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Management of fragility fractures in Switzerland: results of a nationwide survey

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Summary

A nationwide survey was conducted in Switzerland to assess the quality level of osteoporosis management in patients aged 50 years or older presenting with a fragility fracture to the emergency ward of the participating hospitals.

Eight centres recruited 4966 consecutive patients who presented with one or more fractures between 2004 and 2006. Of these, 3667 (2797 women, 73.8 years old and 870 men, 73.0 years old in average) were considered as having a fragility fracture and included in the survey.

Included patients presented with a fracture of the upper limbs (30.7%), lower limbs (26.4%), axial skeleton (19.5%) or another localisation, including malleolar fractures (23.4%). Thirty-two percent reported one or more previous fractures during adulthood. Of the 2941 (80.2%) hospitalised women and men, only half returned home after discharge. During diagnostic workup, dual x-ray absorptiometry (DXA) measurement was performed in 31.4% of the patients only. Of those 46.0% had a T-score ≤–2.5 SD and 81.1% ≤–1.0 SD. Osteoporosis treatment rate increased from 26.3% before fracture to 46.9% after fracture in women and from 13.0% to 30.3% in men. However, only 24.0% of the women and 13.8% of the men were finally adequately treated with a bone active substance, generally an oral bisphosphonate, with or without calcium / vitamin D supplements. A positive history of previous fracture vs none increased the likelihood of getting treatment with a bone active substance (36.6 vs 17.9%, Δ 18.7%, 95% CI 15.1 to 22.3, and 22.6 vs 9.9%, Δ 12.7%, CI 7.3 to 18.5, in women and men, respectively).

In Switzerland, osteoporosis remains underdiagnosed and undertreated in patients aged 50 years and older presenting with a fragility fracture.

Key words: discharge status; DXA; epidemiology; fragility fractures; osteoporosis; pharmacological treatment

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Introduction

Osteoporosis is a systemic skeletal disease characterised by low bone mass and microarchitectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture [1]. Osteoporotic fractures represent a considerable and growing burden to patients, society and health-care financing [2, 3]. These fractures can occur in virtually any bone, in both genders, typically after a low-energy trauma (fragility fractures) and are a major risk factor for subsequent fractures [4–7] and increased mortality [8].

The diagnosis of osteoporosis relies on individual fracture risk assessment and clinical examination, followed by bone mineral density (BMD) measurement with DXA [9], the diagnostic facilities being readily available throughout Europe [10], including Switzerland. Efficacious treatment options, such as bisphosphonates, SERMs and teriparatides have been proven to reduce fracture risk in adequately designed, randomised, controlled fracture endpoint trials [11] and shown to be cost-effective [12]. Furthermore, there is a general worldwide consensus that patients aged 50 years and older, presenting with a fragility fracture should undergo diagnostic workup, actively seeking for osteoporosis, and benefit from appropriate measures aiming at reducing the risk for further fractures [1, 9].

Despite several initiatives reporting improved disease management [13–16], recent contributions from different countries have shown that even after a dramatic inaugural event such as a

fracture, and even a hip fracture, osteoporosis remains frequently undiagnosed and untreated [17–20].

The aim of the present survey was to assess the nationwide quality level of management of patients with an acute fracture with regard to osteoporosis diagnosis and treatment, in order to establish the baseline for future quality improvement projects to be implemented at the individual hospital level.

Material and methods

Between 2004 and 2006, eight centres recruited consecutive patients with fracture. Three participating hospitals were University Hospitals (Basel, Berne, and Lausanne), three cantonal hospitals (Fribourg, Lucerne, and St Gallen) and two regional hospitals (Estavayer and Riaz). Seventy percent of the patient reports originated from the German speaking part of Switzerland and the remainder 30% from the French speaking part, a distribution which is compatible with that of the Swiss population. When taking additionally into account that Swiss University hospitals also fulfil the role of cantonal and/or regional hospitals in their zone of influence, centres participating in this survey can be considered as being representative for Switzerland as a whole. All centres had direct access to a DXA device for BMD measurement, which could be performed either during hospitalisation or on appointment after discharge.

Consecutive fracture patients were recruited over 8 to 16 months, depending on cantonal requirements and individual differences in time needed for implementing the survey. In each participating centre, a nurse was dedicated to project management and follow-up, whereby no strict criteria applied. Cantonal ethical review committee approval was obtained for each participating site if required, whereby one canton required preliminary written informed consent. In all other centres oral approval for data collection was obtained from the patient by either the dedicated nurse or the resident in charge. For ambulatory patients, approval was obtained either during the consultation or during the week thereafter by follow-up phone call. Patients also gave their approval that missing data be obtained from their treating physician or their family. No data other than those relevant to the treatment of the current fracture event were retrieved from patient records. Whenever possible, missing data (such as BMD values if the DXA examination was made on appointment or the history of previous fracture) were obtained by calling the patient, his family or his treating physician.

All clinical fractures occurring in male and female patients aged 50 years and older were prospectively documented with a predefined standardised questionnaire administered by either the study nurse or the resident in charge. For all patients, gender, fracture localisation, type of orthopaedic treatment (ambulatory vs hospitalisation), and previous history of fracture during adulthood were recorded. Exclusion criteria were: patients not willing to participate, fractures after a high velocity trauma, pathological fractures, typically non-osteoporotic fractures (such as fractures of the finger or the toe), poor general health, and neuropsychiatric disorder with cognitive dysfunction (such as Alzheimer's disease). All remaining patients were included in the cohort and their discharge status, diagnostic workup (clinical status, X-Rays and BMD measurement) and pharmacological treatment measures against osteoporosis (before and after the fracture event) were recorded.

