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ORIGINAL ARTICLE

Spanish National Hip Fracture Registry (RNFC): analysis of its first annual report and international comparison with other established registries

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Abstract

Summary Hip fracture registries have helped improve quality of care and reduce variability, and several audits exist worldwide. The results of the Spanish National Hip Fracture Registry are presented and compared with 13 other national registries, highlighting similarities and differences to define areas of improvement, particularly surgical delay and early mobilization.

Introduction Hip fracture audits have been useful for monitoring current practice and defining areas in need of improvement. Most established registries are from Northern Europe. We present the results from the first annual report of the Spanish Hip Fracture Registry (RNFC) and compare them with other publically available audit reports.

Method Comparison of the results from Spain with the most recent reports from another ten established hip fracture registries highlights the differences in audit characteristics, casemix, management, and outcomes.

Results Of the patients treated in 54 hospitals, 7.208 were included in the registry between January and October 2017. Compared with other registries, the RNFC included patients ≥ 75 years old; in general, they were older, more likely to be female, had a worse prefracture ambulation status, and were more likely to have extracapsular fractures. A larger proportion was treated with intramedullary nails than in other countries, and spinal anesthesia was most commonly used. With a mean of 75.7 h, Spain had by far the longest surgical delay, and the lowest proportion of patients mobilized on the first postoperative day (58.5%). Consequently, development of pressure ulcers was high, but length of stay, mortality, and discharge to home remained in the range of other audits.

Conclusions National hip fracture registries have proved effective in changing clinical practice and our understanding of patients with this condition. Such registries tend to be based on an internationally recognized common dataset which would make comparisons between national registries possible, but variations such as age inclusion criteria and follow-up are becoming evident across the world. This variation should be avoided if we are to maximize the comparability of registry results and help different countries learn from each other's practice. The results reported in the Spanish RNFC, compared with those of other countries, highlight the differences between countries and detect areas of improvement, particularly surgical delay and early mobilization.

Keywords Audit · Hip fracture · Hip fracture registry · International comparison

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Introduction

Among all types of osteoporotic fracture, hip fractures have the highest impact on health care services in terms of financial cost and disability [1]. Nearly all hip fractures are diagnosed acutely, hospitalized, and managed surgically, making them easier to register than other osteoporotic fractures. There are an estimated 1.6 million hip fractures annually worldwide [2], with over 610.000 hip fractures a year in Europe [3]. An estimated 45.000 hip fractures occur every year among people over 65 years of age in Spain [4].

Hip fracture management integrates surgical care, medical care, and rehabilitation treatment, serving as a good indicator of integrative care provided by health care services [5]. Furthermore, there is a relatively strong evidence basis on quality indicators for aspects of care in all phases of management, many of which have been implemented by health management authorities in an effort to improve cost-effectiveness and quality of care [6].

National hip fracture audit programs have been instrumental in monitoring current practices, defining points of improvement and quantifying the effects of implemented measures, and have been shown to improve outcomes, including mortality [7, 8]. The first national audit, Rikshöft, started recording data 30 years ago, in 1988 [9]; in the 1990s, the EU-funded Standardization of Hip Fracture in Europe (SAHFE) project [10] led to the establishment of national audits over the following decade. The Fragility Fracture Network (FFN) followed up developing a minimum common dataset (MCD) that has been used in an international pilot phase including five centers in four European countries. However, most established registries are limited to northern Europe and Anglo-Saxon countries, with a lack of data from Southern Europe and most other continents.

Spain has been offering integrated orthogeriatric care in several institutions for several decades [11–13], and local clinicians have led several local and regional audits [14–17]. In spite of these efforts, Spain is among the countries faring worst in surgical delay for hip fractures, showing a clear need for improvement [18]. Under the guidance of the FFN, this group of clinicians launched the Spanish Hip Fracture Registry (Registro Nacional de Fracturas de Cadera or RNFC) in 2016, and started collecting data in 2017 [19].

The goal of this paper is to describe the results of the RNFC achieved in its first annual report, and to compare these results with other established audits worldwide, as well as to define the areas at greatest need for improvement in Spain.

