

# Diagnosis-Related Groups in Hand Surgery – a comparison of six European countries

## Fallpauschalen in der Handchirurgie – ein Vergleich von sechs europäischen Ländern

### Abstract

Diagnosis-Related Group (DRG) is a classification system, which groups patients according to their diagnosis and resource consumption. Common hand surgical diagnoses and procedures were processed using national DRG-groupers of six European countries.

The upper thresholds of length of stay (LoS) are indicated for every country with the exception of Spain. The mean value in the series was 9.9 days for Germany, 4.5 days for Austria, 10.7 days for Italy, 9.7 days for Sweden and 9.4 days for the United Kingdom (UK). Germany and Austria also have lower thresholds of LoS and the average LoS.

Multiple finger replantation presented the highest single case reimbursement in Germany, Austria and the UK (13,825 €, 10,576 € and 9,198 €). Scaphoid non-union had the highest single case reimbursement in Italy (2,676 €), flap coverage of wounds in Spain (5,506 €) and trapeziometacarpal arthritis in Sweden (5,350 €). The mean values for single case reimbursement were as follows: Germany 3,211 €, Austria 2,821 €, Italy 1,947 €, Spain 3,594 €, Sweden 2,403 € and the UK 3,253 €. Ten out of 19 cases showed the highest reimbursement in Spain, followed by the UK (5 cases), Sweden (2 cases), Germany and Austria (1 case each).

Applying the case numbers of our clinic to the reimbursement system of each country, total proceeds would be 2.25 million € in Spain, 1.79 million € in Germany as well as the UK, 1.75 million € in Austria, 1.63 million € in Sweden and 1.22 million € in Italy.

The consequences of international differences in efficiency and reimbursement are hard to assess as they are influenced by multiple factors that are seldom purely market-driven. However, the consideration of international data for benchmarking and refinement of national compensation systems should be a useful instrument.

**Keywords:** Diagnosis-Related Groups, Hand Surgery, reimbursement, length of stay, Europe

### Zusammenfassung

Diagnosis-Related Groups (DRG) bezeichnet ein Klassifikationssystem, welches Patienten anhand ihrer Diagnosen und des Ressourcenverbrauchs einteilt. Häufige handchirurgische Diagnosen und Prozeduren wurden mit den nationalen DRG-Groupern sechs europäischer Länder bearbeitet.

Die obere Grenzverweildauer (oGVD) wurde außer für Spanien in allen Ländern angegeben. Die mittlere oGVD lag bei 9,9 Tagen für Deutschland, 4,5 Tagen für Österreich, 10,7 Tagen für Italien, 9,7 Tagen für Schweden und 9,4 Tagen für Großbritannien (UK). Nur für Deutschland und Österreich standen die untere Grenzverweildauer und die mittlere Verweildauer zur Verfügung.

Mehrfingerreplantationen zeigten die höchste Einzelfallvergütung in Deutschland, Österreich und UK (13.825 €, 10.576 € und 9.198 €).

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Kahnbeinpseudarthrosen erzielten die höchste Vergütung in Italien (2.676 €), Lappendeckungen von Haut-Weichteil-Defekten in Spanien (5.506 €) und Rhizarthrosen in Schweden (5.350 €). Die durchschnittliche Vergütung der Einzelfälle betrug in Deutschland 3.211 €, Österreich 2.821 €, Italien 1.947 €, Spanien 3.594 €, Schweden 2.403 € und UK 3.253 €. Zehn von 19 Fälle hatten die höchste Vergütung in Spanien, gefolgt von Großbritannien (5 Fälle), Schweden (2 Fälle), Deutschland und Österreich (je 1 Fall).

Unter Verwendung der Fallzahlen unserer Klinik errechnete sich eine Gesamtvergütung von 2,25 Millionen € in Spanien, 1,79 Millionen € in Deutschland und UK, 1,75 Millionen € in Österreich, 1,63 Millionen € in Schweden und 1,22 Millionen € in Italien.

Die Konsequenzen internationaler Unterschiede in Effizienz und Vergütung sind schwer zu erfassen und durch zahlreiche Faktoren beeinflusst, welche oft nicht den klassischen Marktmechanismen unterliegen. Jedoch sollten internationale Daten insbesondere zum Benchmarking und zur Weiterentwicklung nationaler Vergütungssysteme berücksichtigt werden.