Data analysis was performed with descriptive statistics methods, such as the calculation of means, standard deviations, proportions and 95% confidence intervals (CI) of the differences (Δ) between groups for formal comparisons, using a StatsDirect® software version 2.6.5.

Results

Over an average observation period of 12.2 months, 5395 fractures were recorded in 4966 consecutive female (N = 3598) and male (N = 1368) patients aged 50 years and older in the eight participating hospitals. Mean age was 72.5 ± 12.1 years; women were slightly older than men (73.9 ± 11.8 vs 69.0 ± 12.1, respectively). The distribution of all recorded fractures by fracture localisation and by gender is shown in table 1. Of all recorded fracture patients, 1299 (26.2%) were excluded for reasons shown in figure 1. The remaining 3667 women and men with an acute fragility fracture (on average 73.8 ± 11.6 and 70.0 ± 12.1 years old, respectively) were included in the analysis.

History of previous fracture

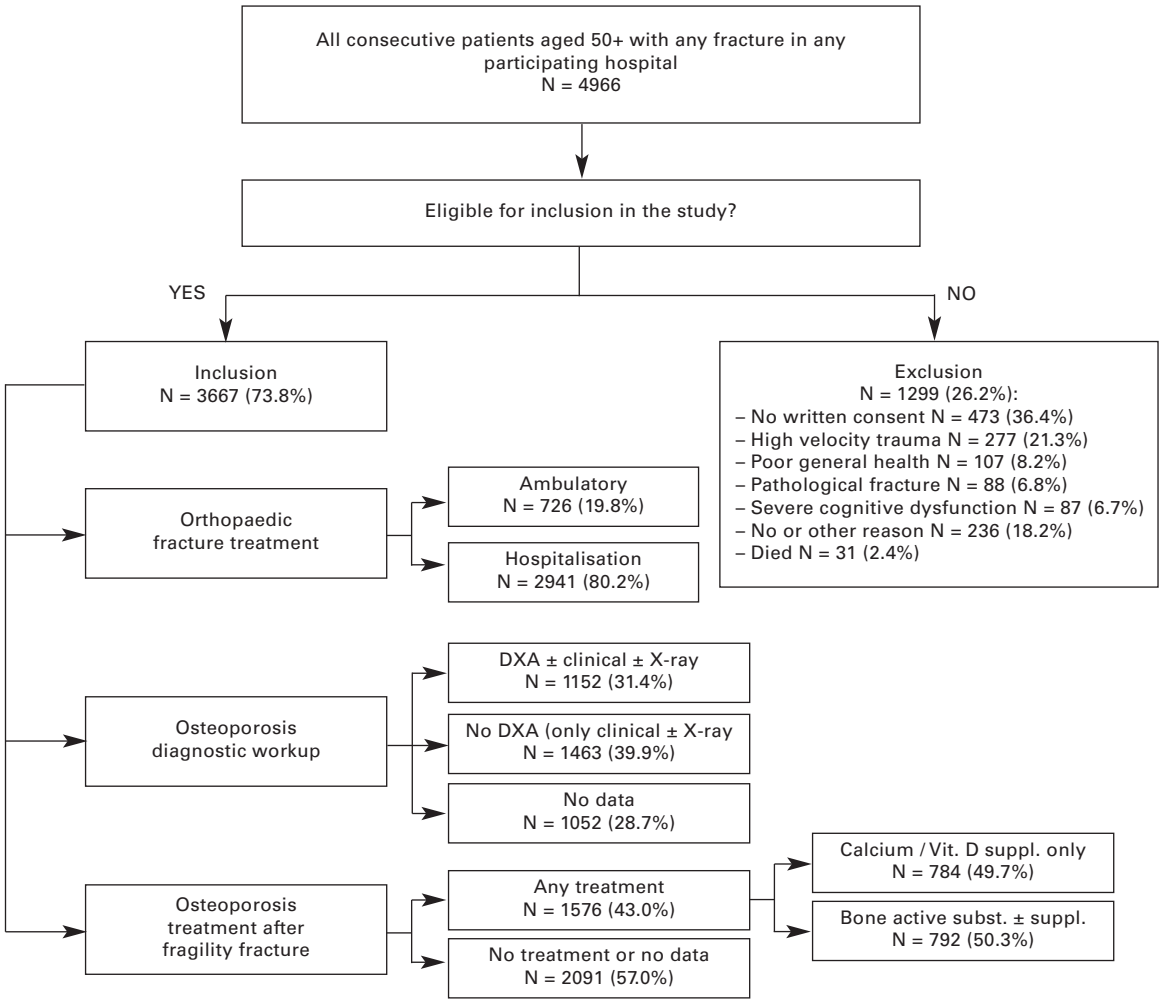
Overall, 1185 (32.3%) patients reported 1634 previous fractures during adulthood, corresponding to an average of 1.38 previous fractures per patient. Although these figures were similar across genders (32.9% of women and 30.6% of men had experienced a mean of 1.39 and 1.35 previous fractures, respectively), previous fractures of the upper limbs were more frequent in women than in men (32.3 vs 21.7%, ∅ 10.6%, 95% CI 5.4 to 15.4), as shown in table 1.

