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ORIGINAL ARTICLE

Higher rates of osteoporosis treatment initiation and persistence in patients with newly diagnosed vertebral fracture when introduced in inpatients than later in outpatients

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Abstract

Summary Whether in-hospital management of patients with newly identified vertebral fractures leads to a higher rate of osteoporosis medication than delayed outpatient management remains unknown. Our study showed that early osteoporosis therapy initiation in a fracture liaison service during hospital stay was a more efficacious strategy for secondary fracture prevention.

Introduction Fracture liaison services are standard care for secondary fracture prevention. A higher rate of osteoporosis treatment initiation may be considered when introduced in the hospital rather than an outpatient recommendation to a primary care physician (PCP). Whether this applies to patients with newly detected vertebral fractures in a general internal medicine ward remains unknown. We prospectively investigated whether in-hospital management of newly identified vertebral fractures led to a higher rate of osteoporosis medication initiation and persistence at 3 and 6 months than delayed outpatient management by a PCP.

Methods We conducted a prospective study including hospitalized patients > 60 years systematically searched for asymptomatic vertebral fractures on lateral chest and/or abdominal radiographs. Patients were included either in phase 1 (outpatient care recommendations on osteoporosis management to a PCP) or in phase 2 (inpatient care management initiated during hospitalization). The percentage of patients under osteoporosis treatment was evaluated by telephone interview at 3 and 6 months.

Results Outpatients' (84 with fracture/407 assessed (21%); 75.7 ± 7.7 years) and inpatients' (100/524 (19%); 77.8 ± 9.4 years) characteristics were similar. Osteoporosis medication was more often prescribed in inpatients at 3 (67% vs. 19%, respectively; $p < 0.001$) and 6 months (69 vs. 27%, respectively; $p < 0.001$). The percentage under treatment was also higher in inpatients than in outpatients at 3 (52 vs. 19%, $p < 0.001$) and 6 months (54 vs. 22%, $p < 0.001$). Length of stay and destination post-discharge were not different between groups.

Conclusions Early patient management after a newly detected vertebral fracture during hospitalization was a more efficacious strategy of secondary fracture prevention than delayed outpatient management following discharge.

Keywords Fracture liaison service · Inpatients · Osteoporosis medication · Outpatients · Vertebral fracture

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Introduction

The prevalence of vertebral fractures increases with advancing age, reaching approximatively 30% in subjects > 60 years [1]. However, most radiological vertebral fractures do not receive medical attention and remain undiagnosed despite their high negative impact on quality of life, morbidity, and mortality, as well as generating extra-cost through inpatient healthcare use [2–5]. Under-identification of vertebral fractures leads also to a significant underestimation of the FRAX® score, and lumbar bone mineral density (BMD) has a low reliability in predicting the presence of vertebral fractures [6]. The presence of one or more vertebral fractures, even when asymptomatic, increases the risk of new vertebral fractures by four- to fivefold, including the risk of subsequent fractures at other skeletal sites [7–9]. In addition, the identification of patients with vertebral fractures for assessment and treatment is critical for the successful prevention of hip fractures [10]. Several osteoporosis medications have demonstrated their efficacy in reducing the risk of further vertebral fractures by up to 70%, such as bisphosphonates [11, 12], denosumab [13], or teriparatide [14]. However, despite their clear benefits, the prescription rates of osteoporosis medication after fragility fractures are very low as well as patient compliance with treatment [15, 16].

Vertebral fractures could be identified opportunistically using standard lateral chest and/or thoracolumbar radiographs for the selection of high-risk patients as recommended by fracture liaison services (FLS) which are now considered as standard care for patient identification and the secondary prevention of osteoporotic fracture [17–21]. A previous review of various FLS models has suggested that higher rates of osteoporosis treatment initiation and persistence were observed when introduced by FLS than upon recommendation to primary care physician (PCP) [22]. Whether higher prevalence of treatment is observed when initiated in inpatients than by recommendations to PCP for patients systematically searched for vertebral fracture in a service of general internal medicine is not known. The aim of this prospective study was to investigate whether the early management of elderly inpatients hospitalized in a general internal medicine ward and with newly identified vertebral fragility fractures detected through a systematic search led to a higher percentage of patients with osteoporosis medication compared with outpatient management by a PCP.