**Schlüsselwörter:** Diagnosis-Related Groups, Handchirurgie, Vergütung, Verweildauer, Europa

## Introduction

Reimbursement systems for hospitals are very complex and differ between countries. Diagnosis-Related Group (DRG) is a payment system that is used to classify hospital cases into groups of similar use of resources. It was created by Fetter and Thompson in Yale University in 1967 [1]. In contrast to fee-for-service payments, capitation fees and per-diem payment reimbursement, DRG is a fixed-payment system. In the last two decades, at least nine European countries have instituted payment systems for inpatient hospital care based on DRGs.

The introduction of lump sum reimbursement using the DRG system has led to profound changes in hospitals in the affected countries. The augmentation of efficiency, enhancement of transparency, price unification and reduction stand in contrast to the fear of quality loss in medical treatment and reimbursement depreciation.

The following is a brief overview of the DRG-systems of this analysis.

**German** DRGs became mandatory for the approximately 2,000 hospitals in 2004. The Institute for Hospital Remuneration System annually calculates a catalogue of case-based lump sums and defines the underlying conditions, based on data, from the year before last, from 225 reference hospitals. In 2010, a total of 1,200 DRGs for reimbursement of inpatient care, were available in Germany [2]. The **Austrian** reimbursement system was introduced in 1997 for inpatient care with each DRG consisting of a performance-component and a day-component. The first is based on costs, which can be directly assigned to patient treatment, whereas the latter depends on the length of stay. The Austrian Health Commission is responsible for the configuration and development of the system. The determinations of reimbursement and trimpoints for 2010 were based on roughly 500,000 inpatient treatments and

costs of 20 reference-hospitals. In 2010, a total of 982 DRGs were available in Austria [3]. **Italian** DRGs were introduced in 1995 and are based on the North American HCFA-DRG-System. All public and private healthcare facilities for inpatients are obliged to register. Since January 2010, a total of 538 DRGs are available [4]. DRGs in **Spain** are not used nationwide. However, the compensatory payment for Autonomous Communities (AC), when treating patients from a different AC, is based on DRG [5]. Since there are not enough hospitals with complete patient cost information, estimates rely upon Spanish case-mix data and North American weights at cost centre level. In 2010, a total of 612 DRGs were in use [6]. **Sweden** implemented the NordDRG as a payment system for acute inpatient care in 1996. The National Centre for Patient Classification System calculates the prices by using the average real cost from the previous year. Furthermore, reimbursement is determined by negotiations between purchasers and providers. There were 983 different DRGs in 2010 [7]. The **British** Payment by Results (PbR) was introduced in 2003. The currency of patient activity associated with PbR is the Healthcare Resource Group (HRG) following the same principle as DRG. Prices in the national tariff are set on the basis of the average cost of providing a particular procedure, using data gathered from all NHS hospitals. HRGs are reviewed periodically with a major revision every three to four years to ensure they reflect current clinical practice. The current version of contains 1,404 categories [8], [9].

In the following investigation, the German, Austrian, Italian, Spanish, Swedish, and British reimbursement systems are analysed in regards to inpatient treatment of common pathologies in hand surgery. Our objective was to highlight and discuss special characteristics of DRGs, both nationally and internationally. Besides the refinement of national DRG-systems, differences might have an influence on European-wide health services.

**Table 1: Top-15 hand surgical diagnoses with corresponding ICD-10 codes and their respective standard procedures with number of cases**

ICD-10	Diagnosis	Standard procedure(s)	Number of cases
M72.0	Palmar fascial fibromatosis (Dupuytren)	Partial fasciectomy and z-plasties	89
M84.14	Nonunion of scaphoid (pseudarthrosis)	Resection, interposition of corticocancellous bone graft and Herbert-screw	73
S61.0	Open wound of wrist and hand	Primary or secondary suture	67
		Full-thickness graft, random-pattern flap or axial-pattern flap	65
L03.01	Cellulitis of finger	Debridement	53
M18.1	Rhizarthrosis	Arthroplasty	49
G56.0	Carpal tunnel syndrome	Carpal tunnel release and neurolysis	39
S68.1	Amputation of one finger	Replantation	12
		Amputation	21
S64.4	Injury of digital nerve	Nerve coaptation	30
S66.3	Injury of extensor tendon at wrist and hand	Tendon repair by suture	27
S63.3	Rupture of ligament of wrist and carpus	Arthroscopic TFCC-refixation	8
		Reconstruction of scapholunate ligament (SL)	18
L03.10	Cellulitis of arm and wrist	Debridement	22
G56.2	Cubital tunnel syndrome	Release and neurolysis of ulnar nerve	21
S68.2	Amputation of two or more fingers	Replantation	5
		Amputation	15
S62.0	Fracture of the scaphoid	Osteosynthesis by Herbert-screw	20
S66.1	Injury of flexor tendon at wrist and hand	Tendon repair by suture	19

