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ORIGINAL ARTICLE

Epidemiology of rotator cuff surgery in Italy: regional variation in access to health care. Results from a 14-year nationwide registry

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Abstract

Purpose Rotator cuff (RC) disease is frequent and represents a common source of shoulder pain. The aim of this study is to analyse geographical differences in RC surgeries from 2001 to 2014 in Italy, a country with universal and free health care for its population.

Methods An analysis of the Italian National Hospital Discharge records from 2001 to 2014 was performed. These data are anonymous and include patient's age, sex, domicile, region of hospitalization, length of the hospitalization and type of reimbursement (public or private). National and regional population data were obtained from the National Institute for Statistics (ISTAT) for each year.

Results During the 14-year study period, 390,001 RC repairs were performed in Italy, which represented a mean incidence of 62.1 RC procedures for every 100,000 Italian inhabitants. Nevertheless, the incidence was very different if every single regional population is considered individually. Lombardy resulted to have the highest number of surgeries during the 14-year study period, with 27.95% (108,954) of the total national procedures performed in the 2001–2014 time span. More than half the surgeries (52.00%) were performed in only 3 regions of the northern part of Italy.

Conclusions This study shows the existence of geographical disparities in access to RC surgery and patients' necessity to migrate among regions in order to obtain it. Southern regions of Italy are characterized by a lower number of surgeries compared to the northern part of Italy.

Keywords Epidemiology · Rotator · Cuff · Surgery · Tears · Health care

Introduction

Rotator cuff (RC) disease is frequent and represents a common source of shoulder pain [1, 2]. Each year in the USA, approximately 4.5 million patient visits related to shoulder pain occur, and the majority of them are due to RC problems [3, 4].

Patients with RC pathology may complain of symptoms ranging from minimal discomfort without functional deficits to severe pain, weakness and marked disability [5, 6]. Surgical repair of RC tears is a well-documented therapeutic option in these patients [7–11].

Geographical variation in the number of RC surgical procedures performed in the USA and variations in what surgeons deemed to be indications for RC surgery has been studied [12, 13]. Several reports have highlighted the apparent broadening of indications for RC surgery [12, 14–16], showing a considerable variation in the treatment of RC disease and the conditions requiring surgical repair. Incidence of RC surgery is rapidly increasing in selected patient cohorts [17], but nationwide incidence rates have been reported only for Finland [18] and Italy [19].

One of the founding principles of the Italian National Health Service (NHS) is fairness in access to health care, being free to every patient at the point of use.

Data from the Italian registry showed that 68.1% of RC repairs were performed in the North from 2001 to 2014, 19.1% in the Centre and 12.8% in the South. Data on domicile of the patient showed that 63.3% patients undergoing RC repairs

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came from the North, 20.2% from the Centre and 16.5% from the South and Islands. These data implicated significant differences in incidence of operations. Considering the Italian population of the 3 different regions of Italy (North, Centre and South), from 2001 to 2014, the incidence of operations was 77.7 per 100,000 person-years in the North, 35.5 per 100,000 person-years in the Centre, and 22.2 per 100,000 person-years in the South. [19].

This study aimed to explore geographical variation in equity in access to RC surgery among regions of Italy from 2001 to 2014, based on the official information source of hospitalization records provided by the Italian Ministry of Health.

Materials and Methods

An analysis of the National Hospital Discharge records (SDO) maintained at the Italian Ministry of Health concerning the 14 years of our survey (2001 through 2014) was performed. This archive collects information concerning all hospitalizations occurring in Italian public and private care settings. These data are anonymous and include patient's age, sex, domicile, region of hospitalization, length of hospitalization and type of reimbursement (public or private). National and regional population data were obtained from the National Institute for Statistics (ISTAT) for each year. RC repair was defined by the following International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) major diagnosis code: 83.63 (rotator cuff repair).