Methods

Patients

We included male and female patients > 60 years of age admitted to a 120-bed general internal medicine service at Geneva University Hospitals with lateral chest and/or spinal radiographs on admission or during the hospital stay. Exclusion criteria were advanced metastatic cancers, multiple myeloma, traumatic fractures, a radiograph of insufficient quality for analysis, life expectancy less than 1 year, death during hospitalization, patients living outside the country, length of stay less of 24 h, and patients already treated for osteoporosis. The protocol was submitted to the Geneva University Hospitals' Ethics Committee who did not consider necessary to review it since it was dealing with usual care practice, without any risk for the patients.

Vertebral fracture detection

Based on an alert inserted in the electronic medical record system, all lateral chest and/or spinal digital radiographs of consecutively admitted patients were reviewed by two investigators. The validity of the list of patients generated by the electronic alert was verified during an initial observation period of 3 months, which allowed to also determine the prevalence of vertebral fractures. Generated data were regularly checked by manual data extraction. In the case of multiple hospitalizations during the study period, only radiographic examinations obtained during the first hospital stay were considered. Vertebral fractures were determined by a validated semi-quantitative visual grading [23] based on numeric images with software allowing modification of brightness and contrast, as well as zooming. A semi-quantitative method was selected due to its high predictive value for osteoporosis [24] and good correlation with vertebral fracture morphometric determination [25], and also because radiographic examinations were performed as part of routine care, i.e., for any indication rather than under strict conditions suitable for precise morphometric analyses. Vertebrae from T4 to L2 for chest radiographs and from T11 to L5 for lumbar spine examination were classified into four categories: normal, grade 0 (SQ0); mild vertebral body deformity, grade 1 (SQ1, 20–25% reduction in height); moderate deformity, grade 2 (SQ2, 25–40% reduction in height); and severe deformity, grade 3 (SQ3, > 40% reduction in height). All vertebral deformities of grade 1 or more (loss of vertebral body height ≥ 20%) were considered as vertebral fractures. Radiographs showing one or more vertebral deformities were reviewed by a second independent investigator to confirm the diagnosis of vertebral fracture. Interrater reliability was considered very good with a coefficient kappa of 0.85.

Study design and outcomes

This was a prospective study with two sequential phases: phase 1 (outpatient care) and phase 2 (inpatient care).

Phase 1 (outpatient care)

Patients with vertebral fracture and without exclusion criteria were enrolled. The Charlson comorbidity index and the FRAX® scores were assessed. Patients were informed about their vertebral fracture and that their PCP would receive a consultation report from the bone disease service, as well as the hospital discharge letter, recommending additional investigations (serum calcium-phosphate biochemistry, dual-energy X-ray absorptiometry (DXA)) to be performed, in addition to the specific osteoporosis medication to be prescribed according to the best practice [26]. Patients did not receive any specific message either from the hospital or from the PCP to encourage adherence to osteoporosis treatment. At 3 and 6 months, a study nurse interviewed patients by telephone using a structured questionnaire to determine if a specific osteoporosis medication and/or calcium-vitamin D supplements had been prescribed. She also asked if serum calcium-phosphate biochemistry to rule out secondary osteoporosis had been performed as well as DXA. The questionnaire did not attempt to evaluate the reasons for not prescribing a specific osteoporosis medication. Recorded information included only whether outpatients and inpatients were still taking the prescribed medication and if not, why they had stopped or changed medication. A 6-month follow-up period was chosen to increase the likelihood that the patient might have an opportunity to visit the PCP as no time frame concerning a PCP visit following hospital stay was part of the recommendation.

Phase 2 (inpatient care)

By contrast to phase 1, the serum calcium-phosphate biochemistry and DXA when recommended, as well as the prescription of a specific osteoporosis medication and/or calcium-vitamin D supplements, were performed as often as possible during hospital stay. Results of the serum calcium-phosphate biochemistry and DXA were communicated to the PCP together with the specific osteoporosis medication and/or calcium-vitamin D supplements already prescribed or recommended. The same telephone call interview as for phase 1 patients was administered at 3 and 6 months.

