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Osteoporotic hip fracture costs in the elderly Turkish population

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Objective: This study was designed to determine the length of hospital stay and treatment costs of patients with osteoporotic hip fractures in Turkey.

Methods: A total of 1,118 osteoporotic hip fractures taken from patient records in 35 hospitals connected to a Disease Related Group (DRG) network were included in the study. Inclusion criteria were patients over the age of fifty with a diagnosis of a single, low-energy fracture located at the neck, head, or intertrochanteric region of the femur treated with total/hemi-arthroplasty, screw or nail methods. We examined the demographics, location of fracture, treatment type, length of hospital stay (LOS), direct cost and cost extrapolation based on the numbers of hospitals, beds and patient by hospital.

Results: Of the 1,118 patients (mean age: 75.3±9.9 years), 62.8% were female. The main fracture type was of the femur neck without precise localization. The average LOS was 11.0±7.9 days. The total weighed cost of all 1,118 hip fractures was $2,249,885 per year, indicating an average direct medical cost of $3,119 per patient in the 35 DRG hospitals. Based on this sample, the estimated total number of patients is 15,602 by number of hospitals; 8,521 by number of hospital beds and 9,365 by number of hospitalization, costing $31,530 million; $14,793 million and $18,948 million, respectively.

Conclusion: Diverse results in cost estimations of osteoporotic hip fractures reflect the incoherence of data as well as a lack of standardization of health care services. Therefore, ICD and DRG coding needs to be improved and a national database must be created at least for the invoices of importation of prostheses to fully be able to calculate the burden of osteoporosis across Turkey.

Key words: Elderly; direct cost; health economics; hip fractures; length of hospital stay; osteoporosis.

Fragility fracture is the dominant complication of osteoporosis in both genders in terms of morbidity and medical costs, presenting a major challenge for health professionals.[1-3]

Osteoporosis is considered by the World Health Organization (WHO) to be second only to cardiovascular diseases as the most critical health condition.[1,4] Its burden on the health care system was not studied in depth until the increase in the number of fractures brought about by the ageing population in recent decades.[4-6] The International Osteoporosis Foundation (IOF) estimated that worldwide 18% of

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women and 6% of men experience hip fractures and 33% of women and 11% of men aged over 80 experience a hip fracture due to osteoporosis.[1] Accordingly, the annual number of hip fractures will increase to 2.6-3.9 million by the year 2025 and to 4.5-6.3 million by 2050.[2,6-8]

The population of Turkey is estimated to reach 83.6 million by 2025. As of 2008, 18.7% of the population was over 50 year of age. The projected number of hip fractures in the year 2025 range between 26,000 and 39,000. In a recent household survey in Turkey, 6,816 inhabitants of a suburb of Istanbul were screened using BMD/radiographic absorptiometry. Osteoporosis was reported in 7.8% of persons over 40 years.[9]

The direct and indirect costs of osteoporosis in the US in 1998 were estimated at $21.9 billion (≅$80 per capita/year).[10] Since fractures resulting from osteoporosis also incur costs beyond the acute phase, the burden of osteoporosis is suggested to be much higher. Similarly in Sweden, in the year 2007, the total burden of osteoporosis was estimated to be MSEK 15,183, roughly 4.3 fold of acute fracture costs and 2.69 fold of total annual fracture costs.[5] It

Table 1. Type and capacity of the DRG hospitals and overall eligible hospitals, percent distribution of DRG diagnosis and the patient demographics.

	Number of hospital	Number of beds	Annual number of patients	Mean LOS
DRG hospitals				
Total	35	19,540	899,871	11.02
State general	16	7,091	342,966	11.52
State teaching	7	4,096	207,960	11.41
State special branch	2	641	22,257	11.84
Private	4	503	42,129	6.10
University	6	7,209	284,559	9.49
Overall eligible hospitals				
Total	572	142,708	7,804,027	
General public	322	62,410	3,183,088	
Teaching public	33	31,581	1,895,211	
Private	160	16,578	1,339,279	
University	57	32,139	1,386,449	
Mean	143	35,677	1,951,007	

Percent distribution of DRG diagnosis

	Hip replacement		Other hip and femur processes		Neck of femur fractures		Total
	n	%	n	%	n	%	n
Total	544	48.7	189	16.9	385	34.4	1,118
State	334	50.5	106	16.0	221	33.4	661
Teaching	110	50.2	48	21.9	61	27.9	219
Private	13	61.9	5	23.8	3	14.3	21
University	87	40.1	30	13.8	100	46.1	217

