing home. Specific

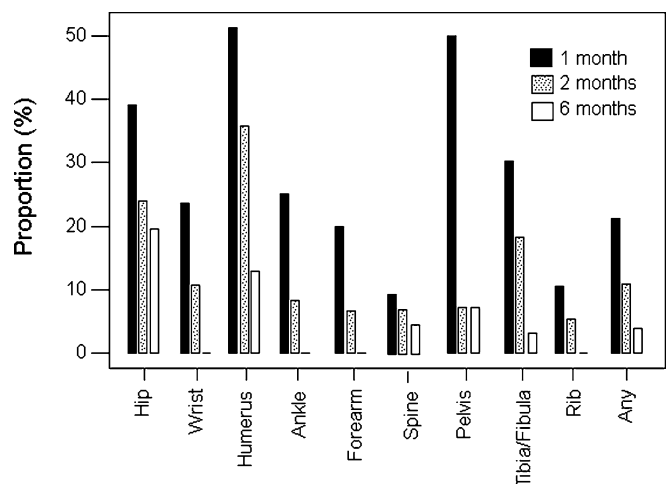


Fig. 2 The proportion of fracture cases unable to bathe or shower independently as a result of the fracture at 1, 2, and 6 months postfracture

percentages for hip fractures were home 56.3%, rehabilitation center 41.7%, and nursing home 2.1%.

Two-thirds of the women visited the family doctor and 41.9% an orthopedic specialist (Table 1). A lower percentage with hip fracture visited the family doctor compared with women with fractures at other sites. However, more of these patients visited an orthopedic specialist. One-third visited a physiotherapist (median six visits), with some reporting daily sessions. Fewer used other health services: occupational therapist 6.0%, endocrinologist 1.4%, chiropractor or osteopath 3.5%, naturopath 1.6%, podiatrist 2.6%, hospital emergency department 2.3%, hospital outpatient service 0.7%, massage therapist 0.4%, and hydrotherapist 0.5%.

Nearly one-third (31.2%) of the women reported that they were on pharmacologic treatment to prevent further fractures, although 30.3% of these were using hormone therapy for which the clinical indication was unclear. Other treatments included calcium, vitamin D, calcitriol, bisphosphonates, and selective estrogen receptor modulators (SERMS). The highest treatment rates were reported for fractures of the spine (50.0%), ribs (45.0%), humerus (41.0%), and pelvis (40.0%); only 22.0% of hip fracture cases received treatment.

Discussion

Following a fracture, most women were compromised in basic activities of daily living (ADL) and suffered loss of confidence and independence. Short-term morbidity was common for all fractures, with prolonged morbidity particularly associated with fracture of the hip.

Irrespective of fracture site, more than half of the women reported loss of confidence. This may be the reason that a quarter with upper limb fractures did not venture outside the house for weeks even though they did not require assistance with walking. Loss of confidence could contribute to a fear of falling [16, 17], with the potential to compromise balance and increase the risk of future fracture [18].

Most women experienced restrictions to everyday activities. Assistance with housework, dressing, and cooking was commonplace for several weeks. It has been estimated that 6.7% of women with a fragility fracture become dependent in basic ADL [19], consistent with our finding that 4% were unable to bathe or shower independently at 6 months. Community services have been shown previously to comprise a major cost (40%) of outpatient-treated fracture [1]. We report that about a third of the women used community services (mostly Home Help), and many incurred further costs from house modifications and acquisition of equipment to assist with ADL.

Hip, spine, and wrist fractures are the sites typically associated with osteoporosis, and in this study they accounted for almost half of the fractures. Hip fractures were the most devastating, associated with severe functional impairment. Advanced age and frailty are

recognized risk factors for hip fracture [20], and because hip fracture cases were the oldest, it is probable that frailty contributed to the severity of postfracture morbidity. One year after hip fracture, nearly one-half of the women were unable to walk independently, and only one-tenth considered they had regained their prefracture mobility, underscoring the marked disability associated with fracture at this site. Long-term help was required for personal care, housework, gardening, and transport. These findings are consistent with reports of 60% of hip fracture cases having difficulty with at least one essential ADL, 80% being restricted in other activities such as driving and grocery shopping [21], and less than half returning to the previous level of walking ability [22]. Over 40% of our hip fracture cases were discharged from hospital to rehabilitation centers. It is uncertain what proportion of these patients required subsequent nursing home placement.

In our study, only symptomatic spine fractures were identified, and 14.4% of these were hospitalized. This estimate falls within the 8–33% range reported by studies from Europe [5, 23, 24]. The impact of spine fractures on ADL persisted long term, and restrictions to mobility persisted for at least a year in 34% of cases. Previous research has shown that women with spine fracture become dependent in a range of everyday activities, including bathing, toileting, dressing, transfer, and continence [25]. The findings have important implications for rehabilitation therapy of the elderly with this condition.

In contrast, wrist fractures caused impairment for shorter periods of time. These women were younger and probably less frail. Nearly one-fifth were admitted to the hospital or required surgical fixation. Impaired mobility was rarely reported, but short-term restrictions to everyday activities such as eating, dressing, bathing and showering, driving, cooking, and housework were common. Chrischilles et al. reported that less than 1% of patients with wrist fracture became dependent, but nearly half reported fair or poor functional outcomes at 6 months [19].

We recognize several limitations in our study. Not all women with fracture were investigated, and this may have biased the findings by excluding frail patients with possible high levels of morbidity. Our fracture ascertainment relied on clinical indication for a medical imaging procedure; therefore, fractures that were not confirmed radiologically remained unidentified. This would only be an issue for vertebral, rib, and minor hand/foot fractures. Within the 12-month period following fracture, 39 (4.7%) of the women enrolled in the Geelong Osteoporosis Study died and 28 (4.6%) for whom postfracture data were available sustained another fracture. For both of these groups there was a high human cost associated with fracture, yet they were excluded from the analysis.

Moreover, in order to analyze outcomes associated with specific fracture sites, women with multiple fractures were also excluded. For these patients, morbidity

was likely to be more severe, generating increased costs and greater health care utilization. Questionnaire data was self-reported and patients with fractures may have had limited ability to accurately recall details of repercussions of the fracture event. We recognize that questions regarding restrictions to activities such as sports, childcare, or driving may not be universally applicable, and the impact of fracture has been expressed in relation to the total number of site-specific fracture cases, irrespective of their prefracture involvement in the activity. It was not possible to distinguish the effects of frailty or comorbidity from the consequences of the fracture itself, and it is likely that frailty exacerbated the debilitating consequences of fracture. We documented neither fracture-related pain—which others have reported causes significant impact on the quality of life [26]—nor coincident soft tissue injuries.

In conclusion, fractures at any site cause short-term morbidity, with prolonged restrictions particularly associated with hip fractures. However, loss of confidence and considerable periods of disability and social dependence were reported for fractures at other sites. These data suggest that a fracture, regardless of site, has a major impact on lifestyle and well-being.

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