Fractures at inclusion

In total, 3897 acute fractures were reported in 3667 patients, corresponding to a mean of 1.06 fractures per included patient. According to predefined categories, 30.7% of the acute fractures were of the upper limb (distal forearm or proximal humerus), 19.6% of the axial skeleton (spine, including sacrum and ribs, or pelvis), 26.4% lower limb fractures (femur or tibia), and 23.3% at another localisation (such as distal humerus, elbow, and malleolar fractures). Acute fractures of the

Figure 1

OsteoCare survey flowchart.



upper limbs were more frequent in women than in men (32.9 vs 23.7%, ∅ 9.2%, CI 5.9 to 12.3), respectively). Details by fracture localisation and gender are shown in table 1.

Discharge status

Of all patients with a fragility fracture, 2941 (80.2%) were hospitalised, women numerically less often than men (79.3 vs 83.0%, ∅ –3.7%, CI –6.5 to 0.0), respectively) while the remainder were treated on an out-patient basis. The average length of hospital stay was similar in women and men (9.0 ± 6.9 and 9.3 ± 7.1 days, respectively). After discharge 49.8% of the hospitalised patients returned home, 32.7% went to a rehabilitation clinic and the remainder 17.1% went either to a nursing home or a retirement home, were transferred to another hospital, or died (0.4%), with no significant differences between women and men, as shown in figure 2.

Osteoporosis diagnostic workup

Data were available for 2615 (71.3%) patients. DXA measurement was performed in 1152 (44.0%) of these, either alone (N = 501) or in combination with clinical examination and/or x-ray (N = 651), generally of the lumbar and thoracic spine aiming at identifying spinal osteoporosis and/or associated vertebral fractures. In the remaining 1463 (56.0%) patients, osteoporosis diagnosis relied upon clinical examination (N = 1196), an x-ray (N = 219) or both (N = 48). When DXA examination was performed (N = 1152), the most frequently analysed regions of interest were the lumbar spine (LS, 69.5%) and the femoral neck (FN, 67.0%). In 495 patients (43.0%), three regions or more (generally total hip, FN, and LS) were analysed, in 46 patients (4.0%) two (generally LS and FN), and in 611 (53.0%) patients one (generally LS or FN). Based on the definition of osteoporosis proposed by the WHO [1, 9] and considering the lowest measured T-score as diagnostic for osteoporosis, 46.0% of the patients with an acute fragility fracture had severe osteoporosis (T-score ≤ –2.5 SD in the presence of one or more fragility fractures), 35.1% had osteopenia (–2.5 < T-score ≤ –1 SD), 14.4% were normal (T-score > –1 SD), and no value was available for 4.5%. In women (N = 908), the prevalence of severe osteoporosis and osteopenia was 47.5% and 34.7%, respectively. The corresponding prevalences in men (N = 244) were 40.6% and 36.5%, respectively. Detailed mean T-score values by fracture type and gender are shown in figure 3.

Pharmacological treatment against osteoporosis (table 2)

Previous treatment: prior treatment of osteoporosis was reported in 849 patients (23.2%), more frequently in women than in men (26.3 vs

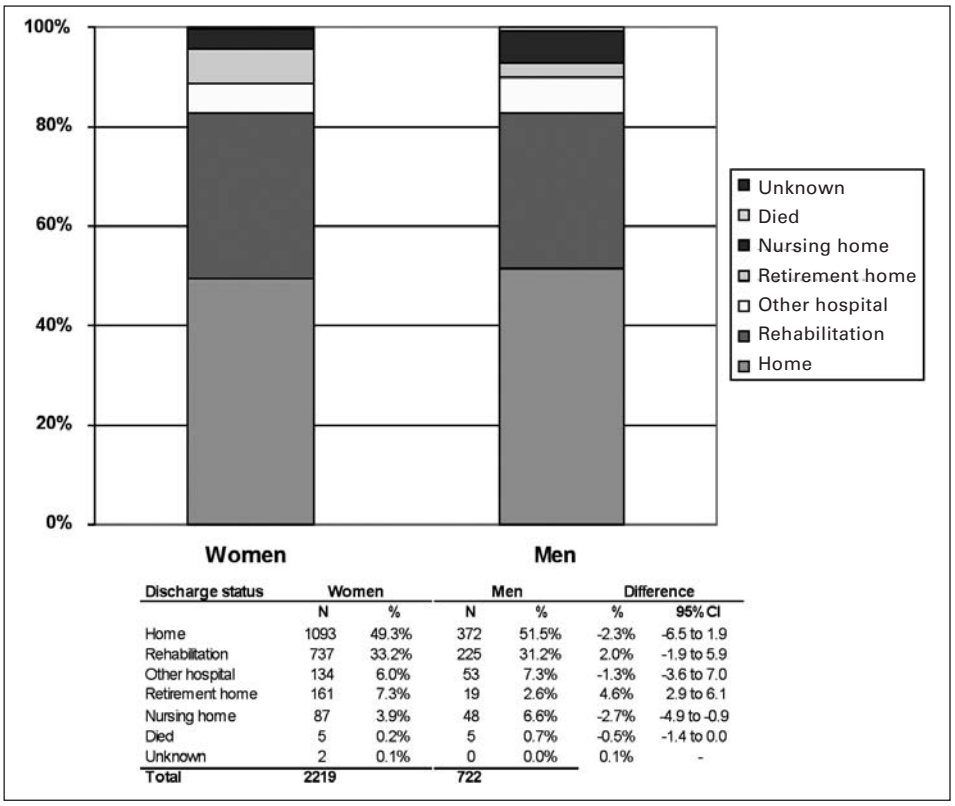
Table 1

Distribution of fractures in all recorded patients (n = 4966) and in included patients with a fragility fracture (n = 3667), by gender and fracture type. Some patients had multiple fractures.