Material and methods

Spanish Hip Fracture Registry (RNFC)

The Spanish National Health Care System is a universally accessible, public health care system funded indirectly through taxes. Each of the 17 Autonomous Regions provide for health care through their own institutions, coordinated by the Spanish Ministry of Health, Consumer Affairs, and Social Welfare. A total of 505 hospitals are registered in the Ministry, of which 225 are public-owned general hospitals (i.e., not pediatric, psychiatric) [19].

Initiated by interested clinicians throughout Spain, the Spanish Hip Fracture Registry (RNFC) is a multicenter, observational, prospective audit including the variables proposed in the FFN MCD endorsed by over 20 regional and national scientific societies, as well as the FFN. It includes all patients 75 years or older admitted for hip fractures in any of the participating centers, which consent their inclusion, followed up for 30 days [20]. The pilot phase started in January 2017 with 10 hospitals, increasing to over 60 hospitals at the current moment (List of participating investigators of the Spanish RNFC, Supplementary Material). Of all patients treated in the participating centers, 96.5% consented inclusion in the registry. Non-consenting patients were of similar age and gender as included patients. Registry members of the included hospitals participate and include data on a voluntary basis, following approval by local institutional review boards. The registry is registered in the Spanish Data Protection Agency (Agencia Española de Protección de Datos (AEPD)). Donations from industry sponsorship (see Acknowledgements) have allowed for the Registry to hire a statistician and administrative personnel, and funding obtained from public research grants offered by private foundations (see Acknowledgements) ensure the continuity of the Registry for the near future. The Annual Report for 2017 is freely available in Spanish on the websites of the Spanish Society for Geriatrics and Gerontology (SEGG) and the Spanish Society for Bone Research and Mineral Metabolism (SEIOMM) [21], and an English translation is planned.

Other established national audits

We performed a PubMed and Embase search using the keywords “hip fracture” AND “national” AND (“registry” OR “database” OR “audit”), including all papers in any language up to October 2018, revealing a total of 709 articles. The abstracts of the articles were reviewed for the mention of a national hip fracture registry. We discarded 567 papers that studied registries for diseases other than hip fractures, retrospectively based their data on hospital discharge records or

administrative claims databases, comprised prospective population cohorts, or were registries that included single centers or a limited geographic region. The other 142 articles were studied in full text, and referred to the 13 registries analyzed. We performed an Internet search to find the most recent report or publication of the registries studied, including those presented in European languages other than English, to present the data included in the report. When incomplete, we used the data from the paper by Johansen et al. [22]. Information regarding the individual registries compared for this study is summarized in Table 1. In the USA, other national databases, though not specific to hip fracture patients, have also been the

Table 1 History and characteristics of national hip fracture registries included in the study