Epidemiology of RC repairs based on Italian geographical macroregions has already been reported [19]. This article reports details of patients' domicile, region of hospitalization and region where the surgery was performed. These data aim to highlight potential disparities in access to health care in Italy and patients' necessity to migrate among regions in order to obtain it.

We distinguished patients by their regional domicile, thus defining them "regional populations". Moreover, we distinguished for each region the origin of patients who underwent surgery. Procedures performed on patients residing in the same region of hospitalization were defined as "regional surgeries". Procedures performed on patients not residing in the same region of hospitalization were defined "extra-regional surgeries".

Descriptive statistics was performed.

Results

Demographics

During the 14-year study period, 390,001 RC repairs were performed in Italy, which represented a mean incidence of 62.1 RC procedures for every 100,000 Italian inhabitants. Nevertheless, the mean incidence is very different if every single regional population is considered individually.

Of 390,001 RC repairs performed in Italy during the study period, patients' domicile data were not available for 244 RC repairs, thus resulting in a total of 389,757 RC repairs for which patients' domicile data were available (Table 1). Only 5 over 21 regional populations (Patients from Aosta Valley, Veneto, Lombardy, Autonomous Province of Trento and Emilia Romagna) had an incidence greater than the national one. Seven over 21 regional populations (Patients from Basilicata, Molise, Apulia, Calabria, Sicily, Sardinia, Campania) had less than half the incidence than the national one. Patients from Campania resulted to be the ones with the lowest incidence of RC repair in Italy (13.39 RC procedures for every 100,000 inhabitants). Further details about the incidence of surgeries performed for each regional population are reported in Fig. 1 and Table 2.

Region of hospitalization and domicile of the patients

Regarding regional distribution of surgeries, the majority of patients underwent surgery in their own region of domicile. Lombardy resulted to have the highest number of surgeries during the 14-year study period, with 27.95% (108,954) of the total national procedures performed in the 2001–2014 time span. More than half the surgeries (52.00%) were performed in only 3 regions of northern Italy (Lombardy, Emilia Romagna, Veneto). Lombardy also performed the highest number of extra-regional surgeries (19,791). Umbria resulted instead the region with the highest percentage of extra-regional surgeries (47.7%). Patients from the Autonomous Province of Bolzano resulted to be the only regional population from the Northern part of Italy to have an incidence of RC repair below the national one. Further details about the number of surgeries performed in each region are reported in Fig. 2. A number of regional and extra-regional surgeries are reported in Fig. 2 and Table 2. Specifics on regional migration in the 2001–2014 time span are summarized in Table 1.