Patient demographics

		Gender[a]				Age (years)[b]	
	Total	Male		Female		Mean	SD
	n	n	%	n	%		
Total	1,118	417		701		75.3	9.9
General	616	228	37.0	388	63.0	75.7	9.1
Teaching	219	89	40.6	130	59.4	76.7	10.0
Special branch	45	15	33.3	30	66.7	70.9	9.7
Private	21	1	4.8	20	95.2	77.2	13.1
University	217	84	38.7	133	61.3	73.6	11.0

Pearson Chi-Square; [a]F=11.060, df=4, p=0.026; [b]F=5.349, df=4, p<0.001

is estimated that the cost of osteoporotic fractures in the US will reach $200 billion by the year 2040 and will rise by 56% of the current estimates by 2050.[5,11]

Identification of the burden osteoporosis places on healthcare in each country will provide a basis for subsequent studies assessing the efficiency of screening and prevention strategies.[4,12]

To our knowledge, no studies exist concerning the costs of hip fractures in the elderly Turkish population and no data are available on the frequency and cost of hip fractures in the records of the Social Security Institution or the Ministry of Health. Therefore, the present study was designed to determine osteoporotic hip fracture location by gender and age, and their impact on both the length of hospital stay and cost of treatment in the elderly Turkish population.

The aim of our study was to determine if the direct cost related to osteoporotic hip fractures can provide a basis to calculate part of the financial burden of osteoporosis in a given country.

Patients and methods

The present study included 1,118 osteoporotic hip fracture patients discharged between January 1 to December 31, 2008 from 35 hospitals of various types (e.g. university, state teaching, state general, special branch, and private) connected to a DRG network created by a specialized group of experts in August 2007. Hospital characteristics are given in Table 1. Patients who were coded as S72.0 according to ICD-10 classification and discharged from the hospital in 2008 were selected from the electronic DRG data base.

Selection criteria (Fig. 1) were patients over the age of fifty with a diagnosis of a single, low-energy fracture located at the neck, intertrochanteric region or head of femur and treated with total/hemi-arthroplasty, screw or nail methods.

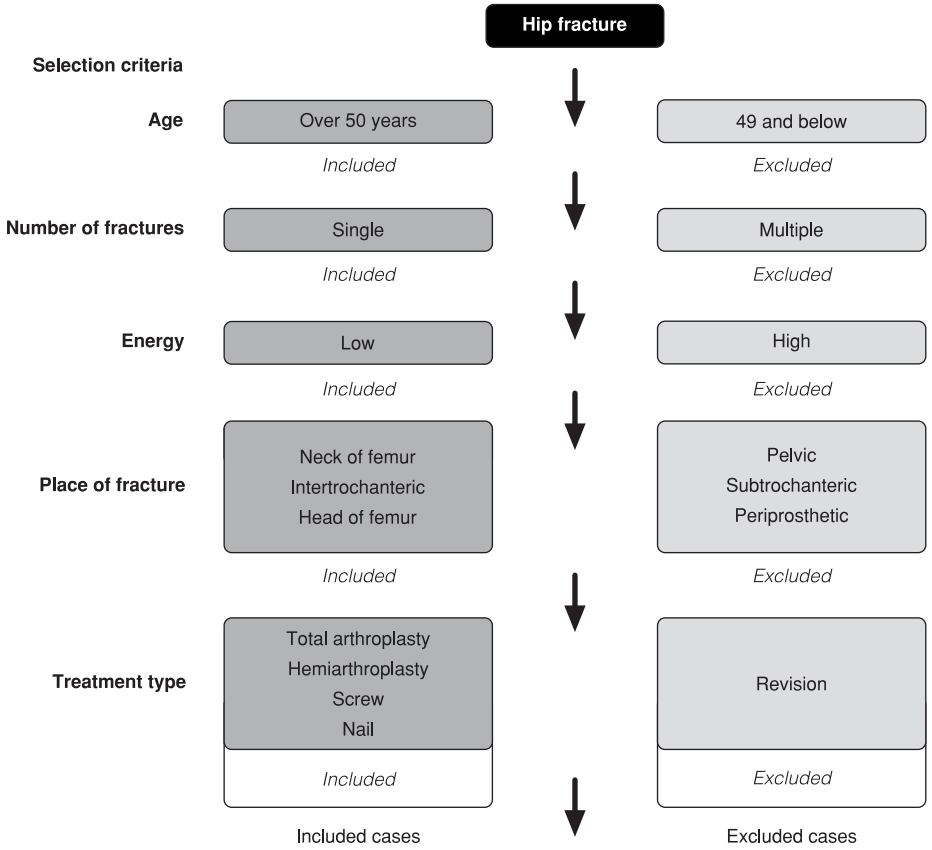

Fig. 1. Osteoporosis screening grid among hip fractures patients.