Outcomes

The primary outcome was to compare in phases 1 and 2 the percentage of patients adherent to the recommended specific osteoporosis medication and/or calcium-vitamin D supplements. Secondary outcomes were the percentage of patients who had a serum calcium-phosphate biochemistry and DXA, as well as length of stay.

Statistical analysis

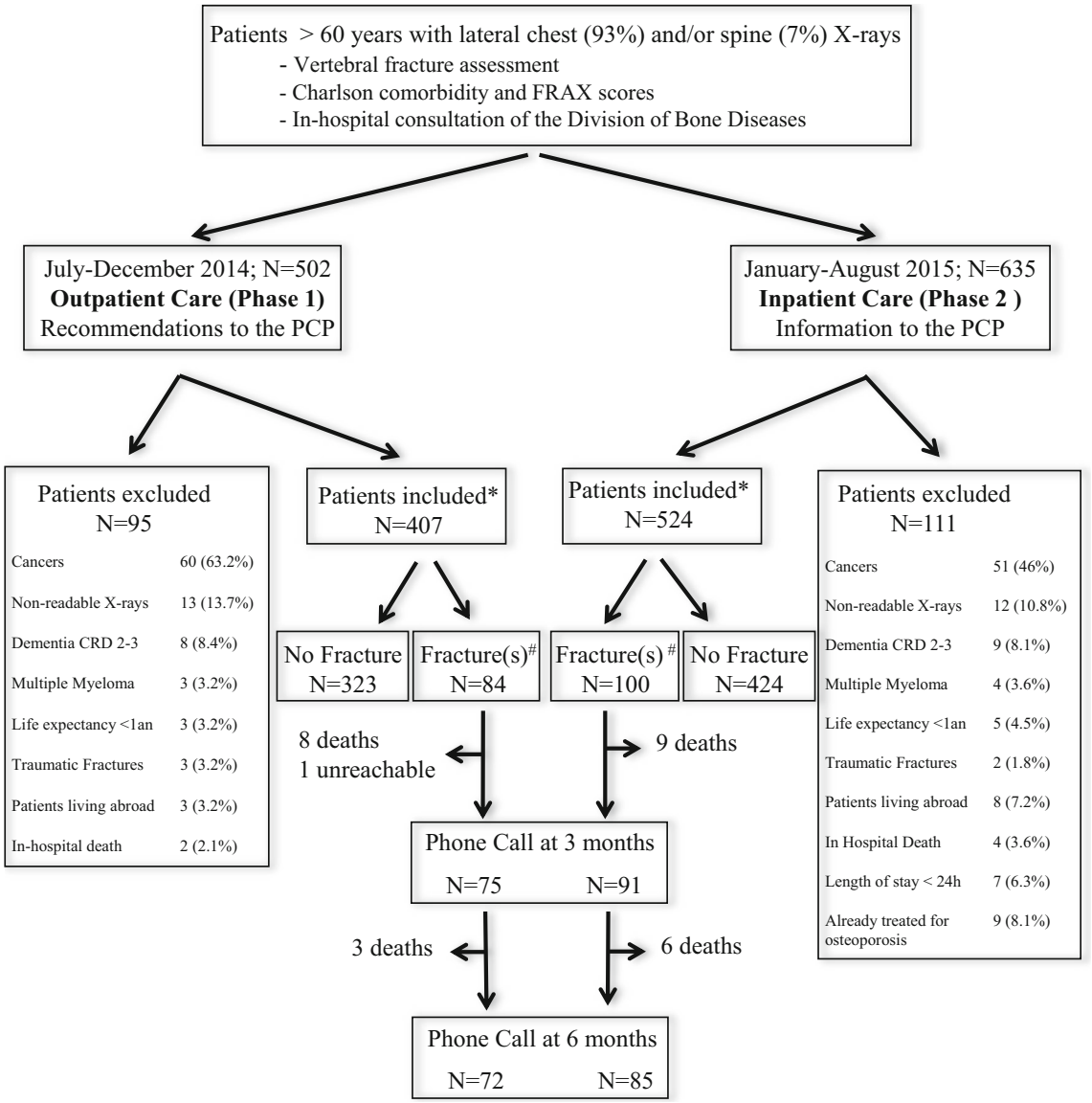
Characteristics of patients with vertebral fractures are presented as means ± standard deviation (SD). A chi-square test was used to compare the percentage differences between phases 1 (outpatient care) and 2 (inpatient care) of patients under specific osteoporosis medication and/or calcium-vitamin D supplements at 3 and 6 months, as well as the percentage of patients who underwent serum calcium-phosphate biochemistry and DXA. The power analysis was based on the hypothesis that inpatient as compared with outpatient care would be associated with a higher percentage of patients under specific osteoporosis medication at 3-month follow-up, but with the possibility of a longer length of stay. Therefore, we used a theoretical rate of 75% of patients at 3 months under specific osteoporosis medication with inpatient care and 50% for those with outpatient care, with an alpha of 0.05 and a beta error of 0.90. The total number of patients required for this study was 154 which means at least 77 patients for each of the two phases. A p value of less than 0.05 was chosen as the minimal significance level. Analyses were performed with STATA 14.0 software (Stata, College Station, TX.).