Country: name of registry/abbreviation	Years active	Comment
Sweden: Rikshöft [9]	1988–current	- Online form since 2005 - No written consent required. The patient can refuse registration
Scotland: Scottish Hip Fracture Audit (SHFA) [23]	1993–2008 2009–2015 (internal monitoring by boards) 2016–current	- Coordinated by the Scottish Government Directorate of Heath
Denmark: Dansk Tværfagligt Register for Hoftenære Lårbensbrud (DTRHL) [24]	2003–current	- Reporting is mandatory, via registration in the National Patient Register
Finland: PERFormance, Effectiveness and Cost of Treatment Episodes (PERFECT) project [25]	2004–current	- Under direction of the Department of Health and Welfare - Tracks the care processes of myocardial infarction, stroke, and hip fractures - Uses a web interface instead of annual reports, including data since 2001.
Norway: Nasjonalt Hoftebruddregister (NHR) [26]	2005–current	- Established as part of the Norwegian Arthroplasty Register, initiated in 1987 by the Norwegian Orthopedic Association. - Approved as national medical quality register in 2009
England: Wales and Northern Ireland: National Hip Fracture Database (NHFD) [27]	2007–current	- Joint initiative of the British Geriatrics Society (BGS) and the British Orthopedic Association (BOA) - National clinical audit project commissioned by the Healthcare Quality Improvement Partnership (HQIP) - Managed by the Royal College of Physicians (RCP).
USA: Kaiser Permanente Hip Fracture Registry [28]	2009–current	- Kaiser Permanente is the largest managed care organization in the USA (including over 11 million health plan members). - Established as part of the insurer's National Implant Registries, which tracks implants in patients who are insured by Kaiser Permanente.
Ireland: Irish Hip Fracture Database (IFHD) [29]	2012–current	- Joint venture of the Irish Gerontological Society and the Irish Institute for Trauma and Orthopedic Surgery - In partnership with the Health Service Executive (HSE), under governance of the National Office of Clinical Audit (NOCA)
Australia/New Zealand: Australian and New Zealand National Hip Fracture Registry (ANZHFR) [30]	2016–current	- Collaborative project between the Australian and New Zealand Society for Geriatric Medicine (ANZSGM), the Australian Orthopedic Association (AOA), and the New Zealand Orthopedic Association (NZOA) - Funded though several public and private grants
Germany: Alterstraumaregister (ATR-DGU) [31]	2016–current	- Coordinated by the German Society for Trauma Surgery (Deutsche Gesellschaft für Unfallchirurgie (DGU)) - Includes proximal femoral fractures: most of the cases included are hip fractures; also, some periprosthetic fractures end peri-implant fractures. - Participation is a requirement for centers to be accredited for geriatric trauma. - Includes several Swiss hospitals.
Netherlands: Dutch National Hip Fracture Audit (DHFA) [32]	2016–current	- Coordinated through the Dutch Institute for Clinical Auditing (DICA), which includes 22 medical registries of several disciplines. - 2017 was the first full year reported
Italy: Gruppo Italiano di Ortogeriatria (GIOG) [33]	2016–current	- The Gruppo Italiano di Ortogeriatria is an inter-society study group established in 2012 - Web-based audit

source for studies regarding hip fracture patients, such as the Nationwide Inpatient Sample (NIS) including retrospective data from patients admitted using the ICD-9 codes for diagnosis and comorbidities, or the prospectively collected National Surgical Quality Improvement Program (NSQIP) by the American College of Surgeons [34]. However, they are not specific to hip fractures, but rather record data for patients undergoing major surgical procedures of any kind.

We found other registries from Asia such as the National Orthopedic Registry of Malaysia (NORM) [35] and the Middle East [36]; their continuity is however questionable, as we have not found any reports from these registries less than 5 years old.

Comparisons

For comparison with the Spanish RNFC, we confined our report to data publicly available in the registries studied. We did not have the necessary data to allow for cross-dataset statistical comparisons due to information governance issues.

Data of all demographic, casemix, care, and outcome variables were cross-tabulated following the FFN MCD, including the results presented in the most recent annual reports. Where data from the most recent year was unavailable, we supplemented the data from previous reports.

Results

Audit characteristics and casemix (Table 2)

Between January and October 2017, the RNFC collected data from 7.208 patients from 54 hospitals. The mean age of the patients included was 86.7 (SD 5.58; range 75–108) years, and nearly 8% of patients were 95 years old or older. Females comprised 75.4% of the patients. Regarding fracture type, 51.9% were intertrochanteric.

Comparison of the 13 registries reveals clear differences in inclusion criteria, which have an influence over some results: while the registries of Sweden, Scotland, Australia, and New Zealand include patients aged 50 years and older, and others all patients, such as Norway, Holland, and Kaiser Permanente, the Spanish audit only includes patients 75 years and older.

Consequently, the mean age reported in the Spanish audit (nearly 87 years) is much greater than any other audit analyzed (range of mean ages: 80 to 85 years). The proportion of female patients is also greater than that reported in the other registries, except Italy.

Prefracture ambulatory status was worse for patients included in the Spanish audit than in other registries. However, prefracture residence in a nursing home (24%) was not very different from other audits, which ranged from 17 to 24%, and the percentage diagnosed with cognitive dysfunction (36%) was in line with the rates reported by other registries (17 to 39%), as was also the percentage of patients classified as American Society of Anesthesiologists (ASA) grade 3 or 4 (71%, compared to 58–91%).

