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Characteristics and outcomes of hospitalised patients with vertebral fragility fractures: a systematic review

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Abstract

Background: the complex management for patients presenting to hospital with vertebral fragility fractures provides justification for the development of specific services for them. A systematic review was undertaken to determine the incidence of hospital admission, patient characteristics and health outcomes of vertebral fragility fracture patients to inform the development of such a service.
Methods: non-randomised studies of vertebral fragility fracture in hospital were included. Searches were conducted using electronic databases and citation searching of the included papers.
Results: a total of 19 studies were included. The incidence of hospital admission varied from 2.8 to 19.3 per 10,000/year. The average patient age was 81 years, the majority having presented with a fall. A diagnosis of osteoporosis or previous fragility fracture was reported in around one-third of patients. Most patients (75% men and 78% women) had five or more co-pathologies. Most patients were managed non-operatively with a median hospital length of stay of 10 days. One-third of patients were started on osteoporosis treatment. Inpatient and 1-year mortality was between 0.9 and 3.5%, and 20 and 27%, respectively, between 34 and 50% were discharged from hospital to a care facility. Many patients were more dependent with activities of daily living on discharge compared to their pre-admission level. Older age and increasing comorbidities was associated with longer hospital stay and higher mortality.
Conclusion: these findings indicate that specific hospital services for patients with vertebral fragility fractures should take into consideration local hospitalisation rates for the condition, and should be multifaceted—providing access to diagnostic, therapeutic, surgical and rehabilitation interventions.

Keywords: *vertebral fragility fracture, hospital, osteoporosis, older people*

Introduction

In Europe, it is estimated that 3.5 million fragility fractures are sustained annually, 520,000 of them vertebral fragility fractures [1]. Patients presenting to hospital with vertebral fragility fractures have varying levels of pain and disability, for which there are an increasing number of interventions, both medical and surgical. The large number of such patients, their clinical complexity and the complexity of their management may provide justification for the development of specific services for them, as has been done with the orthogeriatric model of care for patients with hip fracture [2]. To develop such a service for vertebral fragility fractures, it is important to have an understanding of the number of patients in need of hospital admission, their clinical presentation, management and outcomes. A review of existing scientific literature would provide such information. Therefore, we conducted a review of the existing literature to determine the incidence of hospital admission for vertebral fragility fractures, their characteristics and health outcomes with the overall intention of informing the development of a specific service for vertebral fragility fracture management in hospital.

Methods

Eligibility criteria

The protocol (available on request from the authors) and reporting of this review was conducted in accordance with the PRISMA statement for systematic reviews [3]. All non-randomised studies (cohort, case-control and cross-sectional studies) of patients which reported either hospital admission incidence, patient characteristics or outcomes associated with hospitalisation for vertebral fragility fracture were eligible for inclusion. Eligibility criteria were if the majority of participants were ≥50 years, and if the fractures were either low-trauma or due to osteoporosis. Studies were excluded if they included participants with malignancy, clinical features of a high impact injury (i.e. burst fracture, unstable fracture and spinal cord impingement), cervical fractures, incidental vertebral fragility fracture and recruitment outside an inpatient setting.

Search strategy

The search was conducted using MEDLINE, EMBASE, CINAHL and AMED database from inception till November 2015. The search strategy focussed on the core search terms of 'vertebral fracture' and its focus of care which is in 'hospital' using the appropriate search terms, synonyms, and related terms. Citation searches were performed on the included papers and their reference lists were also scanned for relevant papers. The search strategy for MEDLINE is detailed in the supplementary data (Appendix 1).

Study selection

The screening of titles and abstracts were done independently by two reviewers (T.O. and P.K.). Full texts were obtained for those studies fulfilling the eligibility criteria or where there was uncertainty. Disagreements were resolved through discussion.

Data extraction

The variables of interest were specified prior to the search and comprised: hospital admission incidence; patient demographics; bone health; comorbid burden; frailty; cognition; mood, activities of daily living; clinical presentation to hospital; proportion of patients managed operatively; health outcomes (mortality, institutionalisation, hospital complications, changes in patient's health status) and resource utilisation (length of hospital stay, primary and secondary care attendance post-hospitalisation). Data were extracted by two reviewers (T.O. and P.K.) using a specified data extraction form.