The case numbers originate from a database in our clinic considering “DRG-patients” only, i.e. patients covered by the statutory health insurance. DRGs are not applied to patients insured by the Employer’s Liability Insurance Association. As in 4 diagnoses, the therapeutic options induced 2 different DRGs each, the table above shows 19 scenarios. Following the AOP-catalogue (German ambulatory treatment catalogue) some necessitate treatment in an ambulatory setting and are not reimbursed by DRG. If certain conditions are listed in the G-AEP (German appropriate evaluation protocol) however, selected patients can be treated as inpatients and are deducted as DRG-cases.

According to our literature review, this analysis can be considered to be the first of its kind to compare reimbursement systems from practice. Unlike most health economic studies, that have their focus on the reimbursement systems as a whole, this analysis is based on concrete clinical cases in hand surgery.

## Materials and methods

We looked at the 15 most frequent hand surgical pathologies of inpatients covered by the statutory health system in our clinic in 2010 (Table 1). In 4 of the 15 pathologies, the therapeutic options induced 2 different DRGs, which resulted in 19 scenarios.

Patients covered by the employers’ liability insurance, which remunerates by daily rates and not by DRG, were excluded from our series. There were a total of 653 cases corresponding to 69% of all of our hand surgical inpa-

tients in 2010. The German diagnoses, according to the International Classification of Diseases (ICD 10) and their corresponding procedures (OPS 2010), were coded with a grouper software (ID Diacos®, Firma ID, Berlin/Germany) to obtain the respective DRGs [10], [11]. Thus, we determined the proceeds in Euro, the lower threshold of length of stay (lLoS), the average length of stay (aLoS) and the upper threshold of length of stay (uLoS).

The data was then transferred to the Austrian, Italian, Spanish, Swedish and English patient classification systems. Respective national grouper software was applied to obtain the proceeds and trimpoints. The official software package KDoK® 6.0 was used for the comparison with the Austrian system whilst for Italy, the online-grouper of qbgroup® (Padova/Italy) Version 24 was applied [12], [13]. The Spanish data sets were processed with the 3M AP-Grouper® Version 23, 3M (Barcelona/Spain) [14]. Swedish NordDRGs were identified by using the online-grouper of DRG System Development AB® (Stock-

**Table 2: Thresholds of length of stay of the top-15 hand surgical diagnoses**

	D			AT			I	S	UK
	LLOS	ALOS	ULOS	LLOS	ALOS	ULOS	ULOS	ULOS	ULOS
Palmar fascial fibromatosis	2	4.2	8	1	2.6	4	4	15	4
Nonunion of scaphoid	2	4.2	8	2	3.0	5	4	8	5
Open wound of wrist and hand -suture	2	3	6	1	2.3	3	12	12	4
Open wound of wrist and hand -flap	4	10.9	24	1	2.3	3	12	12	11
Cellulitis of finger	2	4.9	10	2	3.9	6	22	13	6
Rhizarthrosis	2	3.5	6	3	5.0	8	12	12	5
Carpal tunnel syndrome	2	2.8	5	2	3.6	5	4	12	3
Amputation of 1 finger - replantation	3	9.9	19	1	2.5	4	12	7	37
Amputation of 1 finger - amputation	2	3.4	6	1	2.5	4	12	7	5
Injury of digital nerve	2	4.2	9	2	3.6	5	14	12	5
Injury of extensor tendon	2	3.5	6	2	3.0	5	4	7	5
Rupture of ligament of wrist - TFCC	2	3.5	6	1	1.8	3	12	7	5
Rupture of ligament of wrist - Suture of SL	2	3.5	6	1	1.8	3	12	7	5
Cellulitis of arm and wrist	2	4.9	10	2	3.9	6	22	13	6
Cubital tunnel syndrome	2	4.2	9	2	3.6	5	14	12	20
Amputation of ≥2 fingers - replantation	6	17.3	33	1	2.5	4	12	7	37
Amputation of ≥2 fingers - amputation	2	3.4	6	1	2.5	4	12	7	5
Fracture of the scaphoid	2	3.5	6	1	2.3	3	4	7	5
Injury of flexor tendon	2	3.5	6	2	3.0	5	4	7	5
Minimum	2.0	2.8	5.0	1.0	1.8	3.0	4.0	7.0	3.0
Mean	2.4	5.2	9.9	1.5	2.9	4.5	10.7	9.7	9.4
Maximum	6.0	17.3	33.0	3.0	5.0	8.0	22.0	15.0	37.0