Results

From July 2014 to August 2015, 1137 patients aged > 60 years were admitted to the 120 beds of the general internal medicine service: 502 during phase 1 (outpatient care) and 635 during phase 2 (inpatient care) (Fig. 1). Based on exclusion criteria, 95 (18.9%) and 111 (17.5%) patients were excluded during phases 1 and 2, respectively, mainly due to active cancers. There was no difference in the prevalence of vertebral fractures among patients included in phases 1 (84/407 (20.6%)) and 2 (100/524 (19.1%)) (Fig. 1). Vertebral fractures were more frequent in the mid-thoracic and thoracolumbar junction as previously reported [3], and their distribution was not different in phases 1 and 2 (Supplementary Fig. 1). For excluded patients, the prevalence of vertebral fractures among readable radiographs was not different in phase 1 (53.8%) compared with that in phase 2 (57%). There was no difference in gender distribution, mean age, and Charlson comorbidity index scores between patients included and excluded in phases 1 and 2.

Characteristics of patients with vertebral fracture in phases 1 and 2

Characteristics of patients with vertebral fractures included in phases 1 and 2 were similar in terms of gender distribution, mean age, percentage with vertebral fractures of grade 1 or



*No significant age difference between included and excluded patients in phases 1 and 2
#No significant age difference between patients with and without fracture in phases 1 and 2

Fig. 1 Patient flowchart

grade ≥ 2, prevalence of prior fractures, FRAX® scores, and the Charlson comorbidity index (Table 1).

Evaluation at 3- and 6-month follow-up by telephone calls

Due to some deaths occurring during the 6-month follow-up, 75 and 72 among the 84 outpatient care patients and 91 and 85 among the 100 inpatient care patients were evaluated by a structured telephone interview administered by the same investigator at 3 and 6 months, respectively (Fig. 1).

Primary endpoint

Specific osteoporosis medication and calcium-vitamin D supplements

A specific osteoporosis medication was more often prescribed to inpatients compared with outpatients at 3 months (67% vs. 19%, respectively; $p < 0.001$) and 6 months (69% vs. 27%, respectively; $p < 0.001$) (Table 2, Fig. 2), although it was more often recommended to outpatients at both follow-up periods (Table 2). The distribution of recommendations for medications was not significantly different between phase 1