Methodological quality

The Newcastle-Ottawa Scale (NOS) was used to assess quality of the included studies (Appendix 2 in Supplementary data). The scale was adapted to appraise the quality of cross-sectional studies. Cut-off scores were used to rate quality of the studies [4, 5]. No studies were excluded on the basis of their methodological quality.

Synthesis of results

A narrative synthesis was done under specific headings based on the framework by the Economic Social and Research Council [6]. The synthesis process was an iterative one of exploring relationships within and between the reported data to see how different studies contributed to the relevant headings. Where appropriate, findings from included studies were grouped together and reported using appropriate descriptive statistics. When results were pooled, studies were weighted according to their sample size.

Results

The search strategy identified 6,057 titles and abstracts. After excluding duplicates, 5983 titles and abstracts were screened. A total of 18 studies were identified from the search for inclusion and one paper was further identified through citation searching (Fig. 1). In total, 19 studies were included in the systematic review, of which seven studies were cross-sectional and twelve were cohort studies, originating from eleven countries (Table 1). Overall, 12 out of the 19 included studies were judged to be of moderate or good quality (Supplementary data Appendix 3).

Incidence of hospital admission with vertebral fracture

Seven studies reported the incidence of hospital admission with vertebral fragility fracture using large national hospital databases of Spain [8], America [9], Hungary [12], Italy [13], Sweden [17] and France [20]; and Medicare, an American national insurance programme dataset [10]. There was geographical variation in

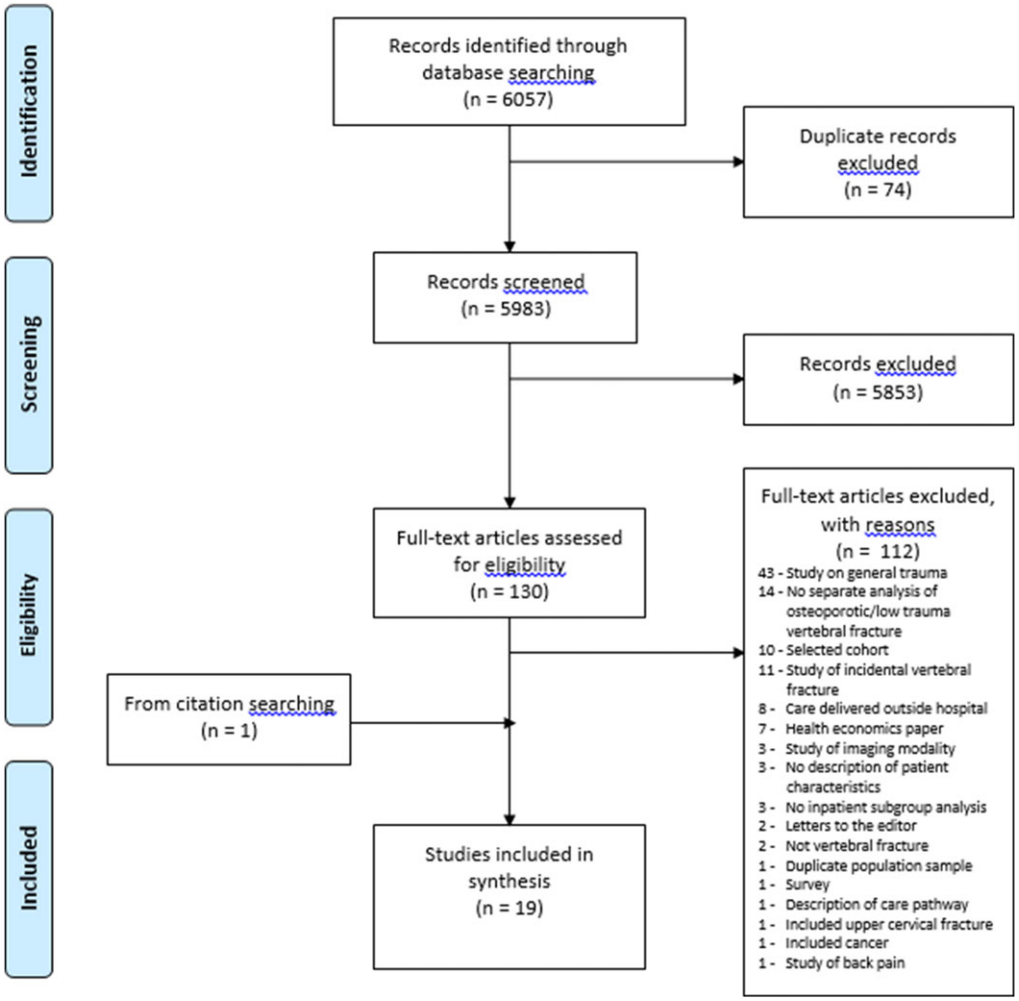

Figure 1. Flow diagram of study selection.