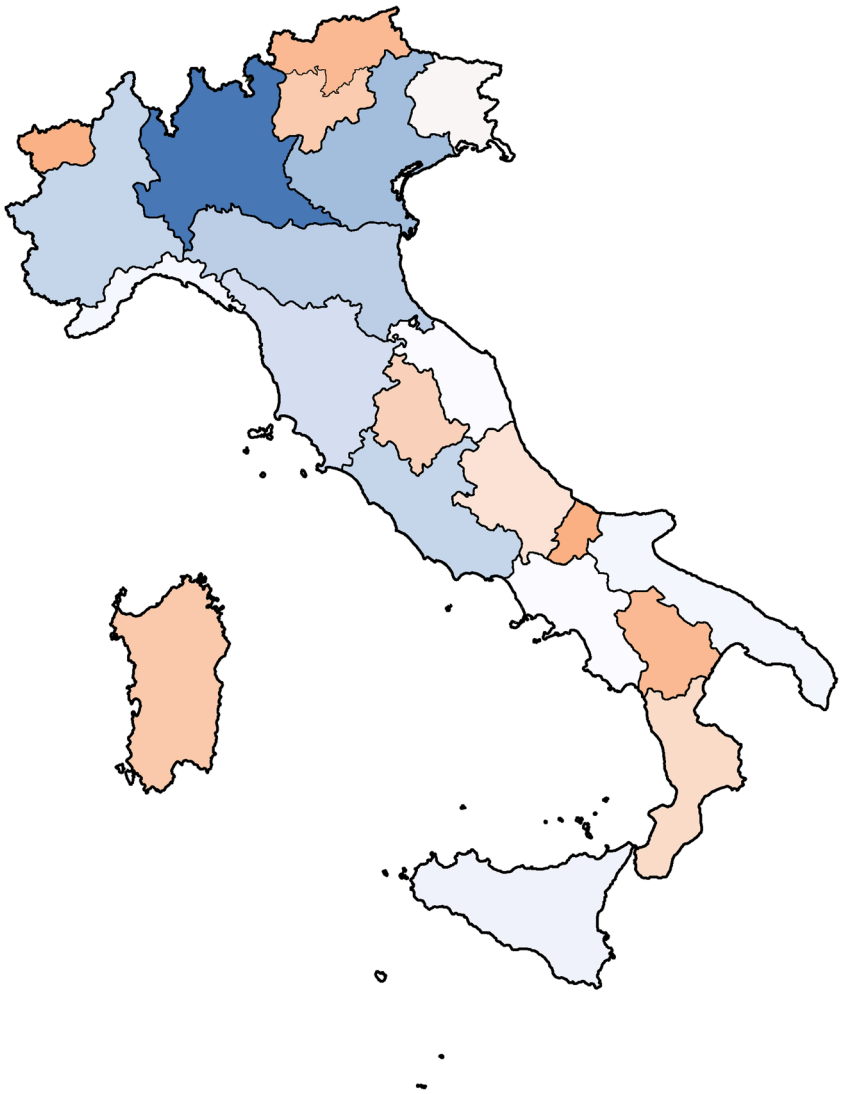
Discussion

The most important finding from our registry study is that severe geographical variations in RC repair rates were present among regions of Italy. The majority of RC procedures were performed in the northern part of Italy, with more than half the surgeries (52.00%) performed in only 3 regions (Lombardy, Emilia Romagna, Veneto).

Regions from the southern part of Italy were characterized both by a lower number of regional and extra-regional

Table 1 Regional migration summary, 2001–2014 time span

2001–2014 Time span	Region of hospitalization																			
	Piedmont	Aosta Valley	Lombardy	AP of Bolzano	AP of Trento	Veneto	Friuli-Venezia Giulia	Liguria	Emilia Romagna	Tuscany	Umbria	Marche	Lazio	Abruzzo	Molise	Campania	Apulia	Basilicata	Calabria	Sicily	Sardinia
Patient's origin																					
Piedmont	29,610	50	3559	2	2	24	5	149	116	43	3	4	23	1	0	14	6	1	6	12	5
Aosta Valley	830	446	188	0	0	2	0	6	9	6	0	0	2	0	0	0	0	0	1	0	0
Lombardy	1266	24	89,163	2	87	1219	16	52	2067	120	4	13	39	8	1	13	11	1	7	6	6
AP of Bolzano	3	0	217	1929	57	368	2	0	18	1	0	0	3	0	0	0	0	0	0	0	0
AP of Trento	1	0	565	114	3456	737	2	0	66	6	0	0	2	2	0	0	0	0	0	0	0
Veneto	26	0	3914	217	509	40,051	1630	0	2144	35	3	1	25	1	0	8	4	0	1	5	1
Friuli-Venezia Giulia	5	1	96	9	3	665	9153	2	259	6	1	3	10	1	0	0	3	0	0	3	0
Liguria	3948	0	1462	0	3	22	3	6278	192	1804	0	0	13	3	0	1	2	0	2	2	0
Emilia Romagna	80	3	4656	4	29	962	14	14	30,947	596	7	119	23	3	1	5	8	2	0	4	4
Tuscany	96	0	468	7	5	50	5	1523	2232	22,615	434	8	211	6	1	7	8	0	0	3	1
Umbria	6	0	86	1	0	5	3	1	1112	1437	2657	97	276	36	0	5	1	0	0	1	0
Marche	4	0	137	0	1	51	3	2	3531	310	242	7215	72	287	0	1	3	0	1	1	0
Lazio	20	1	224	3	4	51	10	11	256	1488	1069	219	26,790	2932	20	130	22	5	2	12	6
Abruzzo	14	0	161	0	1	62	2	4	1285	89	76	630	379	5008	47	10	3	0	0	1	0
Molise	6	0	20	0	1	11	0	5	178	21	29	16	127	173	518	85	30	0	0	0	0
Campania	45	0	604	2	3	64	8	7	420	212	15	31	921	99	69	8031	77	238	9	2	1
Apulia	93	1	819	1	2	121	12	24	1532	262	388	170	414	241	70	85	10,031	233	2	3	0
Basilicata	17	0	77	0	2	90	3	4	207	130	113	2	147	10	0	52	437	1240	5	1	0
Calabria	144	4	797	1	3	76	12	22	853	565	17	7	679	15	0	32	180	52	3011	351	1
Sicily	331	1	1552	2	14	132	44	36	1305	455	16	29	262	9	0	21	17	0	43	12,006	0
Sardinia	46	0	189	2	2	26	2	15	186	54	4	5	181	3	0	5	3	0	0	2	3694
Total for each region	36,591	531	108,954	2296	4184	44,789	10,929	8155	48,915	30,255	5078	8569	30,599	8838	727	8505	10,846	1772	3090	12,415	3719