Table 1 Characteristics of patients with newly identified vertebral fracture

	Outpatient care (phase 1), $N = 84$	Inpatient care (phase 2), $N = 100$	p
Female (*N*/%)	38/45	46/46	n.s.
Age (years)	75.7 ± 7.7	77.8 ± 9.4	0.104
Female	77.4 ± 8.3	79.2 ± 10	0.381
Male	74.2 ± 6.9	76.5 ± 8.7	0.150
Vertebral fracture			
Patients with grade 1 (*N*/%)	37/44	38/38	n.s.
Patients with grade ≥ 2 (*N*/%)	47/56	62/62	n.s.
Nb of vertebral fractures			
Grade 1 (*N*/%)	68/46.9	72/42.9	
Grade 2 (*N*/%)	39/26.9	63/37.5	
Grade 3 (*N*/%)	38/26.2	33/19.6	
Prior fracture (s)*			
N/%	52/65	60/61	n.s.
≥ 1 low-trauma fractures[$] (*N*/%)	41/51	45/46	n.s.
FRAX (%)			
Major osteoporotic fracture	28.7 ± 14.3 ($N = 80$)	29.6 ± 13.6 ($N = 95$)	0.685
Hip fracture	13.7 ± 10.9 ($N = 80$)	16.0 ± 12.0 ($N = 95$)	0.194
Charlson comorbidity score	1.9 ± 1.7	1.6 ± 1.5	0.236
Length of stay (days)	13.6 ± 12.0	13.0 ± 8.5	0.741
Destination (*N*/%)			
Home	54/64	61/61	n.s.
Rehabilitation ward	29/35	39/39	n.s.
Nursing homes	1/1	0/0	n.s.

Values are means ± SD

n.s. not significant

*Among 80 (phase 1) and 94 (phase 2) patients with available information

[$] After 45 years of age

(outpatients) and phase 2 (inpatients): 41% vs. 52% for oral bisphosphonates, 34% vs. 37% for zoledronic acid, and 25% vs. 11% for denosumab. Among inpatients, a specific osteoporosis medication was initiated during their hospital stay in 74% and by their PCP in an additional 12% following discharge. Seven outpatients (two oral bisphosphonates, two zoledronic acid, and three denosumab) and six inpatients (two oral bisphosphonates, one zoledronic acid, and three denosumab) were already on osteoporosis medication prior to study enrolment. Specific osteoporosis medication could not be prescribed by the PCP in 8% of outpatients and 9% of inpatients as they did not visit their PCP within 6 months. All patients receiving osteoporosis medication were included in the group that had a biochemical examination, even in the outpatient procedure. Characteristics of patients who underwent a serum calcium-phosphate biochemistry, with or without treatment prescribed, or those having DXA, with or without specific osteoporosis prescription, were not different in terms of gender distribution, mean age, percentage of patients with vertebral fractures of grade 1 or grade ≥ 2, prevalence of prior fractures, FRAX scores, and the Charlson comorbidity index. As adherence to prescribed specific osteoporosis medication was not different between phases 1 and 2 at both 3- and 6-month follow-ups, the percentage of patients under specific osteoporosis medication was higher in inpatients compared with that in outpatients at 3 (52% vs. 19%, respectively; $p < 0.001$) and 6 months (54% vs. 22%, respectively; $p < 0.001$) (Table 2, Fig. 2). In a subanalysis among patients with vertebral fracture grade ≥ 2, a specific osteoporosis medication was more often prescribed to inpatients at 3 and 6 months. Thus, the percentage of patients under a specific osteoporosis medication was higher in inpatients compared with that in outpatients at 3 (52% vs. 28%, respectively; $p < 0.001$) and 6 months (52% vs. 29%, respectively; $p < 0.001$) (Table 2).

At 3 and 6 months, calcium-vitamin D supplements recommended to all patients of phases 1 and 2 were more often prescribed to inpatients compared with outpatients (Table 2). By contrast, adherence to prescribed calcium-vitamin D supplements was higher in outpatients at 3 months, but not at