Fracture characteristics, surgical, and anesthetic management (Table 3)

Forty percent of the fractures included were intracapsular, the lowest proportion of any of the registries studied (range for the other registries: 43 to 58%). The overall proportion of non-displaced vs. displaced cervical fractures and of subtrochanteric fractures was however similar to other registries.

Sixty percent of all hip fractures were managed with intramedullary nails, in contrast to 10 to 50% for the other audits; this proportion was mainly in lieu of sliding hip screws (1% for Spain vs. 13 to 34% for the other registries except Germany—with 3%—and Italy—with 6%). Total hip arthroplasties accounted for 3% of surgeries, a proportion on the lower end of the range reported for the other countries (3 to 10%).

A large majority of surgeries were performed under spinal anesthesia (93%), as occurred in Sweden and Norway. In the United Kingdom, approximately half of the surgeries are performed under general anesthesia, which was the preferred type of anesthesia in Australia and New Zealand as well as Germany.

Surgical delay was much greater in Spain (mean, 75.7 [63.6] h; median, 62.6 [28.8–96.3] h) practically doubling the delay of any other country analyzed (mean, 26 to 39 h), except the other Mediterranean audit included, Italy (54 h). Only 40% had been operated on in less than 48 h, less than half the percentage reported in most other registries (range, 75–95%).

Ward management, process, and outcomes (Table 4)

Spain had the highest percentage of geriatrician or other clinician involvement during acute hospitalization (94%) of any of the registries studied (50–91%). However, the proportion of patients mobilized on the first postoperative day (58.5%) ranked lowest of all countries studied (69–89% for the other registries), and the incidence of newly diagnosed pressure ulcers (6.7%) was higher than any other audit (2–5%).

Median length of stay in acute hospitalization (9.4 days, interquartile range 6–20 days; mean, 11 [SD 6.7] days) was in the range of those reported by other audits (7.3 to 12 days), with the exception of Kaiser Permanente, which reported a mean length of stay of less than 5 days.

The percentage of patients receiving bone protective medication—defined as antiresorptive or bone-forming treatment—at discharge and at follow-up ranks among the highest of the countries analyzed, second to the NHFD and Ireland.

In spite of the greater age of the Spanish patients, 37% were discharged to home, second only to the 52% reported by the

Table 2 Characteristics and casemix of the analyzed audits

	Spain (RNFC) [21]	Sweden (Rikshöft) [9]	Scotland (SHFA) [23]	Denmark (DTRHL) [24]	Finland (PERFECT) [25]	Norway (NHR) [26]	England, Wales, Northern Ireland (NHFD) [27]	USA (Kaiser Permanente) [28]	Ireland (IHFD) [29]	Australia (ANZHFR) [30]	New Zealand (ANZHFR) [30]	Germany (ATR-DGU) [31]	Holland (DHFR) [32]	Italy (GIOG) [33]
Audit characteristics														
Year established	2017	1988	1993	2003	2004	2005	2007	2009	2012	2016	2016	2016	2016	2016
Age included (years)	≥ 75	≥ 50	≥ 50	≥ 65	≥ 50	All ages	≥ 60	All ages	≥ 60	≥ 50	≥ 50	≥ 70	All ages	≥ 65
Duration of follow-up (days)	30	120	30	30/2 years	30/90/180	120	120	Unspecified	30	120	120	120	90	30/120
Publication date (month/year)	06/2018	10/2018	08/2018	05/2017	2017	06/2018	11/2018	2018	11/2018	08/2018	08/2018	11/2018	2018	07/2018
Cases included	7.208	13.272	6.669	6.679	4.458	8.321	65.958	44.221	3.497	7.117	2.291	6.137 [b]	10.794	2.557
Hospitals included	54	48	19	25	24	48	175	50	16	41	15	~60	56	14
Casemix														
Gender (female, %)	75	66	73	69	–	69	(72)	69	71	69	70	72	67	76.3
Age (years) (mean, [median])	86.6 [87] 95+: 7.9%	82	[82]	82 [83] 85+: 44%	–	80	(83)	80 (men) 85 (women)	{79 (men)} {81 (women)}	84 90+: 25%	84 90+: 25%	84.5 [85]	[82]	85 ± 7
Place of residence (%)														
Own home	75	71	75	75	–	–	{81}	–	82	71	72	74	60	91
Nursing care	24	24	18	18	–	–	{19}	–	10	17	17	23	19	–
Hospital	0.4	3	6	(1)	–	–	4 (in-hospital)	–	8	–	–	1	–	–
Walking ability (%)				CAS score										
Independent, unaided	37	70	{50}		–	–	{37}	–	54	45	46	–	38	–
Independent, technical aids	46		{39}		–	–		–	36	51	51	–	31	–
Supervision	12	15	{10}		–	–		–	8			–	6	–
Unable to walk	5	3	{1.4}		–	–	{1.3}	–	2	3	2.3	–	2	–
Able to walk outdoors before fracture (%)	56	63	–	–	–	–	–	–	73			–		–
Prefracture cognitive dysfunction (%)[a]	36[a]	30	26	–	–	26	–	–	32[a]	39	39	–	17	50[a]
ASA grade				Charlson										
ASA grade 1–2 (%)	29	39	(26)	comor-bidity	–	34	–	–	41	9	11	23	42	34
ASA grade 3–4 (%)	71	61	(68)	index	–	65	–	–	59	91	89	75	58	66