the overall incidence of hospital admission from 2.8 to 19.3 per 10,000/year (Table 2). The incidence rose with increasing age, peaking at 10–50 per 10,000/year in people older than 80. The incidence of hospitalisation for vertebral fragility fracture for men and women were relatively similar in the 50–60 years age group, but a higher incidence was reported in women older than 60, with at least a ratio of 2:1.

Patient demographics

In total, 10 studies [7–10, 13, 14, 17, 18, 20, 25] were considered fully representative of a hospitalised vertebral fragility fracture cohort using the NOS assessment of study quality. The pooled, weighted, proportion of women in these studies was 65% (range: 57–84%). Four of these studies [7, 8, 14, 25] reported patients' ages: the pooled weighted mean age was 81 years (range: 70–82). No other demographic details were reported in the included studies.

Bone health history

The prevalence of osteoporotic bone disease was reported in five studies. These studies, except one which was assessed as of poor quality [23], were of moderate quality [7, 8, 16, 22]. One study [8] reported data from a national registry and four used individual local hospital data [7, 16, 22, 23]. Gosch reported that 49% of those admitted to hospital with a vertebral fragility fractures had a known diagnosis of osteoporosis [16]. Bouza using the national Spanish registry reported that 35% of their study population had osteoporosis coded as part of the hospital admission [8]. Both Suseki and Takahara did not describe the prevalence of osteoporosis but reported that the average bone mineral density values in among their study participants was low enough to be considered osteoporotic [22, 23]. Gosch and Bloomfield further reported that 42 and 35% of those with vertebral fragility fractures had sustained a low trauma fracture previously [7, 16] (Table 3).

Comorbidities

Four studies used the Charlson comorbidity index to report comorbidities [8, 14, 16, 25] and two studies simply reported the number of comorbidities [9, 20]. The Charlson comorbidity index is a clinical scale of weighted