Women	**All recorded fractures**				**Included fragility fractures**			
	History of previous fracture		**Current fracture**		**History of previous fracture**		**Current fracture**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Total patients	1016	28.2%	3598		919	32.9%	2797	
Total fractures	1396		3829		1275		2965	
Fractures / patient (mean)	1.37		1.06		1.39		1.06	
Fractures by localization								
Distal forearm	302	21.6%	801	20.9%	271	21.3%	628	21.2%
Proximal humerus	161	11.5%	446	11.6%	141	11.1%	347	11.7%
Subtotal upper limbs	463	33.2%	1247	32.6%	412	32.3%	975	32.9%
Rib	45	3.2%	104	2.7%	44	3.5%	90	3.0%
Sacrum	7	0.5%	27	0.7%	5	0.4%	21	0.7%
Pelvis	52	3.7%	127	3.3%	48	3.8%	100	3.4%
Spine, lumbar	118	8.5%	256	6.7%	112	8.8%	207	7.0%
Spine, thoracic	126	9.0%	183	4.8%	120	9.4%	141	4.8%
Subtotal axial skeleton	348	24.9%	697	18.2%	329	25.8%	559	18.9%
Femur, neck	79	5.7%	280	7.3%	78	6.1%	254	8.6%
Femur, trochanter	106	7.6%	601	15.7%	82	6.4%	419	14.1%
Femur, shaft	0	0.0%	29	0.8%	0	0.0%	19	0.6%
Tibia, proximal	73	5.2%	128	3.3%	69	5.4%	95	3.2%
Subtotal lower limbs	258	18.5%	1038	27.1%	229	18.0%	787	26.5%
Other	215	15.4%	541	14.1%	202	15.8%	391	13.2%
Malleolar, lateral	53	3.8%	167	4.4%	51	4.0%	142	4.8%
Malleolar, median	37	2.7%	123	3.2%	33	2.6%	108	3.6%
No indication	19	1.4%	1	0.0%	17	1.3%	1	0.0%
Face	3	0.2%	10	0.3%	2	0.2%	2	0.1%
Skull	0	0.0%	5	0.1%	0	0.0%	0	0.0%
Subtotal all other	327	23.4%	847	22.1%	305	23.9%	644	21.7%
Men								
Total patients	304	22.2%	1368		266	30.6%	870	
Total fractures	404		1566		359		932	
Fractures / patient (mean)	1.33		1.14		1.35		1.07	
Fractures by localization								
Distal forearm	50	12.4%	182	11.6%	44	12.3%	124	13.3%
Proximal humerus	37	9.2%	163	10.4%	34	9.5%	97	10.4%
Subtotal upper limbs	87	21.5%	345	22.0%	78	21.7%	221	23.7%
Rib	20	5.0%	70	4.5%	19	5.3%	38	4.1%
Sacrum	1	0.2%	4	0.3%	1	0.3%	0	0.0%
Pelvis	9	2.2%	74	4.7%	9	2.5%	35	3.8%
Spine, lumbar	43	10.6%	130	8.3%	37	10.3%	78	8.4%
Spine, thoracic	29	7.2%	98	6.3%	24	6.7%	54	5.8%
Subtotal axial skeleton	102	25.2%	376	24.0%	90	25.1%	205	22.0%
Femur, neck	33	8.2%	89	5.7%	31	8.6%	79	8.5%
Femur, trochanter	30	7.4%	206	13.2%	26	7.2%	129	13.8%
Femur, shaft	0	0.0%	4	0.3%	0	0.0%	1	0.1%
Tibia, proximal	22	5.4%	65	4.2%	19	5.3%	31	3.3%
Subtotal lower limbs	85	21.0%	364	23.2%	76	21.2%	240	25.8%
Other	101	25.0%	305	19.5%	93	25.9%	165	17.7%
Malleolar, lateral	10	2.5%	87	5.6%	7	1.9%	60	6.4%
Malleolar, median	6	1.5%	59	3.8%	5	1.4%	39	4.2%
No indication	7	1.7%	0	0.0%	7	1.9%	0	0.0%
Face	3	0.7%	18	1.1%	1	0.3%	2	0.2%
Skull	3	0.7%	12	0.8%	2	0.6%	0	0.0%
Subtotal all other	130	32.2%	481	30.7%	115	32.0%	266	28.5%

Figure 2

Discharge status of hospitalised patients by gender (n = 2941).