Note. Where data was not available in the most recent publically available report, it was obtained from the paper by Johansen et al. [31]—shown in parentheses ()—or from the audit of the year immediately prior—shown in brackets {}

ASA American Society of Anesthesiologists, CAS Cumulative Ambulation Score

[a] Normal cognition defined by Abbreviated Mental Test (AMT) score > 6/10 in IHFD and > 7/10 in NHFD. Pfeiffer's Short Portable Mental Status Questionnaire (SPMSQ) was used in the RNFC (cognitive dysfunction defined as > 3/10 errors) and in Italy (cognitive dysfunction defined as ≥ 5/10 errors)

[b] Three-hundred-fifteen cases (5.1%) of proximal femoral fractures included were periprosthetic or peri-implant fractures

NHFD. This rank was maintained at 30-day follow-up (47% living in own home), even though 24% were unable to walk without the help of others 1 month after the fracture.

Orthopedic 30-day readmission and reoperation rates (2.7 and 2.1%, respectively) were in line with those stated in other reports. The same was true for in-hospital and 30-day mortality (4.4 and 7.6%, respectively), even though the patients in the Spanish audit were much older on average than other audits, which had similar mortality rates (4 to 6.7% in-hospital, and 5 to 11% at 1-month follow-up).

Discussion

We have summarized the data of the first annual report of the Spanish Hip Fracture Registry (RNFC), and compared them to 12 other established registries throughout the world. While Johansen et al. recently summarized the differences in casemix, management, and outcomes for eight audits [22], this study presents updated data and includes several new registries not included in their study, particularly the Spanish RNFC. This is one of only two national registries originating from a country in the Mediterranean area, and its data is therefore very interesting for comparison, as it highlights differences in hip fracture management and areas in need of improvement.

Both Mediterranean registries (the Spanish RNFC and the Italian GIOS registry) reported the highest mean ages. However, comorbidity, as defined by the ASA score, prefracture cognitive dysfunction, and mortality were similar to other national audits.

The proportion of extracapsular hip fractures, more common among older patients, was however higher than in other registries, as can be expected in an older and more female patient cohort [37, 38]. Several differences in surgical and anesthetic management stood out: the proportion of fractures stabilized using intramedullary nails was the highest of all the registries, justified only in part by the higher proportion of extracapsular fractures. The preference for intramedullary implants may be due to practice differences among countries, as occurs also with the choice of anesthesia. A large, international, multicenter, randomized controlled trial comparing general and regional anesthesia for hip fractures is underway and will hopefully provide some answers to this question [39, 40].