Table 2 Osteoporosis medication—follow-up at 3 and 6 months

	3 months			6 months		
	Outpatient care (phase 1), $N = 75$	Inpatient care (phase 2), $N = 91$	p	Outpatient care (phase 1), $N = 72$	Inpatient care (phase 2), $N = 85$	p
Specific osteoporosis medication (bisphosphonates, denosumab, PTH), *n* (%)						
Recommended	67 (89)	64 (70)	< 0.01	64 (89)	61 (72)	< 0.01
Prescribed	13 (19)	43 (67)	< 0.001	17 (27)	42 (69)	< 0.001
Side effects	2 (15)	5 (14)	n.s.	3 (18)	6 (16)	n.s.
Adherence	13 (100)	33 (77)	n.s.	14 (82)	33 (79)	n.s.
Under specific medication	13 (19)	33 (52)	< 0.001	14 (22)	33 (54)	< 0.001
Calcium-vit D, *n* (%)						
Recommended	75 (100)	91 (100)	n.s.	72 (100)	85 (100)	n.s.
Prescribed	47 (63)	91 (100)	< 0.001	47 (65)	85 (100)	< 0.001
[$]Stopped or modified	2 (4)	24 (26)	< 0.01	9 (19)	25 (29)	n.s.
Adherence	45 (96)	67 (74)	< 0.01	38 (81)	60 (71)	n.s.
Under calcium-vit D	45 (60)	67 (74)	n.s.	38 (53)	60 (71)	< 0.05
Specific osteoporosis medication in patients with vertebral fractures grade ≥ 2.						
	$N = 39$	$N = 56$		$N = 37$	$N = 55$	
Recommended	36 (92)	46 (82)	n.s.	34 (87)	46 (84)	n.s.
Prescribed	10 (28)	29 (63)	< 0.01	12 (35)	29 (63)	< 0.05
Side effects	2 (20)	3 (10)	n.s.	2 (17)	3 (10)	n.s.
Adherence	10 (100)	24 (83)	n.s.	10 (83)	24 (83)	n.s.
Under specific medication	10 (28)	24 (52)	< 0.05	10 (29)	24 (52)	< 0.05

[$] By the patient and/or the primary care physician

n.s. not significant

6 months. Therefore, the percentage of patients under calcium-vitamin D supplements was not different between phases 1 and 2 at 3 months but higher at 6 months among inpatients (71% vs. 53%, respectively; $p < 0.05$) (Table 2).

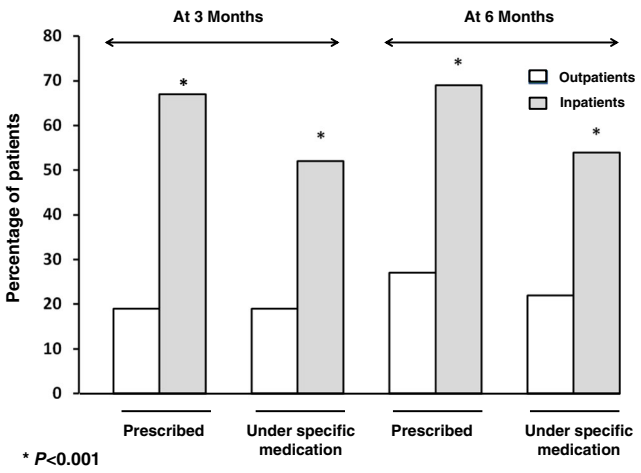


Fig. 2 Percentages of outpatients (white columns) and inpatients (gray columns) in whom a specific osteoporosis medication was prescribed and those still under specific medication at 3- and 6-month follow-up. *$p < 0.001$

Secondary endpoints

Serum calcium-phosphate biochemistry and DXA

Serum calcium-phosphate biochemistry recommended to 89% and 100%, respectively, of patients in phases 1 and 2 both at 3 and 6 months was more often performed in inpatients both at 3 (100% vs. 54%, respectively; $p < 0.001$) and 6 months (100% vs. 55%, respectively; $p < 0.001$) (Table 3). Similar results were observed in a sub-analysis among patients with vertebral fracture grade ≥ 2 (Supplementary Table 1). These differences were mainly due to the fact that the serum calcium-phosphate biochemistry was prescribed and performed during hospital stay in phase 2.