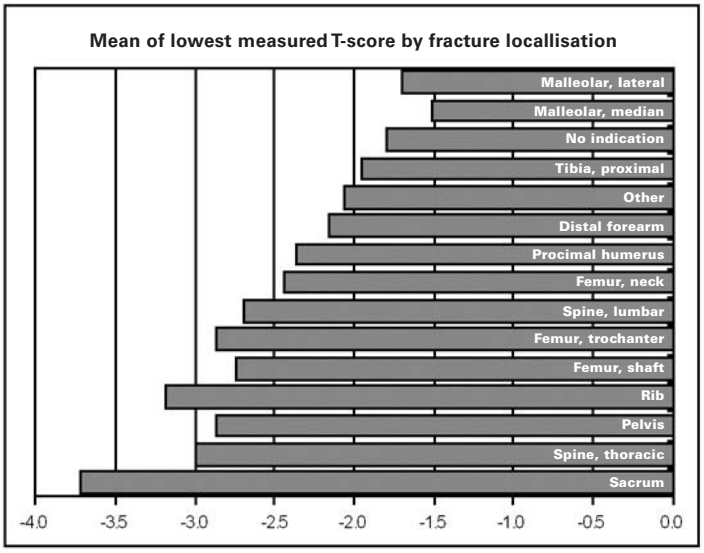


Discharge status	Women		Men		Difference	
	N	%	N	%	%	95% CI
Home	1093	49.3%	372	51.5%	-2.3%	-6.5 to 1.9
Rehabilitation	737	33.2%	225	31.2%	2.0%	-1.9 to 5.9
Other hospital	134	6.0%	53	7.3%	-1.3%	-3.6 to 7.0
Retirement home	161	7.3%	19	2.6%	4.6%	2.9 to 6.1
Nursing home	87	3.9%	48	6.6%	-2.7%	-4.9 to -0.9
Died	5	0.2%	5	0.7%	-0.5%	-1.4 to 0.0
Unknown	2	0.1%	0	0.0%	0.1%	-
Total	2219		722			

Figure 3

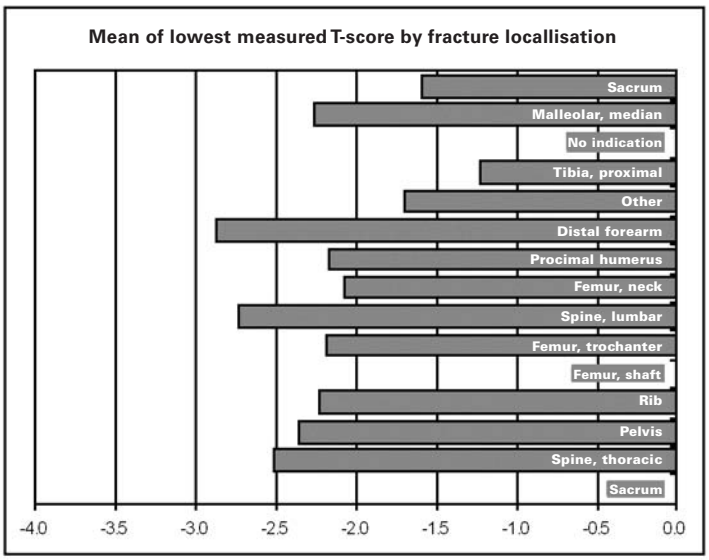
Mean of lowest measured T-scores, by fracture type and by gender (n = 1152).

Women (N = 908)



Fractures (N)	Mean T-score (SD)
69	–1.7
40	–1.5
1	–1.8
41	–2.0
108	–2.1
203	–2.2
113	–2.4
82	–2.4
77	–2.7
122	–2.9
2	–2.8
17	–3.2
33	–2.9
57	–3.0
10	–3.7
975	**–2.3**

Men (N = 244)



Fractures (N)	Mean T-score (SD)
16	–1.6
15	–2.3
0	–
8	–1.2
45	–1.7
29	–2.9
32	–2.2
21	–2.1
25	–2.7
38	–2.2
0	–
9	–2.2
7	–2.4
19	–2.5
0	–
264	**–2.2**

Table 2

Treatment rate before and after inclusion for fragility fracture, by history of previous fracture and gender (n = 3667).

Women	Before current fracture		After current fracture		Absolute difference after vs before	
All patients (n = 2797, 100.0%)	N	%	N	%	Δ (%)	95%CI
Any treatment	736	26.3%	1312	46.9%	20.6%	18.1 to 23.0
Calcium and/or vitamin D supplements only	415	14.8%	640	22.9%	8.0%	6.0 to 10.1
Bone active substance ± supplements	321	11.5%	672	24.0%	12.5%	10.6 to 14.5
Positive history of previous fracture (n = 919)						
Any treatment	397	43.2%	541	58.9%	15.7%	11.1 to 20.1
Calcium and/or vitamin D supplements only	189	20.6%	205	22.3%	1.7%	2.0 to 5.5
Bone active substance ± supplements	208	22.6%	336	36.6%	13.9%	9.8 to 18.0
No or unknown history of previous fracture (n = 1878)						
Any treatment	339	18.1%	771	41.1%	23.0%	20.2 to 25.8
Calcium and/or vitamin D supplements only	226	12.0%	435	23.2%	11.1%	8.7 to 13.5
Bone active substance ± supplements	113	6.0%	336	17.9%	11.9%	9.9 to 13.9

Men	Before current fracture		After current fracture		Absolute difference after vs before	
All patients (n = 870, 100.0%)	N	%	N	%	Δ (%)	95%CI
Any treatment	113	13.0%	264	30.3%	17.4%	13.6 to 21.1
Calcium and/or vitamin D supplements only	72	8.3%	144	16.6%	8.3%	5.2 to 11.4
Bone active substance ± supplements	41	4.7%	120	13.8%	9.1%	6.4 to 11.8
Positive history of previous fracture (n = 266)						
Any treatment	69	25.9%	122	45.9%	19.9%	11.8 to 27.8
Calcium and/or vitamin D supplements only	43	16.2%	62	23.3%	7.1%	0.4 to 13.9
Bone active substance ± supplements	26	9.8%	60	22.6%	12.8%	6.6 to 19.1
No or unknown history of previous fracture (n = 604)						
Any treatment	44	7.3%	142	23.5%	16.2%	12.3 to 20.3
Calcium and/or vitamin D supplements only	29	4.8%	82	13.6%	8.8%	5.6 to 12.1
Bone active substance ± supplements	15	2.5%	60	9.9%	7.5%	4.9 to 10.3

Any treatment = calcium and/or vitamin D supplements and/or any bone active substance
Bone active substance ± supplements = bisphosphonate, SERM, teriparatide, hormone replacement therapy or androgens, or calcitonin, with or without calcium and/or vitamin D supplement.