Surgical delay has been shown to increase complications and mortality. Spain had, by far, the highest surgical delay of all the registries studied. This aspect is common to the Mediterranean region, as shown in a recent Organization for Economic Cooperation and Development (OECD) report, in which Italy, Spain, and Portugal occupied three of the five last places of the OECD, with only 52.8, 48.4, and 46.5% of patients operated on in 2 days or less [18]. This difference is likely to be due to organizational aspects, and warrants further study. The lack of available surgical theaters accounted for approximately half of

Table 3 Fracture characteristics, surgical, and anesthetic practice among the analyzed audits

	Spain (RNFC) [21]	Sweden (Rikshöft) [9]	Scotland (SHFA) [23]	Denmark (DTRHL) [24]	Finland (PERFECT) [25]	Norway (NHR) [26]	England, Wales, Northern Ireland (NHFD) [27]	USA (Kaiser Permanente) [28]	Ireland (IHFD) [29]	Australia (ANZHFR) [30]	New Zealand (ANZHFR) [30]	Germany (ATR-DGU) [31]	Holland (DHFR) [32]	Italy (GIOG) [33]
Fracture characteristics, surgical, and anesthetic practice														
Fracture type (%)														
Cervical, nondisplaced	11	17	(17)		–	12	{9.4}	–	11	15	26	13	15	15
Cervical, displaced	29	37	(36)	55[a]	–	41	{49.2}	–	41	30	30	33	32	15
Intertrochanteric	52	42	(38)	38	–	35	{34.8}	–	36	47	35	49	33	39
Subtrochanteric	7	5	(4)	7	–	6	{5.9}	–	6	8	9	5	2	8
Operation type														
Nonsurgical (%)	2.4	1		Internal	–		2.2	–	5	4	2		2	
Cannulated screws (%)	2	15	2	fixation: 65	–	14	{3}	–	2	(4)	(13)	2	6	6
Sliding hip screw (%)	1	20	34	Arthroplasty: 35	–	21	{32}	–	21	(19)	(22)	3	13	6
Intramedullary nail (%)	60	27	10		–	20	{12}	–	24	(36)	(30)	50	39	46
Hemiarthroplasty (%)	34	25	48		–	40	{43}	–	47	(33)	(26)	34	35	30
Total arthroplasty (%)	3	10	6		–	5	{8}	–	4	(8)	(9)	6	5	10
Cemented arthroplasty (%)	–	(97)	91	–	–	86	89	–	73	(81)	(95)	–	–	–
Anesthesia type														
Spinal anesthesia (%)	93	(95)	[51]	–	–	84	44.2	–	75	27	31	7	51	–
General anesthesia (%)	7	(5)	[49]	–	–	12	50.6	–	21	73	69	92	34	–
Preoperative regional nerve block (%)	–	–	48	–	–	–	–	–	30	66	36	–	–	–
Surgical delay (hours)														
Mean	75.7	25.5	–	–	–	–	33	–	{48.1}	36.8	39.3	25.5	–	54
Median	62.6	20.3	–	–	–	–	{24.1}	21.5	30	30	30	18	24	–
Surgeries in less than														
< 24 h (%)	18.1	68	53	69	–	53	–	–	38	–	–	69	–	–
< 36 h (%)	26.1		70	85	–	–	70.2	–	55	–	–	82	–	–
< 48 h (%)	40.3	94	86	–	94.9	83	–	90	72	77	80	89	–	–

Note. Where data was not available in the most recent publically available report or web page, it was obtained from the paper by Johansen et al. [22]—shown in parentheses ()—or from the audit of the year immediately prior—shown in brackets {}

[a] The Danish Hip Fracture registry includes intracapsular hip fractures as a single group, without separating displaced and undisplaced fractures

Table 4 Ward management, process, and outcomes of hip fractures in the audits analyzed