Despite no difference in the percentage of recommended DXA between phases 1 and 2 both at 3 and 6 months, the percentage of DXA performed was higher in inpatients compared with that in outpatients both at 3 (86% vs. 17%, respectively; $p < 0.001$) and 6 months (88% vs. 23%, respectively; $p < 0.001$) (Table 3). Similar results were observed among patients with vertebral fracture grade ≥ 2 (Supplementary Table 1).

Table 3 Serum calcium-phosphate biochemistry and DXA performed at 3 and 6 months

	3 months			6 months		
	Outpatient care (phase 1), $N = 75$	Inpatient care (phase 2), $N = 91$	p	Outpatient care (phase 1), $N = 72$	Inpatient care (phase 2), $N = 85$	p
Serum calcium-phosphate biochemistry, *n* (%)						
Recommended	67 (89)	91 (100)	n.s.	64 (89)	85 (100)	n.s.
Performed	36 (54)	91 (100)	< 0.001	35 (55)	85 (100)	< 0.001
Do not know	5 (8)	0 (0)	n.a.	4 (6)	0 (0)	n.a.
DXA, *n* (%)						
Recommended	64 (85)	80 (88)	n.s.	61 (85)	74 (87)	n.s.
Performed	11 (17)	69 (86)	< 0.001	14 (23)	65 (88)	< 0.001
Planned	7 (11)	0 (0)	n.a.	2 (3)	0 (0)	n.a.
Do not know	3 (5)	1 (1)	n.s.	2 (3)	1 (1)	n.s.

n.s. not significant, *n.a.* not applicable

Length of stay and destination at discharge

There was no difference in length of stay and the destination after hospital discharge between phases 1 and 2 (Table 1).

Discussion

To our knowledge, this prospective study is the first to demonstrate that the identification of vertebral fracture through a systematic search on available radiographic examinations, which led to a bone health assessment and an initiation of osteoporosis medication during hospital stay, greatly improved the rate of patients still under specific osteoporosis medication at 3 and 6 months compared with delayed outpatient management by PCPs. Asymptomatic morphometric vertebral fractures are most often not diagnosed as a routine procedure of the internal medicine ward, and therefore, PCPs were not used to receive recommendations for the management of these patients prior to this study. Therefore, this change in the routine procedure should have prompted PCPs' action although they did not. Serum calcium-phosphate biochemistry and BMD testing, which were also more often performed in inpatients, induced little additional burden on staff, and this inpatient care strategy was not associated with an increase of hospital length of stay. In our healthcare setting, this inpatient care strategy is associated with additional healthcare costs for the hospital, but with subsequent higher costs for the health insurance companies as a result of delayed outpatient management. Similar to other reports, we observed excellent intra-rater reliability for SQ scoring [27]. In addition, the prevalence of vertebral fractures and their distribution and grade over the individual vertebral levels were a good representative of previous observations in subjects > 60 years of age [3, 28]. Our results on osteoporosis treatment following a systematic search for vertebral fractures are in agreement with a report among patients with incidentally detected vertebral fractures, in whom a physician intervention increased osteoporosis treatment (17% vs. 2%), BMD testing (44% vs. 4%), and BMD testing or treatment (49% vs. 6%) at 3 months [29] compared with usual care. This pragmatic intervention directed at patients with incidentally detected vertebral fractures and their physician has been shown to be highly cost-effective at improving osteoporosis treatment and even cost-saving in most circumstances [30]. Similar results were obtained in a randomized controlled trial comparing usual care after hip fracture with the intervention of a case manager who educated patients, organized BMD testing, provided prescriptions, and communicated with the primary care physician [31]. Indeed, at 6 months, 51% of patients in the intervention group were receiving bisphosphonates compared with 22% in the control group, and BMD tests were performed in 80% in the intervention group compared with 29% in the control group. In another study aiming to prescribe osteoporosis medication to patients with fragility hip fracture before hospital discharge, 81% of patients received osteoporosis medication within 90 days of identification of the fracture in the intervention group compared with 32% prior to this intervention [32]. The efficacy and the cost-effectiveness of FLS in secondary fracture prevention have been mainly evaluated and confirmed in patients with symptomatic fracture [18–22]. An FLS approach was also applied in our study to patients with a newly detected vertebral fracture during a hospital stay for diseases unrelated to osteoporosis.