A total of 10,657 hospitalizations of 1,761 patients (average of 6 visits per patient) with a main diagnosis of hip fracture were found under code ICD-10. The number of eligible patients fell to 1,376 (78.1%) after application of the age criterion, to 1,173 (66.6%) using DRG definitions and finally to 1,118 (63.4%) using ICD-10 definitions. The remaining 1,118 patients were included as "osteoporotic hip fractures" in our study.

Three independent factors were used for extrapolation; the number of hospitals, the number of beds, and the number of patients by type of hospital. The hospitals were grouped in four categories; general public, teaching public, private, and university hospitals. The Ministry of Health database from 2008 was used to determine hospitals' capacity to provide treatment for hip fractures. Selected were 322 general hospitals out of the 849 public hospitals, 160 of the 371 private hospitals, and all 57 university and 33 public teaching hospitals (Table 1).

Distribution of patients according to hospital type was then made: general hospitals had 661 hip fracture patients, teaching hospitals 219, private hospitals 21, and university hospitals 217 (Table 2). Next, the percent distribution of different costs according to hospital type (Table 1) were applied to the estimations made using DRG data.

Analysis of the hip fracture patients selected from hospitals connected to DRG-based data network was made with respect to age, gender, site of fracture, type of treatment, duration of hospital stay, and cost estimates. DRG costs used for cost estimates of osteoporotic hip fractures covered only the direct medical costs of primary hospitalization.

Total DRG costs of hip fractures were estimated using three criteria; the number of hospitals, number of hospital beds, and number of hospitalized patients.

Statistical analysis was performed using SSPS software (version 13.0, SPSS Inc. Chicago, IL, ABD). The Student's t-test, ANOVA and post Hoc Tukey tests were used for the comparison of clinical parameters in terms of average direct cost items. $p<0.05$ was considered statistically significant.

Results

Of the 1,118 selected patients (mean age: 75.3±9.9 years), 62.7% were female. Female patients were sig-

Table 2. Expected numbers of hip fractures according to the numbers of hospitals, beds and patients by type of hospital in Turkey in 2008.

		By # of hospitals					By # of beds					By # of patients				
		Turkey		DRG			Turkey		DRG			Turkey		DRG		
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Type of hospital	Obs	n	%	n	%	Exp	n	%	n	%	Exp	n	%	n	%	Exp
Total	**1,118**	572	100.0	34	100. 0	**15,602**	142,708	100. 0	19,240	100. 0	**8,521**	7,804,027	100. 0	882,060	100.0	**9,365**
Non-teaching hospitals	**616**	322	56.3	17	50.0	11,668	62,410	43.7	7,432	38.6	5,173	3,183,088	40.8	347,412	39.0	5,644
Teaching hospitals	**219**	33	5.8	7	20.6	1,032	31,581	22.1	4,096	21.3	1,689	1,895,211	24.3	207,960	24.0	1,996
Private hospitals	**21**	160	28.0	4	11.8	840	16,578	11.6	503	2.6	692	1,339,279	17.2	42,129	5.0	668
University hospitals	**217**	57	10.0	6	17.6	2,062	32,139	22.5	7,209	37.5	967	1,386,449	17.8	284,559	32.0	1,057

Obs: Observed; **Exp:** Expected; **A:** Observed numbers of hip fracture patients in the DRG hospitals **B:** Numbers of eligible hospitals by type in Turkey; **C:** Percent distribution of eligible hospitals in Turkey; **D:** Numbers of DRG hospitals by type; **E:** Percent distribution of DRG hospitals; **F:** Expected numbers by standardisation of hip fracture patients in Turkey hospitals; **G:** Number of beds by type of hospital in Turkey; **H:** Percent distribution of hospital beds by type of eligible hospital in Turkey; **I:** Number of beds of DRG hospitals by type; **J:** Percent distribution of beds of DRG hospitals; **K:** Expected numbers by standardisation of hip fracture patients in Turkey hospitals; **L.** Numbers of hospitalised patients by type of hospital in Turkey; **M.** Percent distribution of hospitalised patients by type of eligible hospital in Turkey; **N:** Numbers of hospitalised patients in DRG hospitals by type; **O:** Percent distribution of patients in DRG hospitals; **P:** Expected numbers by standardisation of hip fracture patients in Turkey hospitals

Table 3. Site of fracture by demographics and hospital type in Turkey in 2008.