LLOS = lower threshold of length of stay, ALOS = average length of stay, ULOS = upper threshold of length of stay  
 D = Germany, AT = Austria, I = Italy, S = Sweden, UK = United Kingdom  
 No values are given for Spain

holm/Sweden) [15]. In the British system, Healthcare Resource Groups (HRGs) were derived from the official HRG4 2010/2011 Local Payment Grouper [16]. The reimbursement was determined by using the national tariff under PbR funding policy [17]. The principle of grouping was the same in all six countries and among all software products: a clearly defined record called Minimal Basic Data Set containing information such as date and kind of admission, date and kind of discharge as well as patient-centred and medical data was necessary to define a DRG. For conversion of Swedish Kronor (SEK) and Great Britain Pound (GBP) into Euro (€), the mean exchange rate of 2010 was applied (11.10 SEK = 1 €, 0.858 GBP = 1 €) [18].

For consistency of the data, we assumed a 50-year-old male patient without any complications or relevant comorbidities. We conformed to the official coding guidelines of the respective country. Purchasing power parities (PPPs) were used to make reimbursement between the countries comparable. The purchasing power indicates how many money units are necessary to acquire the same quantity and quality of goods and services abroad as inland [19].

## Results

### Length of stay (LoS)

The thresholds of LoS are shown in Table 2. The lower threshold (lLoS) in Germany lies at 2 days with the exception of replantation of a single finger (3 days), multiple fingers (6 days) and wound coverage by flaps (4 days). These also show high values concerning the average length of stay (aLoS) which usually stays within 3 to 5 days. The upper threshold (uLoS) reveals the widest range with values between 5 and 33 days (mean 9.9 days). The highest uLoS is found with reconstructive flap coverage of wounds and multiple finger replantations in Germany. In Austria, the lLoS averages 1.5 days (range 1–3 days), the aLoS shows values between 1.8 and 5.0 days (mean 2.9 days), and the uLoS ranges between 3 and 8 days (mean 4.5 days). Unexpectedly, trapeziometacarpal arthritis shows the highest value for all three thresholds in Austria. The lowest values in this country are found with ligamentous injuries of the wrist. In Italy, Sweden and the UK, only the uLoS is recorded. Italy shows a mean value of 10.7 days (range 4–22 days), whereas Sweden has an average value of 9.7 days (range 7–15 days) and the UK of 9.4 days (range 3–37 days). A high upper

threshold is found for cellulitis in Italy (22 days), Dupuytren’s disease in Sweden (15 days) and replantations in the UK (37 days). No thresholds are given in the Spanish DRG-system.