Table 1. Characteristics of included studies

Study	Country	Study description	VFF patients, *n*	Age, y	VFF diagnosis
Cross-sectional					
Bloomfield and Sing [7]	New Zealand	Analysis of discharge records of patients from a large district hospital over 12 months for prescription of secondary prevention for osteoporosis on discharge.	154	>65	Identified using hospital discharge summaries
Bouza *et al.* [8]	Spain	Using the 2002 National Hospital Discharge Register of patients admitted with vertebral fragility fracture and osteoporosis over 12 months to determine the burden of vertebral fragility fracture and its impact on healthcare services.	7,100	>30	ICD-9 (code 805, all subgroups)
Gehlbach *et al.* [9]	America	Describe characteristics of patients with vertebral fragility fracture identified using the 1997 Nationwide Inpatient Sample and their resource use compared with hip fractures.	68,901	≥45	ICD-9 (code 733.13, 805.2, 805.4 and 805.8)
Jacobsen *et al.* [10]	America	Incidence of vertebral fragility fracture hospitalisation over 4 years using the Medicare Provider Analysis and Review file.	14,091	≥65	ICD-9 (code 805.0, 805.2, 805.4, 805.8)
Papaioannou *et al.* [11]	Canada	Length of stay of patients in an acute hospital with vertebral fragility fractures identified from the Canadian Institute for Health Information Discharge Abstract Database over 12 months.	3,494	≥50	ICD-9 (code 805.2, 805.4, 733.13)
Pentek *et al.* [12]	Hungary	Hospital incidence of patients admitted with vertebral fragility fractures identified from the Hungarian National Health Insurance Fund Administration over 5 years.	8,195	≥50	ICD-10 (code S22.0, S22.1, S32.0, M48.5)
Piscitelli *et al.* [13]	Italy	National incidence of vertebral fragility fractures over 7 years based on the national hospitalisation database maintained by the Italian Ministry of Health to assess hip, vertebral, humerus, wrist/forearm fragility fracture incidence.	413,724	≥40	ICD-9 (code 805, all subgroups)
Cohort					
Chen *et al.* [14]	America	Compare outcomes of vertebral fragility fracture patients treated operatively (vertebroplasty or kyphoplasty) or non-operatively identified from the Medicare 2006 database. Data collected at baseline, discharge, 6 months, 1, 2 and 3 years.	68,752	≥65	ICD-9 (code 733.13, 805.2, 805.4)
Flug *et al.* [15]	America	Outcome of patients admitted with vertebral fragility fractures and treated operatively (vertebroplasty or kyphoplasty) over 30 months compared with those not operated. Data collected at admission and at 30 days post-discharge.	248	Not stated	ICD-9 (code 733.13, 805.2, 805.4)
Gosch *et al.* [16]	Austria	Describe outcome of patients admitted to an orthogeriatric unit with a non-hip fracture (vertebral fragility fractures, humerus, wrist, thoracic, pelvis, lower extremity and other fractures). Data collected on admission and at 1 year follow up.	55	≥70	Not stated
Johnell *et al.* [17]	Sweden	Patients identified from the Swedish Patient Register over 8 years for with either a thoracic or lumbar high- or low-energy fracture and followed up to assess risk of subsequent fracture.	17,425	≥50	ICD-9 (no codes available)
Lee and Yip [18]	Hong Kong	Describe characteristics and outcomes of patients admitted with low back pain and vertebral fragility fractures over a 6-year period. Data collected from admission, at discharge, and at the end of the study period for readmission outcomes.	497	≥65	Plain lateral radiographs of thoracic and lumbar spine with collapse of the anterior and posterior borders at >15% of its normal height
Levy *et al.* [19]	America	Evaluate outcomes in vertebral fragility fracture patients treated operatively and non-operatively over 10 years.	250	Not stated	ICD-9 (cod 805.2, 805.4)
Maravic *et al.* [20]	France	Study of hospital burden and outcomes of patients treated with vertebroplasty or non-operatively admitted into French hospitals with vertebral fragility fractures identified from the 2009 French Hospital National Database. Data collected from admission till 1 year after hospitalisation.	13,624	≥60	ICD-10 (code M48.4, M48.5, M80.-8, M81.-8, S22.0, S22.1, S32.0, S32.7, T08)
Nolla *et al.* [21]	Spain	Describe the patient characteristics presenting to a rheumatology unit with vertebral fragility fracture related back pain over 10 years. Patients followed up till the end of the study period.	120	>30	Radiological evidence of at least 20% reduction in vertebra height taken to indicate a fracture

Continued

Table 1. Continued

Study	Country	Study description	VFF patients, *n*	Age, y	VFF diagnosis
Suseki *et al.* [22]	Japan	Identify risk factors for poor clinical outcomes for vertebral fragility fracture patients admitted with back pain to hospital. Data collected on admission and at discharge from hospital.	159	Not stated	Lateral plain radiographs and T1 weighted sagittal MRI
Takahara *et al.* [23]	Japan	Describe radiographic and clinical features of vertebral fragility fracture patients admitted to hospital with back. Data collected from admission till discharge from hospital.	78	≥50	Spinal x-ray assessed using the Genant semi-quantitative criteria and MRI/bone scan. Pain persisted for >1 week
Theander *et al.* [24]	Sweden	Compare changes in ADL and QoL over 1 year in patients admitted to hospital with a painful hip or vertebral fragility fracture. Follow up interviews conducted 1 week, 4 and 12 months after the index fracture.	42	≥60	Not stated
Zampini *et al.* [25]	America	Compare clinical outcomes and healthcare cost of kyphoplasty compared to those not operated in patients admitted with vertebral fragility fracture using the Nationwide Inpatient Sample.	5,766	≥65	ICD-9 (code 805.2, 805.4)

ADL, activities of daily living; QoL, quality of life; VFF, vertebral fragility fracture.

comorbidities, where higher scores indicate a higher mortality risk, but is not a comprehensive list of all possible comorbidities [26]. Two studies reporting the Charlson comorbidity index were rated as good quality [14, 25] and two [8, 16] were of moderate quality. Between 77 and 95% of those admitted with vertebral fragility fractures had a low Charlson comorbidity index score, between 0 and 2 [8, 14, 25].