Initiation of therapy and type of treatment may vary according to the healthcare setting. Osteoporosis assessment and treatment initiation in outpatients represent an alternative to inpatient care that could potentially contribute to reduce length of stay and hospital healthcare costs, as well as to improve patient satisfaction. In our study, outpatient care with

delayed management of osteoporosis by PCP was not associated with a shorter hospital length of stay, but with a lower prevalence of patients under specific osteoporosis medication at 3 and 6 months. As previously reported, the transitional care, including discharge practices and patient understanding, may be involved in this lower percentage of outpatients in whom osteoporosis was assessed and/or treated [33, 34]. Deficits in communication and information transfer at hospital discharge are common with failure to schedule follow-up appointments and implement advance discharge planning, as well as a poor understanding of key aspects of post-discharge care, particularly among older adults [35]. Interventions to improve the quality of discharge communication through electronic summaries seem to improve timeliness and availability but not consistently quality in most [36], but not all studies [37]. These interventions have still to be tested in patients with a recent fracture deserving secondary prevention.

With usual care, the low percentage of patients under specific osteoporosis medication 6 months after a fragility fracture could be due in part to low awareness about osteoporosis. Indeed, in two reports, fewer than 20% of women recognized that osteoporosis caused their fracture, 52% were not aware that they were at risk of a future fracture, and 75% did not think or know that osteoporosis medication reduces the risk of fracture [17, 38]. Post-fracture osteoporosis management could be improved through a patient-centered care program with a dedicated case manager as recently reported in a randomized controlled trial [39]. A recent systematic review and meta-analysis reported that complex interventions can increase osteoporosis investigations and treatment [40].

According to our results, the hypothetical rates of 75% of inpatients and 50% of outpatients under specific osteoporosis medication at 3 months used in the power analysis were overestimated. Indeed, some patients who were eligible for pharmacotherapy during their hospital stay did not receive osteoporosis medication due to renal insufficiency and/or vitamin D deficiency. Furthermore, many patients were discharged from hospital without outpatient follow-up appointments. Our data highlight the need to facilitate outpatient fracture care through a coordinated effort with the rehabilitation wards and the PCPs. Indeed, management of patients with osteoporotic fractures by their PCP is poor, and systems aimed at improving the identification and treatment of these patients in this setting are required in order to close the osteoporosis care gap [41]. Our data suggest that an early intervention after the identification of the fragility fractures could be recommended in future patient care guidelines. The administration prior to hospital discharge of long-acting, injectable osteoporosis medication, preceded by vitamin D repletion when required, could reduce patient discomfort and allow 6 to 12 months for the outpatient providers to readdress this issue.

The study has some limitations. First, the single-center nature of the study limits its generalizability and our findings should be validated at other institutions. Second, as our study is not a randomized trial, we cannot exclude that a part of the difference observed in the osteoporosis management between outpatient and inpatient phases could be attributed to the design of our prospective study, even if inpatients and outpatients were similar for gender, mean age, prevalence of vertebral fractures of grade 1 or 2 and more, prevalence of prior fractures, FRAX® scores, and the Charlson comorbidity index. Third, osteoporosis medication was more often recommended among outpatients. This difference could be due in part to a lack of information on renal insufficiency and/or vitamin D deficiency in some outpatients, as well as to a different physician in charge of the recommendations during both phases. Nevertheless, this difference may only have contributed to some underestimation of the difference between inpatient and outpatient cares in the percentage of patients under specific osteoporosis medication at 6 months.

In conclusion, this prospective study highlights that early patient assessment and osteoporosis treatment initiation in a FLS during hospital stay is a more efficacious strategy for secondary fracture prevention in those with newly detected asymptomatic vertebral fragility fractures than delayed outpatient management, without any difference in length of stay.

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Compliance with ethical standards

Conflicts of interest None.

Ethical approval The study was conducted in accordance with the ethical standards of the institutional research committee and the 1964 Helsinki Declaration and its later amendments.

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