2001-2014 Time Span: Classification by NUMBER OF TOTAL SURGERIES	Patient's Origin	Total Surgery performed
	Lombardy	94,125
	Veneto	48,575
	Emilia Romagna	37,481
	Piedmont	33,635
	Lazio	33,275
	Tuscany	27,680
	Sicily	16,275
	Apulia	14,504
	Liguria	13,735
	Marche	11,861
	Campania	10,858
	Friuli - Venezia Giulia	10,220
	Abruzzo	7,772
	Calabria	6,822
	Umbria	5,724
	A.P. of Trento	4,951
	Sardinia	4,419
	A.P. of Bolzano	2,598
	Basilicata	2,537
	Aosta Valley	1,490
	Molise	1,220

Fig. 1 Classification by RC procedures performed per 100.000 inhabitants

surgeries. Regional populations of the southern regions of Italy had significantly lower rate of surgeries per 100.000 inhabitants compared to the ones of the northern part of Italy. Patients from Campania resulted to be by far the ones with the lowest incidence in Italy.

Oddly, patients from the Autonomous Province of Bolzano resulted to be the only regional population from the Northern part of Italy to have an incidence of RC repair below the national one: this may reveal an international migration of such patients to the adjoining Austria and Switzerland.

It is not possible to discriminate whether these differences reflect variations in need or in clinical practice because data on prevalence, incidence, severity of RC tears and information regarding clinicians' and patients' attitudes to RC surgery are not available [20]. They may also indicate differing amounts of resources available to provide RC surgery.

In view of the Government and the Italian Ministry of Health focus on reducing health inequalities, this massive difference in RC surgeries incidence among regions of Italy highlights a topic that absolutely needs further investigation.

It is possible that these differences reflect real geographical variation in need or patient consent to surgery. However, some studies have suggested that need is greater among the most deprived groups, and that education and income are unrelated to willingness to undergo surgery [21]. If so, this would imply inequity in the provision of RC surgery. A nationwide registry study in Finland showed higher incidence rate (from 44 to 131 per 100,000 adults per year) compared to rates in Italy [18].