Studies reporting the number of comorbidities indicated higher levels of comorbidity: Gehlbach reported that all patients had at least one co-pathology, and that 75% of men and 78% of women had more than five comorbidities [9]. Maravic reported that 53% had at least one existing ICD-10 coded medical condition:[20] this was the only study that reported on the prevalence of dementia in hospitalised vertebral fragility fractures, which was 8% [20] (Table 3).

Hospital presentation and management

Between 59 and 78% of patients admitted to hospital with vertebral fragility fracture were triggered by a preceding fall or trauma [16, 22, 23].

Plain x-ray imaging was the initial radiology investigation of choice [18, 21–23]. However, each study used a different radiological x-ray definition for vertebral fractures. Two studies reported that magnetic resonance imaging of the spine showed signal changes, even though almost half of those with a fracture had no deformity detected on x-ray done at clinical presentation [22, 23].

The majority of vertebral fragility fractures in hospital were managed non-operatively which centred on bed rest, adequate analgesia, mobilise as pain allowed and osteoporosis management [18, 22–24]. Only two studies reported on the number of patients initiated osteoporosis treatment at 33 and 30%, respectively [7, 19].

Four cohort studies reported on patients that had surgical vertebral augmentation (percutaneous vertebroplasty or balloon kyphoplasty) as part of their treatment in hospital [14, 15, 20, 25]. Three of the studies [14, 20, 25] utilised data obtained from national registries and one study from a local hospital dataset [15]. Between 7 and 11% of patients with vertebral fragility fractures proceeded to vertebroplasty [14, 20]; and between 15 and 33% proceeded to balloon kyphoplasty [14, 25]. Three of these cohort studies described a younger group of patients that were managed operatively [14, 20, 25], and two of them reported that they also had fewer comorbidities [14, 20] although but this association was not demonstrated in another study [25].

Health outcomes

Overall hospital mortality ranged from 0.9 to 3.5% [8, 14, 20, 25]. Among the variables analysed, increasing age [8, 14, 20], male gender [8, 14], and increasing comorbidities [8, 14, 20] was associated with higher mortality. No other variables associated with hospital mortality were

Table 2. Incidence of vertebral fragility fractures admitted to hospital

Study	Country origin	Data source	Age inclusion, y	Overall incidence of hospital admission per 10,000/year
Bouza *et al.* [8]	Spain	National Hospital Discharge Register 2002	≥30	2.8
Pentek *et al.* [12]	Hungary	Hungarian National Health Insurance Fund Administration 1999–2003	≥50	4.8
Maravic *et al.* [20]	France	French Hospital National Database 2009	≥60	9.3
Jacobsen *et al.* [10]	America	Medicare Provider Analysis and Review 1986–1989	≥65	9.4
Johnell *et al.* [17]	Sweden	National Swedish register, the patient register of the National Board of Health and Welfare, from 1987 to 1994	≥50	9.7
Gehlbach *et al.* [9]	America	Nationwide Inpatient Sample 1997, part of the Healthcare Cost and Utilisation Project sponsored by the Agency for Healthcare Research and Quality	≥45	16
Piscitelli *et al.* [13]	Italy	National hospitalisation database maintained by the Italian Ministry of Health 2002–2008	≥40	19.3

described. One year mortality was reported between 20.0 and 26.9% [14, 16, 19]. Increasing age and comorbid burden were also associated with lower 1 year survival [14, 19].

Three studies assessed as good on the NOS reported on the discharge destination of patients after their hospital admission [9, 14, 25]. Overall, between 34 and 50% were transferred to either an institutional care facility or skilled nursing facility; between 24 and 38% were discharged to their usual residence without any formal support; and 11–15% went home with formal support [9, 14, 25]. The studies did not report long term care home rates. None of the studies reported any predictors of discharge destination.

Only two cohort studies reported data on hospital-related complication [14, 25]. Pneumonia was the most prevalent complication at 3% [14, 25]. The prevalence of pressure ulcers was 1%; and hospital acquired infection was 0.1% [14, 25]. Prevalence of deep vein thrombosis (DVT) varied from 0.2 [25] to 2.7% [14]. The reason for this difference is unclear as neither study described its DVT diagnostic criteria or presence of any local venous thromboembolic prevention and management.