	ICD-10 Code							
	Fracture of the neck of femur with no precision of localization		Intracapsular fracture of femur		Subcapital fracture of femur		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age (years)	75.31	9.86	78.10	10.63	67.33	9.97	75.29	9.88
Gender	n	%	n	%	n	%	n	
Male	411	98.6	3	0.7	3	0.7	417	
Female	691	98.6	7	0.9	3	0.4	701	
Total	1,102	99.6	10	0.9	6	0.5	1,118	
Hospital type								
Total	1,102	98.6	10	0.9	6	0.5	1,118	
State general	605	98.2	9	1.5	2	0.3	616	
State teaching	218	99.5	0	0.0	1	0.5	219	
Special branch	45	100.0	0	0.0	0	0.0	45	
Private	21	100.0	0	0.0	0	0.0	21	
University	213	98.2	1	0.5	3	1.3	217	

p>0.05; Pearson Chi-Square

nificantly older than male patients (73.4±10.5 vs. 76.4±9.3; p<0.000) (Table 1).

The youngest patients were hospitalized in special branches and university hospitals (p<0001) (Table 1). The highest male/female ratios were detected in state teaching (68%) and university (63%) hospitals (p<0.05) (Table 1).

The most frequent site of hip fractures was the femoral neck with no precision of localization in most cases. Fracture type did not differ according to patient demographics or hospital type (Table 3).

Hip replacement surgery was more prevalent among older patients (p<0.001) and in state general and state teaching hospitals (p<0.01) (Table 4).

Table 4. Type of treatment by gender, age and hospital type in Turkey in 2008.

	Type of treatment (DRG)							
	Hip replacement		Internal/ external fixation		Other interventions		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age (years)[a]	76.08	9.17	75.24	10.04	73.11	11.14	75.29	9.88
Gender	n	%	n	%	n	%	n	%
Male	192	46.1	144	34.5	81	19.4	417	100.0
Female	352	50.2	241	34.4	108	15.4	701	100.0
Total	544	48.6	385	34.4	189	16.9	1,118	100.0
Hospital type[b]								
State general	321	52.1	198	32.1	97	15.7	616	100.0
State teaching	110	50.2	61	27.8	48	21.9	219	100.0
Special branch	13	28.8	23	51.1	9	20.0	45	100.0
Private	13	61.9	3	14.2	5	23.8	21	100.0
University	87	40.1	100	46.1	30	13.8	217	100.0
Total	544	48.6	385	34.4	189	16.9	1,118	100.0

Pearson Chi-Square; [a]F=6.431, df=2, p=0.002; [b]F=33.426, df=8, p=0.0005.349, df=4, p<0.001

Table 5. Length of hospital stay (LOS) by gender, hospital type, site of fracture and type of treatment in Turkey in 2008.

	n	LOS	
		Mean	SD
Gender			
Male	417	11.20	7.85
Female	701	10.91	7.96
Total	1,118	11.02	7.92
Hospital type+			
State general	616	11.52	7.01
State teaching	219	11.41	8.02
Special branch	45	11.84	8.07
Private	21	6.10	2.92
University	217	9.49	9.82
Total	1,118	11.02	7.92
Site of fracture (ICD-10 Code)			
Total	1,118	11.02	7.92
Fracture of the neck of femur with no precision of localization	1,102	11.02	7.95
Intracapsular fracture of femur	10	11.60	4.89
Subcapital fracture of femur	6	9.83	6.21
Type of treatment*			
Total	1,118	11.02	7.92
Hip replacement	544*	13.27	7.66
Internal/external fixation	385	7.01	7.05
Other hip and femur processes	189*	12.71	7.15

+p<0.001 (F=4.994, df=4); *p<0.001 (F=87.358, df=2) compared to LOS of the neck of femur fractures; Gender: t=0.601, p=0.548; Site of fracture: 0. 94, df=2, p=0.910