13.0%, ∅ 13.3%, CI 10.5 to 16.0) as shown in table 2. Patients with a positive history of previous fracture were more likely to have been pretreated for osteoporosis compared to those without (women 43.2 vs 18.1%, ∅ 25.1%, CI 21.5 to 28.8, and men 25.9 vs 7.3%, ∅ 18.7%, CI 13.3 to 24.6). However, less than half (42.6%) of all pretreated patients were taking a bone active substance.

Treatment after the current fragility fracture: After the acute fragility fracture reported in the present study, 1576 patients (43.0%) received any treatment against osteoporosis, which represents an absolute increase in osteoporosis treatment rate of 19.8% (17.7 to 21.9) compared to before the fracture event in both genders. The osteoporosis treatment rate increased by 20.6% (18.1 to 23.0) in women and 17.4% (13.6 to 21.1) in men as shown in table 2. Patients with a positive history of previous fracture during adulthood, i.e., patients currently presenting with a second fracture or more, were significantly more likely to get any treatment against osteoporosis than those without (58.9 vs 41.1%, ∅ 17.8%, CI 13.9 to 21.7, and 45.9 vs 23.5%, ∅ 22.4%, CI 15.5 to 29.2, for women and men, respectively). Similarly, a positive history of previous fracture increased the likelihood of getting treatment with a bone active substance (36.6 vs 17.9%, ∅ 18.7%, CI 15.1 to 22.3, and 22.6 vs 9.9%, ∅ 12.7%, CI 7.3 to 18.5, in women and men, respectively). However, only half (50.3%) of all treated patients received a "state of the art" combination of a bone active substance with or without supplements, corresponding to 21.6% (24.0% of the women and 13.8% of the men) of all eligible being adequately treated after an acute fragility fracture. When given calcium and/or vitamin D supplements, 85.3% of the patients received a combination of both. When given a bone active substance, 89.3% of the patients received a bisphosphonate, generally an oral bisphosphonate. Figure 4 shows the relative proportions of patients adequately diagnosed and subsequently treated by 10-year age groups.

Discussion

The aim of the present prospective cohort study which included 3667 patients from a representative sample of 8 Swiss hospitals was to provide a snapshot of the current situation regarding patient characteristics, current diagnostic workup and treatment patterns of osteoporosis in patients 50 years old or more and presenting to the emergency ward with a fracture.

Fractures were three times more frequent in women than in men. Fractures tended to be more frequent with increasing age in both genders, and this effect was more pronounced in women than in men. Considering that the number of persons alive decreases with age, this observation is consistent with an exponential increase of fragility fractures with age and with a delayed increase by approximately 10 years in men compared to women [2, 21].

Approximately one third of all patients had one or more previous fractures during adulthood before inclusion. Fractures at inclusion were distributed across the whole range of possible fractures and evenly distributed between lower limbs, upper limbs and the axial skeleton, albeit fractures of the upper limbs were more frequent than other fractures in women and more frequent in women than in men, which is consistent with earlier observations [2]. Eighty percent of the patients were hospitalised, with a mean length of stay of 9.1 days. Thereafter, only 50% of these patients were discharged home. For a significant proportion of hospitalised patients, the fracture event resulted in a transient or permanent loss of independence, approximately one third being discharged to a rehabilitation clinic and one sixth being institutionalised. This observation is consistent with the observation according to which recent osteoporotic fractures have a significant impact on health related quality of life in postmenopausal women [22] and men [23, 24].

The "classical" osteoporotic fractures (distal forearm, spine, and femoral neck and trochanter)