Three different studies reported new disability and pain symptoms after hospital admission [16, 23, 24]. Theander *et al.* [24] reported that among patients that were independent with personal and extended activities of daily living on admission, only 31% at 4 months and none at 12 months was still completely independent post-hospital admission. No patients returned to their pre-admission state. This study did have a cohort with a high prevalence of multiple fractures (average number of vertebral deformities per patient was 5) and was assessed using the NOS to be of poor quality [24]. Gosch *et al.* [16] reported that the mean (SD) Barthel index at 1 year post-fracture was 69/100(32), a score the authors felt to indicate significant dependency for assistance with activities of daily living. However, there was no baseline score to compare with. At 12 months post-admission, there was a reduction in mobility as measured using the Parker Mobility Scale by 24% [16]. Suseki *et al.* [22] reported that up to 35% of their cohort had new back related disability (where pain is either more intense, longer in duration, or higher patient-reported pain score; with new limitation of activity not present before back pain) (Table 3).

Healthcare resource utilisation

In total, 13 studies described the length of stay of patients with vertebral fragility fractures in hospital [8, 9, 11, 14–16, 18, 20–25]. These data were drawn from a combination of large national databases to findings from single site studies. The median length of stay was 9.8 (IQR = 5.6–12.5; range: 5–41.7) days. Longer length of stay was associated with increasing comorbidities [8, 9, 20]. Other variables such as age [21], gender [8, 21, 22], increasing number of fractures [21], history of trauma [23] and signal change on MRI of the spine [23] was not associated with duration of inpatient stay (Table 3).

Discussion

There was wide geographical variation in the incidence of patients hospitalised due to vertebral fragility fractures. These patients were mostly older women, between the ages of 70 and 85 years, one-third of whom had a previous diagnosis of osteoporosis or a previous fragility fracture. Three-quarter of patients presented following a low trauma injury. Most patients were managed non-operatively; and there was wide variability in the proportion who had either percutaneous vertebroplasty or balloon kyphoplasty. Bone health assessment and prescription of medication for osteoporosis occurred in only a third. Patients stayed an average 10 days in hospital. Although hospital mortality from vertebral fragility fracture was low (0.9–3.5%), there were longer term consequences post-fracture: up to half of patients were discharged from hospital into a care facility; a considerable proportion of patients (depending upon the way this was measured in different studies) were more dependent for their activities of daily living after discharge. Age and comorbidities were associated with worse outcomes, such as hospital length of stay and mortality.

Although this review used a systematic search process, some of the findings were limited by the small number of studies contributing to each aspect of patient characteristics and outcomes. Of the 19 studies included, only five studies were considered high quality and we have drawn our key findings and conclusions from the most reliable studies. For

Table 3. Main findings of included studies

	Known osteoporosis	Previous fracture	Comorbidities	Mortality	Discharge destination	Disability post-hospitalisation	Mean length of stay, days
Bloomfield *et al.* [7]		35.1%					
Bouza *et al.* [8]	35.2%		CCI score: ≤2 95.1%; ≥3 4.9%	3.5%			11.4
Gehlbach *et al.* [9]			≥5 diagnoses in 75.1% men, 78.4% women		Institutional care: 42.0% men, 52.3% women Usual residence with support: 11.6% men, 13.1% women Usual residence with no support: 46.4% men, 34.6% women		5.8
Papaioannou *et al.* [11]							10.1
Chen *et al.* [14]			CCI score: ≤2 77.0%; ≥3 23.0%	1.7% 1 year mortality: 26.9%	Institutional care: 32.7% Usual residence with support: 14.8% Usual residence with no support: 37.9%		7.4
Flug *et al.* [15]							8.1
Gosch *et al.* [16]	49.1%	41.8%	Mean (SD) 2.3 (1.6)	1 year mortality: 20%		BI at 12 months post-hospitalisation was mean (SD) 68.7(31.6); reduction in PMS by 24%	9.0
Lee and Yip [18]							5.0
Levy [19]				1 year mortality: 25.2%			
.Maravic *et al. et al.* [20]			53% had at least one medical condition	0.9%			9.6
Nolla *et al.* [21]							15.9
Suseki *et al.* [22]	Study mean BMD considered diagnostic of osteoporosis					35% had new back related disability	41.7
Takahara *et al.* [23]	Study mean BMD considered diagnostic of osteoporosis						22.6
Theander *et al.* [24]						Independent with personal and extended ADL: 30.5% at 4 months; 0% at 12 months	Median, 10
Zampini *et al.* [25]			CCI score: ≤2 86.0%; ≥3 14.0%	2.5%	Institutional care: 33.5% Usual residence with support: 11.3% Usual residence with no support: 21%		5.3