Table 2 Classification by surgeries per 100.000 inhabitants

2001–2014 time span: classification by surgeries per 100.000 inhabitants	Total surgery performed	Regional surgery (ABS)	Regional surgery (REL) (%)	Extra-regional surgery (ABS)	Extra-regional surgery (REL) (%)	Surgeries per 100.000 inhabitants
Patient's Origin						
Aosta Valley	1.490	446	29.93	1.044	70.07	84.92
Veneto	48.575	40.051	82.45	8.524	17.55	72.37
Lombardy	94.125	89.163	94.73	4.962	5.27	70.03
AP of Trento	4.951	3.456	69.80	1.495	30.20	69.01
Emilia Romagna	37.481	30.947	82.57	6.534	17.43	62.62
Liguria	13.735	6.278	45.71	7.457	54.29	61.60
Friuli-Venezia Giulia	10.220	9.153	89.56	1.067	10.44	60.05
Marche	11.861	7.215	60.83	4.646	39.17	55.58
Piedmont	33.635	29.610	88.03	4.025	11.97	55.08
Tuscany	27.680	22.615	81.70	5.065	18.30	54.10
Umbria	5.724	2.657	46.42	3.067	53.58	46.71
Lazio	33.275	26.790	80.51	6.485	19.49	43.24
Abruzzo	7.772	5.008	64.44	2.764	35.56	42.33
AP of Bolzano	2.598	1.929	74.25	669	25.75	37.64
Basilicata	2.537	1.240	48.88	1.297	51.12	30.79
Molise	1.220	518	42.46	702	57.54	27.34
Apulia	14.504	10.031	69.16	4.473	30.84	25.49
Calabria	6.822	3.011	44.14	3.811	55.86	24.41
Sicily	16.275	12.006	73.77	4.269	26.23	23.14
Sardinia	4.419	3.694	83.59	725	16.41	19.07
Campania	10.858	8.031	73.96	2.827	26.04	13.39

This study has some limitations. It relied upon administrative data, and thus, there is the possibility that changes in coding practices could have impacted our results. That said, we are unaware of any systematic changes in the coding of RC repair that would have significantly impacted our findings. Significant regional variations were found in our study, confirming an inequity. This may express unmet needs in the low RC repair rate areas, or else over-indication in the high RC repair rate areas. So, part of this variability may be related to patients and to surgeons, and this cannot be clarified from the database analysis.

Thirdly, a limitation of this registry study is that we are unable to evaluate potential inaccuracies in diagnoses or procedures coding. Fourthly, the diagnosis and procedure coding used during the study period did not allow differentiation between open and arthroscopic procedures, or between partial and full-thickness tears. That said, this does not represent a major issue, since we focused in this article on geographical disparities in access to health care.

Conclusions

In conclusion, this study confirms the existence of a geographical disparity in access to health care and patients' necessity to migrate among regions in order to obtain it. Regions from the southern part of Italy are characterized by a lower number of surgeries. Patients residing in southern regions of Italy had significantly lower incidence of surgeries compared to the ones of the northern part of Italy.

We found evidence of a concentration of RC procedures in the north of Italy. Our results give pause over whether efforts on regionalization of RC repair should turn towards improving quality in hospitals in the South of Italy. There is evidence of inequity in access to RC surgeries across macroregions of Italy. Today's levels of RC surgery are below the expected maximum incidence, and we expect a continued annual increase in the total number of RC