### Single-case reimbursement

Regarding single-case reimbursement in the six countries, 14 out of 19 cases show higher reimbursement in Germany when compared to Italy. However, in comparison to Spain, only 3 cases revealed higher reimbursement. In Austria, remuneration of 13 cases was higher than in Italy and only 2 cases showed higher reimbursement in Sweden when compared to Spain. In this latter country, all cases have higher values when compared to Italy. Overall, Spain has the highest values in 80 cases when compared to each of the other countries. Further relations between the countries are shown in Table 3. Single-case reimbursement is illustrated in Figure 1. In Germany, Austria and the UK, the highest reimbursement was reached by multiple finger replantation (13,825 €, 10,576 € and 9,198 €). The lowest value was represented by the carpal tunnel syndrome in Germany (1,529 €), single or multiple digit amputations in Austria (829 €) and simple wound closures in the UK (1,351 €). Scaphoid non-union accounts for the highest (2,676 €) and the carpal tunnel syndrome for the lowest (786 €) reimbursement in Italy. Flap coverage reached the highest reimbursement in Spain (5,506 €) whereas the carpal tunnel syndrome represented the lowest (2,435 €). In Sweden, the trapeziometacarpal arthritis was at the top end (5,350 €) but single and multiple finger amputations of one or multiple digits show the lowest remuneration (1,919 €). The mean values for single-case reimbursement were as follows: Germany 3,211 €, Austria 2,821 €, Italy 1,947 €, Spain 3,594 €, Sweden 2,403 € and UK 3,253 €. The biggest margin was found in Germany (1,529 €–13,825 €) as compared to Italy with the lowest margin (786 €–2,676 €). The biggest discrepancy of single case reimbursement was present in replantation of multiple fingers with the highest value in Germany (13,825 €) and the lowest value in Italy (1,910 €).

### Total proceeds

Total proceeds per diagnosis are calculated by multiplying the number of cases in 2010 by the proceeds per case in the respective country (Figure 2). The biggest margin was seen in Austria (12,435 €–512,200 €) and the lowest margin was found in Italy (11,575 €–195,348 €). When total proceeds per diagnosis are compared internationally, the biggest margin was present in flap coverage of open wounds (97,500 €–512,200 €) and the lowest with lesions of ligaments of the wrist and carpus (18,040 €–30,170) as well as cellulitis of the arm and wrist (41,954 €–61,123 €).

The total revenue per country was determined by adding the total proceeds per diagnosis. In doing so, 1.79 million € was calculated for Germany, 1.75 million €

for Austria, 1.22 million € for Italy, 2.25 million € for Spain, 1.63 million € for Sweden and 1.79 million € for the United Kingdom.

Reimbursement was adjusted by purchasing power parities (PPPs) to make the reimbursement between the countries comparable. One Euro that is earned in Germany is worth 6.2% less in Austria, 11.3% less in Italy, 4.0% less in Spain, 4.5% less in Sweden and 4.4% less in the UK [20]. Therefore, total proceeds increase by almost 110,000 € in Austria, 137,000 € in Italy, 90,000 € in Spain, 73,000 € in Sweden and 79,000 € in the UK.

**Table 3: Comparison of single-case reimbursement between the six countries**

	D	AT	I	ES	S	UK
D	–	6	5	16	14	7
AT	13	–	6	14	13	11
I	14	13	–	19	12*	13
ES	3	5	0	–	2	6
S	5	6	5*	17	–	9
UK	12	8	6	13	10	–

D = Germany, AT = Austria, I = Italy, ES = Spain, S = Sweden, UK = United Kingdom

The value shows the number of cases which are reimbursed higher in the country of the column as compared to the country of the row

\*Two cases are reimbursed equally which results in a total amount of 17 instead of 19

## Discussion

We analysed the reimbursement modalities and trim-points of length of stay (LoS) of six European countries regarding inpatient treatment of common pathologies in hand surgery.

### Length of stay (LoS)

The upper threshold of length of stay (uLoS) was given in five of the six countries analysed whereas the average (aLoS) and lower (lLoS) thresholds existed only in the German and Austrian DRG-systems. Especially the absence of the lower threshold bares the risk of so-called “bloody discharges”, due to economic motivation of dismissing a patient without having to fear a penalty deduction. The mean upper threshold of the case vignettes in this analysis is highest in Italy (10.7 days) and lowest in Austria (4.5 days) which is similar to the average LoS of all inpatients in the respective countries [21]. The main reason for the missing uLoS in Spain was due to the fact that only a small amount of insufficient data on the period of hospitalization was available and that this cannot be compensated by North American data. Some aberration in the upper threshold was found for Dupuytren’s contracture (15 days) and carpal tunnel syndrome (12 days) in Sweden, cellulitis of the finger as well as cellulitis of the