BI, Barthel index; PMS, Parker mobility scale; BMD, bone mineral density; ADL, activities of daily living; CCI, Charlson comorbidity index.

example, the finding that there was wide variation in the incidence of hospitalisation for vertebral fragility fracture was evidenced by large national database studies and is likely to be genuine. We appreciate that the results we reviewed do not take account of incidental vertebral fractures encountered in patients admitted for other conditions. The findings we present about the demographic features of patients are based on robust, representative studies, but the data in them were limited. We note that we found little or no information about levels of frailty, mood, cognition or quality of life. The wide scope of this review requires limits on what is found by the search and selection process, which may lead to the omission of some relevant studies. We aimed to examine and mitigate against this by hand searching the reference lists of selected papers; we identified only one of our 19 papers this way.

To the best of our knowledge, there have been no previous reviews that have reported the characteristics and outcomes specifically for patients admitted to hospital with vertebral fragility fractures. We have identified that patients with vertebral fragility fractures admitted to hospital are on average in their 80s and have a traumatic event preceding their hospital admission, making them slightly different from those who are not admitted, who more commonly sustain 'atraumatic' fractures [27]. Studies using the Charlson Comorbidity Index showed low levels of comorbidity, but this index is a prognostic score rather than a comprehensive list. Studies listing the total number of comorbidities showed comorbidity to be common—three quarter of patients had five or more comorbidities. This is important because healthcare outcomes such as mortality, length of stay and discharge to a care facility are associated with increasing comorbidities. Therefore, services taking into account of comorbidities in many, but not all, patients could potentially influence their outcomes. Such a specialised service for vertebral fragility fractures admitted to hospital could deliver similar benefits as those in the management of hip fractures where levels of comorbidity are also high [28].

Thus, this review provides a unique summary of the evidence base upon which plans for a specific service for vertebral fragility fractures admitted to hospital can be based. The review indicates considerable geographical variation in admission rates, which could reflect both the geographical incidence of vertebral fragility fractures (and hence the prevalence of osteoporosis and the falls rate) and the proportion of these patients that are admitted to hospital. Those setting up services for patients with vertebral fragility fractures may need to acquire local data in order to scope an appropriately sized service. The review also indicates that such a service will need to have second-line diagnostic capabilities, given that half of patients will have no changes on plain X-rays. The review also shows that such a service has the potential to improve bone health and prevent future fractures through routine diagnosis and management of osteoporosis. A service would need to have a consistent approach to ensure that all who might benefit from surgery have access to it. Furthermore, the review demonstrates that a vertebral fragility fractures service would need to identify those with co-pathologies in order to mitigate their effects upon length of stay and subsequent outcomes. It is likely that a service making use of Comprehensive Geriatric Assessment, either as an in-patient or elsewhere, would be required for this group. Given that most people will have presented with a fall, all patients should be given access to services and interventions that reduce the risk of further falls such as strength and balance training.

The review also illustrates gaps in the research knowledge that are suitable for future research. Relatively little is known about the effect that frailty and cognitive impairment has upon the management and outcome of vertebral fragility fractures. Similarly, little is known about exactly why there is increased disability in many patients at outcome and hence how this might be reduced. Whilst this review did not study the effectiveness of intervention or services for vertebral fragility fractures, future research will need to be developed for this group of patients.

Key points

- Older people and those with multiple comorbidities admitted to hospital with a vertebral fragility fracture are at higher mortality risk and discharge to a care facility.
- This review highlights that there is still a gap in evidence of how patient and fracture characteristics of those hospitalised affect their short and longer term outcomes.
- Further understanding of the natural history of this cohort will help inform the development of a specialist service, such as an orthogeriatric model for patients admitted to hospital with a vertebral fragility fractures.

Supplementary data

Supplementary data are available at *Age and Ageing* online.

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Conflict of interest

None declared.

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