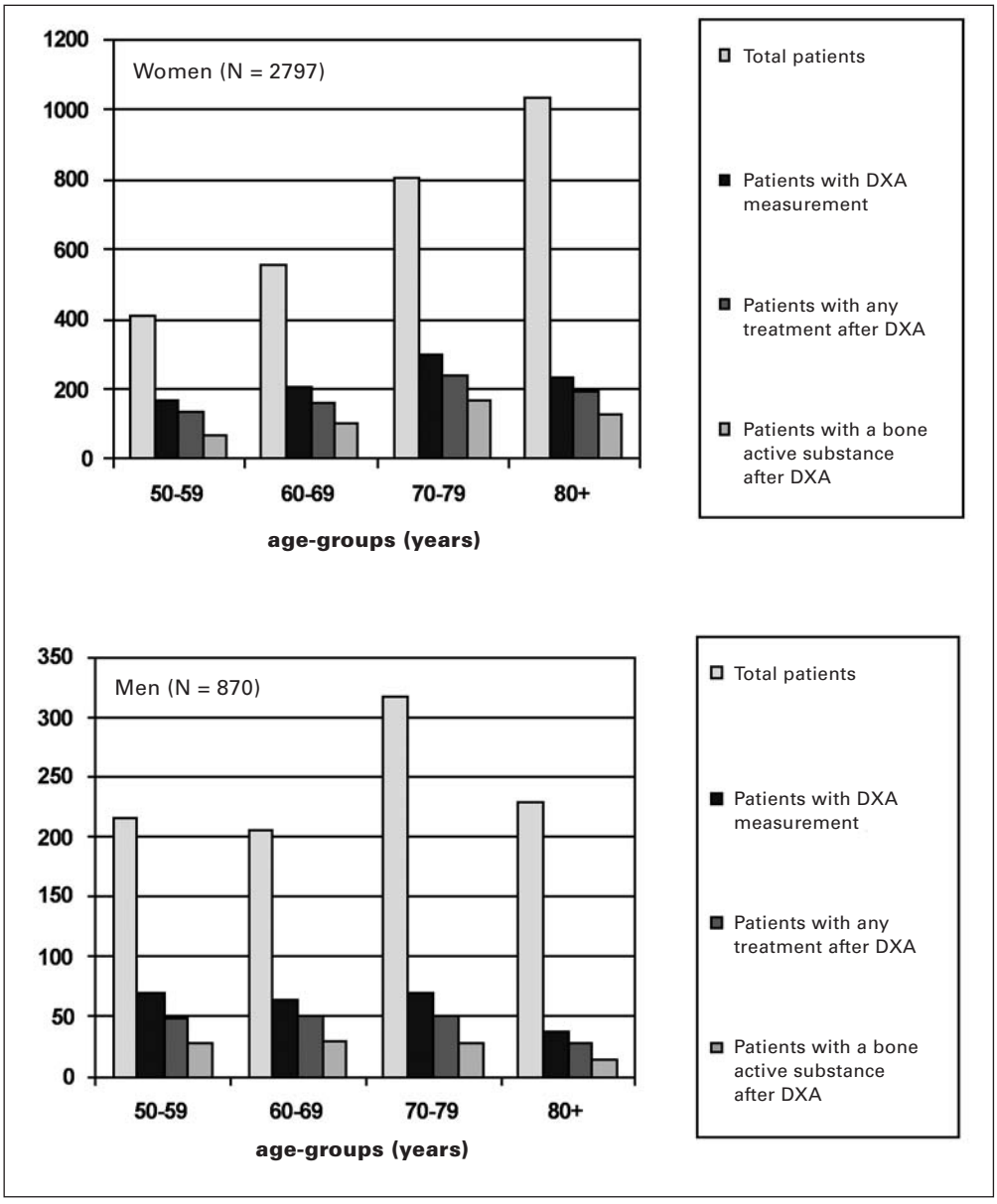


Figure 4

Fragility fractures, subsequent DXA measurement and treatment rates in women and men, by 10-year age-groups. * Any treatment = calcium and/or vitamin D supplements and/or any bone active substance (bisphosphonate, SERM, teriparatide, hormone replacement therapy or androgens, calcitonin).

represented 55.7 and 49.8% of all fragility fractures in women and men respectively. These percentages are lower than previously reported from Swiss hospitalisation data (66.3 and 59.0% for women and men, respectively) [2]. Several possible explanations may account for this observation: First, the present data report all fragility fractures, whether hospitalised or not; second, the definition of an osteoporotic fracture in the Swiss hospitalisation data was based on attribution rates, which may underestimate the proportion of osteoporotic fractures in non typical localisations; and third, fragility fractures may become increasingly recognised as osteoporotic, independently of their localisation, acknowledging the increasing awareness of osteoporosis as a systemic disease.

A BMD measurement by DXA is indicated in all patients presenting with a fragility fracture [9]. In the present survey, diagnostic workup was generally poor, DXA measurement being reported in only 31.4% of all patients presenting with a fragility fracture after the age of 50 years, and was even more so when considering that a dedicated nurse was allocated to the project in all participating centres. However, this result is better than the previously published findings of a pilot study which relied on direct information to the referring physicians and did not involve a dedicated nurse in which a DXA measurement was performed in only 12.6% of the patients presenting with a fracture at the orthopaedic ward [25]. It cannot be excluded that, in some patients, BMD was measured after discharge by their family practitioner, as recommended in some discharge letters. Although this seems a possible scenario, this number is expected to be small based on pilot experience and on the fact that compliance with osteoporosis management guidelines in fracture patients was previously shown to be generally low [10, 26].

In the present survey, osteopenia or osteoporosis as defined by the WHO [1] was identified as underlying disease in approximately 80% of the patients presenting with a fragility fracture. This finding is consistent with reports from other European countries such as Scotland [16, 27], France [28] and the Netherlands [13] but contrasts with one previous finding reporting only 6.4% of postmenopausal women with fracture having a T-score of –2.5 or less, using peripheral measurement devices [29].

The overall osteoporosis treatment rate before current fragility fracture was low (23.2%), but was higher in patients who had experienced a previous fracture (39.3%) compared to those who had not (15.4%). However, only half (19.7%) of these high risk patients with a positive history of previous fracture, were adequately treated with a bone active substance while the other half (19.6%) were treated with calcium and/or vitamin D supplements only. Although the observation that osteoporosis treatment rate almost doubled from 23.2% before the current fracture to 43.0% thereafter is encouraging, the share of those treated with a bone active substance remained unchanged at approximately 50% of all treated.