	Spain (RNFC) [21]	Sweden (Rikshöft) [9]	Scotland (SHFA) [23]	Denmark (DTRHL) [24]	Finland (PERFECT) [25]	Norway (NHR) [26]	England, Wales, Northern Ireland (NHFD) [27]	USA (Kaiser Permanente) [28]	Ireland (IHFD) [29]	Australia (ANZHFR) [30]	New Zealand (ANZHFR) [30]	Germany (ATR-DGU) [31]	Holland (DHFR) [32]	Italy (GIOG) [33]
Ward management, process and outcomes														
Evaluated by geriatrician/-clinician (%)	94	–	78	–		–	91.2	.	50	92	80	85	77	–
Mobilized on first postoperative day (%)	58.5	–	69	69		–	78.8	–	77	89	87	77	–	–
Developed pressure ulcers (%)	6.7	–	–	–		–	4	–	3	2.0	3.6	5	–	3.5
Length of stay (days) (mean or [median])	11 [9.4]	8.4	11	(8)	7.4	–	15.6 [12]	4.8	20 [13]	9.2 [7.7]	8.2 [7.3]	16.9 [16]	–	11
Bone-protection medication														
Prefracture (%)	5	–	–	–	–	–	{8.2}	–	15	9	8	3.9	10	14
At discharge (%)	37	–	–	50	–	–	{49.7}	–	51	24	25	10	19 [a]	30
At follow-up (%)	41	–	–	–	–	–	{34.2}	–		38	30			–
Destination at discharge (%)														
Own home	37	–	31	–	–	–	{52}	–	22	13	14	22	22	11
Nursing care	32	–	15	–	–	–	{12}	–	20	23	17	26	22	10
Rehabilitation facility	25	–	44	–	–	–	{17}	–	45	51	59	44	33	75
Living status at follow-up (%)														
Own home	47	–	–	–	(70.4) [b]	–	67.5	–	–	–	–	39	–	–
Nursing care	35	–	–	–	(11) [b]	–	{25}	–	–	–	–	20	–	–
Rehabilitation facility	15	–	–	–	–	–	{4}	–	–	–	–	–	–	–
Walking ability at follow-up				CAS score			{10} (without aids)		CAS score					
Independent, outdoors (%)	24	39	–		–	–	{9}	–		–	–	74	–	–
Independent, indoors (%)	59	64	–		–	–		–		–	–	18	–	–
Not able to walk (%)	24	10	–		–	–		–		–	–	2	–	–
30-day readmission														
All-cause (%)	–	–	–	17	11.2	–	–	–	–	–	–	–	–	–
Orthopedic (%)	2.7	–	–	2-year FU	–	–	–	–	–	–	–	5	–	–

Table 4 (continued)

	Spain (RNFC) [21]	Sweden (Rikshöft) [9]	Scotland (SHFA) [23]	Denmark (DTRHL) [24]	Finland (PERFECT) [25]	Norway (NHR) [26]	England, Wales, Northern Ireland (NHFD) [27]	USA (Kaiser Permanente) [28]	Ireland (IHFD) [29]	Australia (ANZHFR) [30]	New Zealand (ANZHFR) [30]	Germany (ATR-DGU) [31]	Holland (DHFR) [32]	Italy (GIOG) [33]
Reoperation at follow-up (%)	2.1 (30-day)	–	–	–	–	–	{3.1} (120-day)	3.6 (unspecified)	1	1.7 (30-day) 2.3 (120-day)	2 (30-day) 2.3 (120-day)	4 (120-day)	– –	– –
Mortality														
In-hospital (%)	4.4	–	5		–	–	–	–	5	4.5	4	5	–	–
30-day (%)	7.6	–	7.1	10	6.5	–	6.9	11	–	6	5	–	–	–

Note. Where data was not available in the most recent publically available report, it was obtained from the paper by Johansen et al. [22]—shown in parentheses ()—or from the audit of the year immediately prior—shown in brackets {}

CAS Cumulative Ambulation Score

[a] Newly diagnosed with osteoporosis at discharge

[b] 2011–2013 data, 120-day follow-up

delayed cases in a local audit [12], as occurs in other national audits such as the NHFD [27] and the Scottish Hip Fracture Audit [23]. The deleterious effect of surgical delay is further compounded by the reduced proportion of patients mobilized on the first postoperative day compared to other registries, and the combination of these two elements may account for the increased amount of pressure ulcers observed in our audit. We believe that improvement of these three aspects should be given the highest priority.