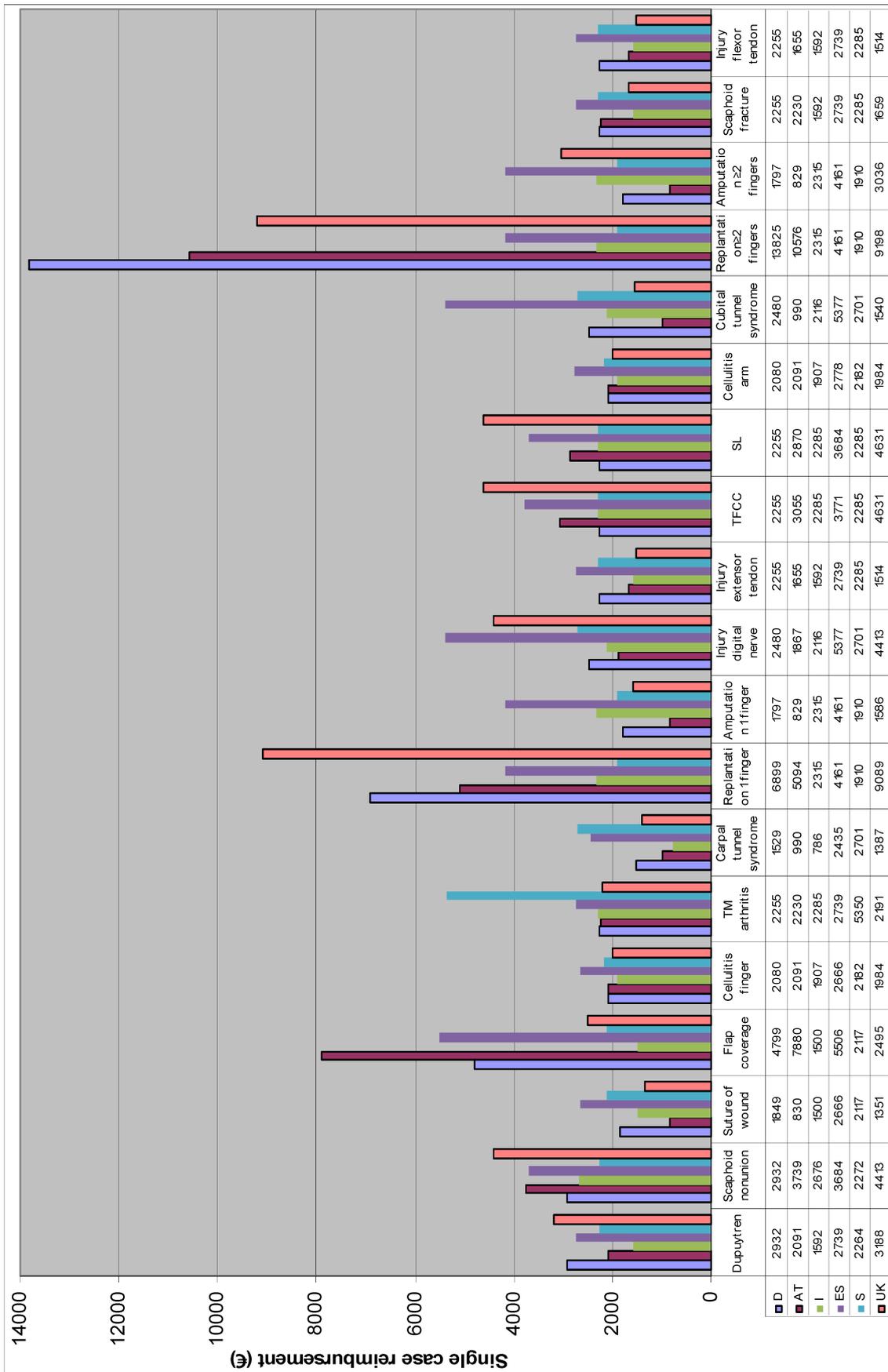


Figure 1: Comparison of single-case reimbursement of the top-15 hand surgical diagnoses