Irrespective of patient number and fracture location, average LOS was 11.0±7.9 (median: 10; range: 10 to 124) days (Table 5). LOS was also similar for age groups even after the adjustment for gender, with the exception of a few patients older than 100 years who most probably could not have survived until surgical intervention. However, the variation of mean LOS was smallest between the ages 70 to 85,

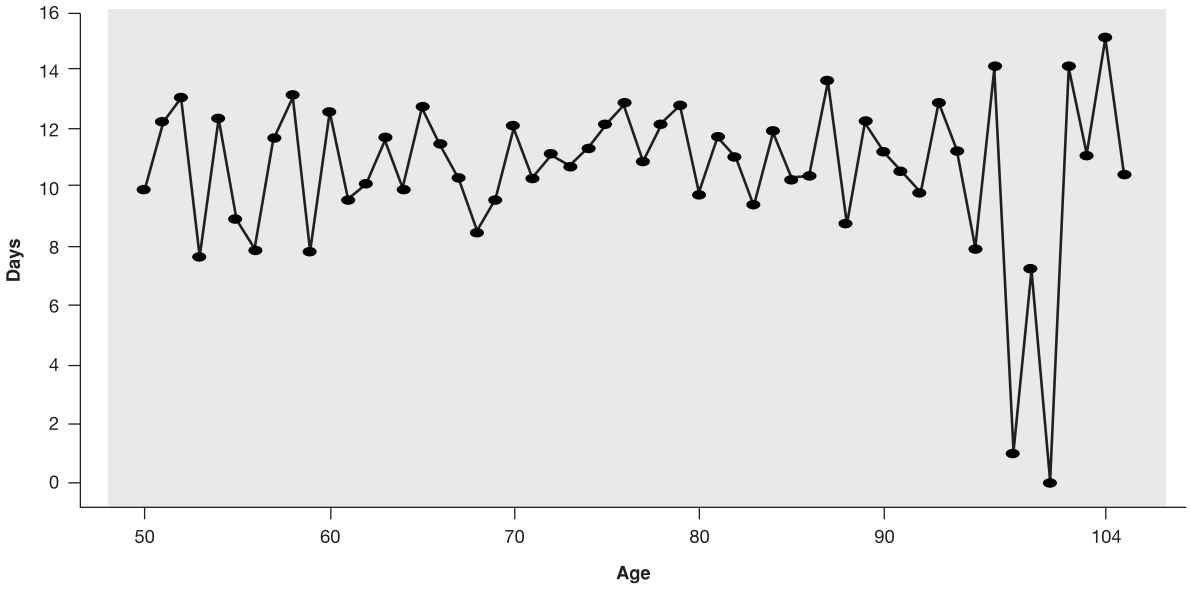

Fig. 2. Length of stay by age in Turkey in 2008.

Table 6. DRG costs ($) by type of treatment in Turkey in 2008.

DRG cost		n	%	Total cost ($)	Mean LOS	Hospital cost/ day
Total	Type of treatment (DRG)	1,118	100.0	2,249,885	11.02	182.6
3,114	Hip replacement	544	48.7	1,304,092	13.27	180.7
2,145	Internal/external fixation	385	34.4	635,739	7.01	235.6
2,131	Other hip and femur processes	189	16.9	310,053	12.71	129.1

intermediate from 50 to 70 and largest over 85 years (Fig. 2).

The shortest hospital stay was detected in private hospitals, followed by the university hospitals ($p<0.001$) (Table 5). LOS was similar in all the state hospitals, regardless of their size and other characteristics (Table 5).

LOS was significantly shorter in internal/external fixation patients compared with other types of treatments ($p<0.001$) (Table 5).

DRG costs used in the estimations do not cover the costs of prosthesis or implant utilized, but only the direct medical costs of the primary hospitalization. The total weighed cost of all patients was determined to be $2,249,885 per year, indicating an average direct medical cost of $3,119 per patient.

Among treatment types, hip replacement was associated with the highest DRG cost in relation to longer LOS (Table 6). State ($1,255,59), teaching ($443.17) and university ($422.90) hospitals were associated with higher DRG costs in accordance with their patient numbers (Table 7).

However, no relationship was found between the costs (DRG code) and the site of fracture (ICD code) even after adjusting for hospital type (Table 8).