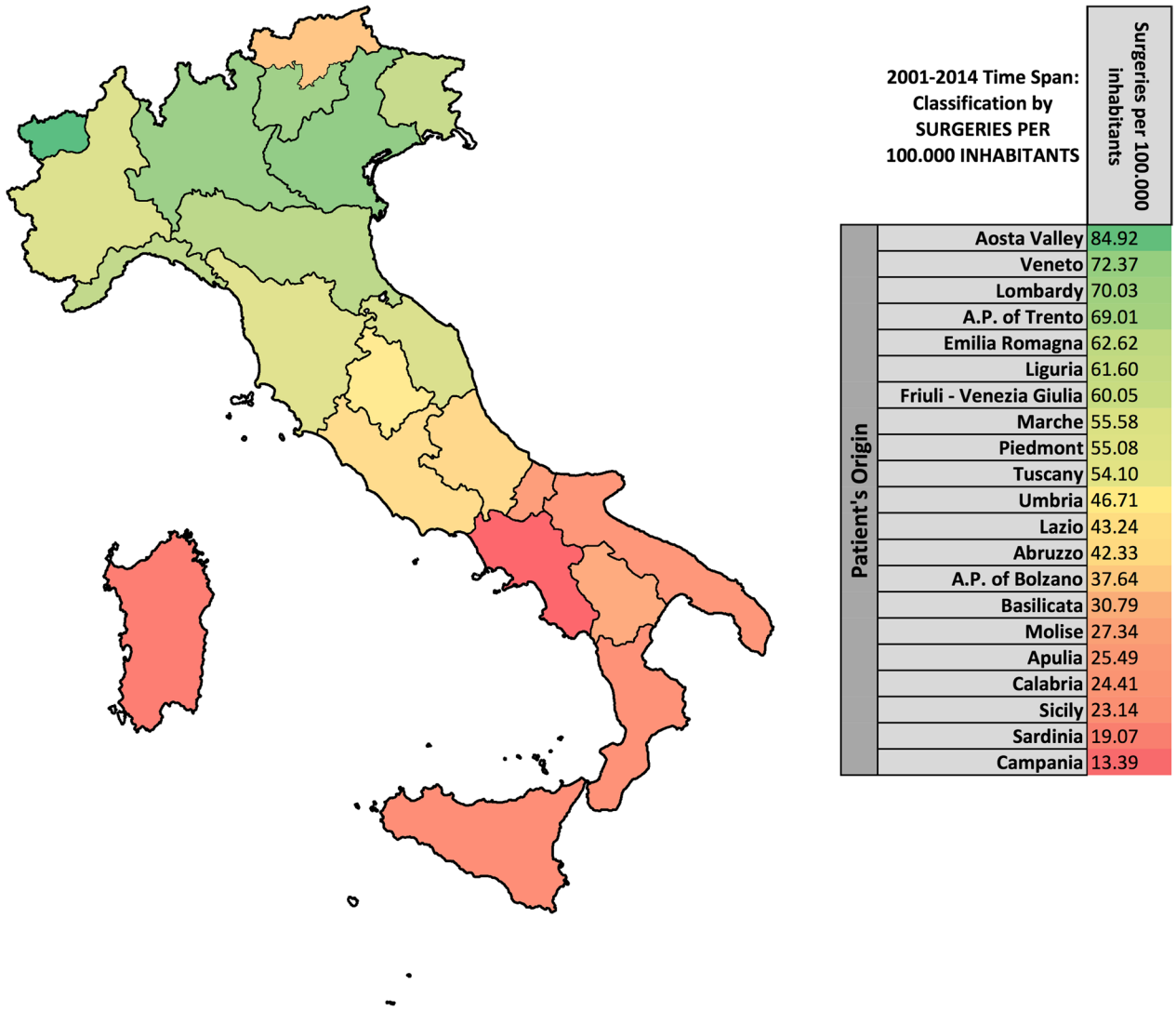


Fig. 2 Classification by total RC procedures performed for each region of Italy

repair performed. Policy makers should examine factors to understand the determinants of inequitable provision.

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Authors' contributions UGL and VD contributed to conceptualization; GS, AB and LRA were involved in data curation; GS was involved in formal analysis; VC and AB helped in methodology; UGL contributed to project administration; FM and SP were involved in software; UGL and VD helped in supervision; GS and UGL were involved in writing—original draft; and GS, UGL and VC were involved in writing—review and editing.

Compliance with ethical standards

Conflicts of interest The authors declare no conflict of interest.

Ethical approval This article does not contain any studies with human participants performed by any of the authors.

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