Although surgical delay was higher, which accounted for approximately one third of acute hospitalization, and despite the fact that patients were mobilized later than in other countries, median length of stay was similar to other registries, suggesting that patients in Spain receive less days of physiotherapy than in other countries. In spite of this, 37% of patients are discharged to their own home, compared to 14 to 21% reported from the other countries excluding the United Kingdom (31% for Scotland and 52% for the NHFD). Organizational aspects such as availability of rehabilitation facilities and cultural aspects such as family involvement may play a role in this difference, and a facility audit is planned to compare the situation in Spain to that in other countries. Orthogeriatric collaboration could account for Spanish patients presenting similar mortality and readmission rates, in spite of being older and having a worse prefracture ambulatory status, and in spite of increased surgical delay compared to other countries. Our registry has the highest proportion of patients evaluated by geriatricians or other clinicians. The voluntary nature of the registry relies on the data introduced by specialists interested in hip fracture audit. Early adopters of the registry, mainly geriatricians and internal medicine specialists, could have an added interest in this hip fracture care, which could explain the nature of this confounding factor.

We believe that we must highlight several positive aspects of our study. Firstly, it is one of only two national registries originating from a country in Southern Europe. Life expectancy at 65 years of age in Spain is among the highest of the entire OECD [18], and cultural and organizational differences make comparisons to Northern Europe particularly interesting. Though the capture of the total amount of hip fractures is relatively low (approximately 7.200 of an estimated 40.200 hip fracture cases in patients aged 75 years or older nationally [4]), the wide geographical distribution, with inclusion of nearly one quarter of public general hospitals nationwide, and the large sample size makes the results representative. Comparison of the common casemix and management variables included in the RNFC with the Minimum Basic Dataset (Conjunto Mínimo de Base de Datos (CMBD)) of the Spanish Ministry of Health is underway. Finally, the variables included in the RNFC are based in the FFN Minimum Common Dataset (MCD), allowing for easy comparison of our national data with other registries worldwide; integration into large, international databases would then be simple, given the common base provided by the FFN MCD.

This report has several limitations. First, participation in the Spanish RNFC is voluntary and on initiative by the treating physicians, also responsible for data collection; the age cutoff for clinician involvement in hip fracture care is usually 75 years of age, accounting for this inclusion criterion, as geriatricians and internal medicine specialists comprised the main nucleus initiating this registry. This may account for some of the observed differences. Expansion of the registry to include all fragility hip fractures would be desirable. Voluntary participation also implies an interest in fragility fractures, so some results such as prescription of bone-protective medication could be more favorable than for non-participating hospitals. This is a similar issue in all registries that are non-compulsory and coordinated by scientific societies, as occurs in Germany and Australia and New Zealand. Furthermore, Spanish patients have to provide informed consent for inclusion in the registry. Non-consenting patients were of similar age and gender as included patients. Second, for comparison of registries, we only had access to publicly available data, so statistical comparison of our registry data with other countries was not possible for this study. The registries compared also had different inclusion criteria, follow-up, and variables. Although most audits collect the variables suggested by the SAHFE project and the FFN Minimum Common Dataset, data is lacking for many registries, particularly regarding postoperative function and living status. Some registries, such as the Kaiser Permanente and Norwegian hip fracture registry, are incorporated into larger administrative databases analyzing joint implants; these largely lack clinical follow-up. The data collected for function also varies between registries: while some collect the ability to walk assisted or unassisted indoors or outdoors, others use scores such as the cumulative ambulation score. Function and living status are more difficult to collect than discrete data such as reoperation rates or mortality, but it can be argued that they are just as or even more relevant for the patient, particularly in the midterm. As such, it is important to agree on common parameters for these variables, in order to allow for comparison between registries. Finally, duration of follow-up is different between registries, making direct comparison of follow-up results difficult.

In conclusion, we have reported data from the first annual report of the RNFC, and compared it to the results presented in another 12 registries from three continents. This has allowed us to find similarities between our audit and those of other countries, as well as to highlight the differences and to define areas for improvement, particularly surgical delay and early mobilization.

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Compliance with ethical standards

Conflicts of interest The following authors have no conflicts of interest to declare: Currie CT[5], Alarcón T[2,8], Gómez-Campelo P[2,11], Gil-Garay E[2,8], Larrainzar-Garijo R[15], Navarro-Castellanos L[2], Otero-Puime A[2,21].

The following authors declare:

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Díez-Pérez A[18] is advisor of has received speaker honoraria from AMGEN, UCB, Lilly, Gilead, Roche, and EchoLight and owns stocks from Active Life Sci; none of them related with the present work.

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