The number of actual patients was estimated to be 15,602 by number of hospitals, 8,521 by number of hospital beds, and 9,365 by number of hospitalization, with costs of $31,530 million, $14,793 million and $18,948 million, respectively (Table 9 and Fig. 3).

The overall incidence of hip fractures in Turkey is estimated as 7.02 per hundred thousand in the population over age 50 and 1.31 per hundred thousand in the general population.

Discussion

In the present study, we extrapolated the direct medical costs of osteoporotic hip fractures across Turkey from using data of 1,118 patients from DRG hospitals representing 13.7% of total hospital beds across Turkey. Consequently, the total number of patients was estimated to be 15,602 by number of hospitals; 8,521 by number of hospital beds, and 9,365 by number of hospitalization, costing $31,530 million, $14,793 million, and $18,948 million, respectively.

The average cost of care during initial hospitalization is approximately $7,000 per hip fracture patient. Costs vary considerably among countries, the lowest cost reported from Norway (US$739) and the highest from Switzerland (US$44,000).[13] Mean in-patient

Table 7. Costs ($) by treatment type in different types of hospitals in Turkey in 2008.

	Hip replacement		Internal/ external fixation		Other hip and femur processes		Overall	
	n	Unit cost 3,114	n	Unit cost 2,145	n	Unit cost 2,131	n	Total cost
Total	544	1,304.09	385	635.74	189	310.05	1,118	2,249.89
State	321	769.51	198	326.95	97	159.13	616	1,255.59
Teaching	110	263.70	61	100.73	48	78.74	219	443.17
Special branch	13	31.16	23	37.98	9	14.76	45	83.91
Private	13	31.16	3	4.95	5	8.20	21	44.32
University	87	208.56	100	165.13	30	49.21	217	422.90

Pearson Chi-Square=33.426, df=8, $p<0.001$

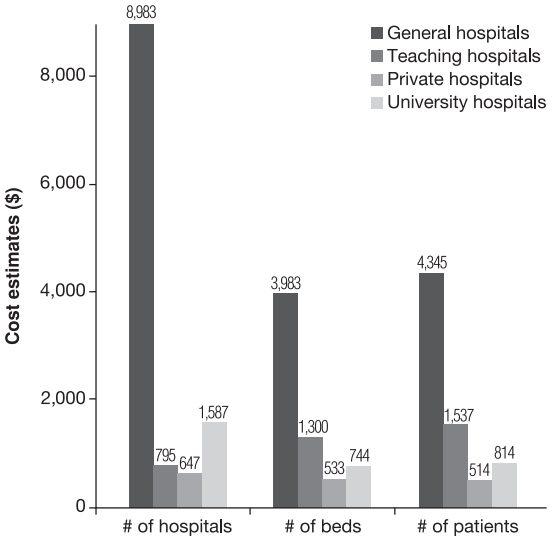

Fig. 3. Cost estimates according to numbers of hospitals, beds and patients with respect to type of hospital in Turkey in 2008.

cost for osteoporosis with fracture in men aged 50 or older from a public perspective was €5,886 for hip fractures in France in 1998,[4] whereas a median cost of $10.000 (S$16.043)[14] was reported in Singapore in 2008, the average in-patient cost of treating a patient was £5,076 in UK in1996[15] and $8,358 in US in 1998.[10]

The predominance of older females in our study population is in line with past studies[10,15,16] stating that hip fractures are clearly more detrimental to a woman's health[17] due to a higher incidence of fracture at any given age and a higher life expectancy.[3]

Hospitalization length due to hip fracture secondary to osteoporosis appears to be shorter across Turkey (11 days) than the average length of stay estimated for France (14 days) in 2001, Italy (15.5 days) in 2002, Singapore (20 days) in 2008 and the UK (23 days) in 2005.[1,4,18,19]

The hospital bed is considered the most expensive item on a hospital bill and published reports confirm this theory stating that the choice of surgery is the second most expensive item.[1,4,18-21] In this respect, the greater selection of treatment options in private hospitals may account for their cost reduction. This paradox of length of stay and costs in the private sector is attributed to a more effective utilization of hospital beds, surgery type, and shifting of patients.[14]

Since the cost estimate based on the number of hospitals and hospital beds provides crude data with

Table 8. Costs by site of fracture in different types of hospitals in Turkey in 2008.