Several drug classes have proven higher efficacy than calcium and vitamin D supplements in reducing fracture risk. Bisphosphonates were shown to reduce fracture risk at all clinically relevant sites, including the hip, in adequately designed primary fracture endpoint trials in postmenopausal women, with consistent observations for men with osteoporosis [30]. In addition to their proven efficacy in reducing fracture risk, these interventions were considered cost-effective in women and men aged 65 years or older [31, 32]. Whether simplified patient identification measures, such as questionnaires for determination of the 10-year absolute fracture risk of an individual patient [33] will contribute to improve treatment penetration remains to be established. Considering that overall only one fifth of the patients presenting with a fragility treatment are getting adequate treatment according to guidelines, osteoporosis should be considered as largely undertreated in Switzerland, a finding which is unfortunately consistent with previous reports from other European countries [10, 26, 28, 34–36].

In the present survey, men accounted for 25.4% of all included fragility fractures, 21.2% of all DXA measurements performed, and 15.2% of all patients treated with at least a bone active substance. This indicates that even after a fragility fracture, osteoporosis identification and treatment remains lower in men than in women, possibly due to lower disease awareness at the physician and the patient level. Osteoporosis is increasingly being recognised as an important cause of morbidity and mortality in older men, representing a growing public health issue in industrialised countries [8, 37]. Approximately 25–35% of hip fractures were shown to occur in men [2, 37] with an associated mortality twice of that in women [38]. Furthermore, prevalent vertebral deformity was shown to predict both increased mortality and increased fracture incidence during the following decade also in men [8]. Taking into consideration 1) the already considerable and increasing burden of osteoporosis in men, 2) that long-term risk of subsequent fracture following an initial fragility fracture is similar in both genders [6], 3) that diagnostic and therapeutic recommendations aiming at reducing fracture risk are similar in both genders, and 4) that the outcome of fracture is similar in both genders, as shown in this survey, fragility fractures in men should deserve the same level of clinical attention as in women.

Overall, management of patient with fractures was not satisfactory and not in line with current expert recommendations. Recent publications have shown that these results can be improved by implementing adequate structures with dedicated personnel and streamlined patient

management processes. A clinical osteoporosis pathway for the management of patients with low trauma fracture was set up in Geneva, Switzerland [15]. In that setting and in a selected population of 384 patients recruited over 3 years, 63% of the patients had BMD measured by DXA, 86% were identified with low bone mass or osteoporosis, 33% were proposed a specific antiosteoporotic therapy, and two thirds of them were still on therapy 6 months later [15]. In a Dutch fracture and osteoporosis clinic, 65% of the admitted patients with fracture followed the diagnostic procedure, 40% were identified as osteoporotic, and treated with a bone active substance (generally a bisphosphonate) with a low discontinuation rate of 11% after 3 months [13]. In addition, experience from other countries has shown that consistent implementation of osteoporosis diagnostic and treatment measures might reverse the predicted increase of osteoporotic fractures [3] despite the aging of the population [39]. In order to improve the quality of fracture patient management, several approaches have been proposed and implemented by the participating hospitals, ranging from additional mandatory fields for osteoporosis diagnosis and treatment in the electronic patient file to the creation of bone disease management units with dedicated personnel and predefined workflows and pathways involving the trauma/orthopaedic ward [40]. The impact on quality of medical care of these measures will be assessed by comparing achieved results with the present baseline.

This survey has several limitations. By design, the aim was to collect consecutive patients in all participating centres. However, across and even within centres, patients were not always consistently included. Although a dedicated nurse was a pre-requirement of the survey, the time the nurses could allocate to the project in addition to their other duties varied by centre and over time, sometimes leading to incomplete data collection, e.g., when a follow-up was needed with the treating physician. This precluded a detailed analysis on the individual contribution of dedicated personnel to the outcome. One particular concern was the low recruitment rate in one centre (35% compared to 82% in the remaining centres) for which the investigators indicated that the reason for unwillingness to participate was the need for written informed consent required by the cantonal ethical review board. It can only be speculated why some patients were reluctant to give their written informed consent, although no data other than those from routine workup were collected: availability of the consent letter at the ward, additional time investment, chosen wording, collection of the signed consent letters, and integration of an additional step in daily routine are possible pitfalls. However, a sensitivity analysis showed that exclusion of these patients from the analysis did not significantly change the results of the present study with regard to mean age, gender distribution, history of previous fracture, DXA measurement rate, mean lowest T-score, treatment rates (any treatment and treatment with a bone active substance) before and after current fracture. Only hospitalization rate increased when excluding the outlier (82.6 vs 80.2%, Δ 2.4%, CI 0.6 to 4.2). Therefore, the site was included in the analysis. Osteoporosis treatment rate increased after the survey. The inclusion dates of the individual patients were not collected, which precluded an analysis of whether the rates of DXA measurement and drug treatment had progressed during the survey, as a result of the physicians being informed that their osteoporosis management behaviour was recorded. The Hawthorne effect is well-known, and generally accounts for behaviour improvements [41]. Therefore, the present results may overestimate actual diagnosis and treatment rates in osteoporosis.

In conclusion, osteoporosis remains widely underdiagnosed and undertreated in Switzerland, even in a high risk population of elderly patients with fragility fractures. This fact is even more worrisome for men. Quality improvement measures for the management of patients presenting with fragility fractures are urgently needed and should rely on an approach integrating individuals at risk, treating physicians and hospitals. Dedicated hospital structures and personnel, with process ownership and taking responsibility for implementation and outcome improvement, or a fracture liaison service may be key success factors.

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