	ICD-10 Code	DRG Cost ($) 1,641	1,651	2,397	n
Hospital type	*Grand total*	189	385	544	1,118
Private	Fracture of the neck of femur with no precision of localization	5	3	13	21
	Total	5	3	13	21
Special branch	Fracture of the neck of femur with no precision of localization	9	23	13	45
	Total	9	23	13	45
State	Fracture of the neck of femur with no precision of localization	96	193	316	605
	Intracapsular fracture of femur	1	5	3	9
	Subcapital fracture of femur	0	0	2	2
	Total	97	198	321	616
Teaching	Fracture of the neck of femur with no precision of localization	48	60	110	218
	Subcapital fracture of femur	0	1	0	1
	Total	48	61	110	219
University	Fracture of the neck of femur with no precision of localization	28	100	85	213
	Intracapsular fracture of femur	0	0	1	1
	Subcapital fracture of femur	2	0	1	3
	Total	30	100	87	217

Table 9. Cost estimates according to the extrapolation to numbers of hospitals, beds and patients in Turkey in 2008.

	Hip replacement		Other hip and femur processes		Neck of femur fractures		Overall	
	n	DRG cost $2,397 Total cost (x1,000)	n	DRG cost $1,641 Total cost (x1,000)	n	DRG cost $1,651 Total cost (x1,000)	n	Total Cost (x1,000)
Number of hospitals								
Total	7,769	18,624	2,577	4,229	5,256	8,679	15,602	31,532
General	5,904	14,153	1,866	3,062	3,897	6,435	11,668	23,651
Teaching	518	1,242	226	370	288	475	1,032	2,088
Private	520	1,246	200	328	120	198	840	1,772
University	827	1,981	285	467	951	1,570	2,062	4,020
Number of beds								
Total	4,281	10,263	1,496	2,453	2,744	4,530	8,521	14,795
General	2,617	6,274	828	1,358	1,728	2,853	5,173	10,486
Teaching	848	2,032	370	607	471	778	1,689	3,417
Private	428	1,026	165	270	99	163	692	1,460
University	388	929	133	218	446	736	967	1,884
Number of patients								
Total	4,695	11,255,707	1,645	2,698,610	3,025	4,995,092	9,365	18,949
General	2,855	6,846	903	1,481	1,885	3,112	5,644	11,440
Teaching	1,002	2,402	437	717	557	919	1,996	4,039
Private	414	990	159	260	96	157	668	1,410
University	424	1,016	146	239	487	804	1,057	2,059

wider confidence intervals, the number of patients is considered to provide more precise and specific information. Therefore, estimations of 9.365 annual hip fractures and the related total hospital care costs in Turkey of $18,949,410 are probably more reliable estimates. The number of orthopedic patients by hospital, if available, might be a more reliable factor of cost estimation. Keeping in mind that only acute hospital care costs are estimated, the findings show that Turkish hip fracture repair costs are not the cheapest in the world. Acute care costs should be doubled to offer a vague idea of the direct unit cost by a societal perspective, and 5 to 10 fold of the latter would provide a rough estimate on the total annual cost of a hip fracture, which is a minimum of $76,982 per patient for Turkey.[1,5,10,13,22,23]

The major limitation of our study is the inclusion of acute care costs, excluding home care, social care, indirect and other costs which are known to exceed the acute hospital care costs. Whilst cost estimates in the present study are comparable with other countries, variations in inflation and currency exchange rates render such comparison difficult. Secondly, although 13.7% of the countrywide number of hospital beds is represented in the DRG hospitals and provide a quite strong basis for estimates, ICD-10 diagnosis remains uncertain in most cases studied, making the correlation between various types of fracture to be nearly impossible. Finally, the terminology used in hospitals is far from uniform.

In conclusion, standardization through hospital number, hospital bed number and hospital patient number/year by type of hospital in the present study has revealed diverse results in cost estimations of osteoporotic hip fractures even in the same groups of hospitals across Turkey. These variations may reflect the incoherence of data as well as a lack of standardization of health care services. Therefore, ICD and DRG coding needs to be improved and a national database must be created at least for the invoices of importation of prostheses to fully be able to calculate the burden of osteoporosis across Turkey.

Ultimately, the gradual increase in the prevalence of osteoporotic hip fractures in Turkey will be a challenge to health economics in Turkey in the near future. Our estimations should help to facilitate the consideration of the total costs and consequences of

osteoporotic hip fractures and the development of an accurate and standardized national database.

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