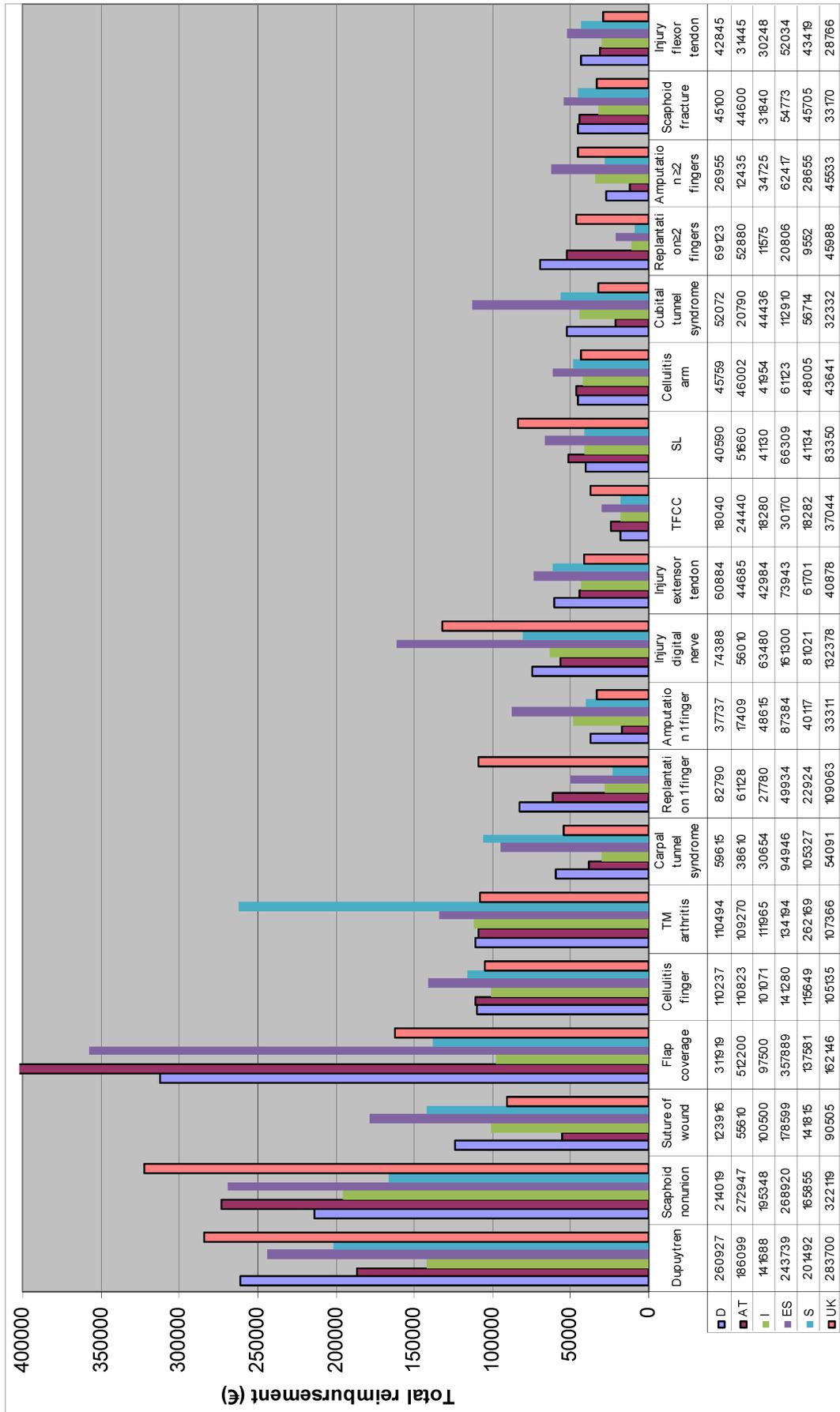


Figure 2: Comparison of total proceeds of the top-15 hand surgical diagnoses

arm and wrist in Italy (both 22 days), replantation of one or more fingers (37 days) as well as cubital tunnel syndrome (20 days) in the UK. When compared to the same diagnosis in other countries, the upper thresholds varied dramatically.

## Single-case reimbursement

A comparison was made between the countries for each DRG case, revealing that Spain had the highest reimbursement values for the majority of single case comparisons. As shown in Figure 1, upward spikes are present in flap coverage of wounds in Austria, trapeziometacarpal arthritis in Sweden, replantations in Germany, Austria and the UK and amputations as well as the ulnar nerve compression syndrome at the elbow in Spain.

No distinction in reimbursement between suture/flap in wounds and amputation/replantation of one or multiple fingers was made in Italy and Sweden. This seems rather illogical as there is compelling evidence for differences in resource consumption between the therapeutic options above. In contrast, discrimination in Germany, Austria and the UK is present and related to the degree of severity of the diagnosis and complexity of treatment. In Spain, this distinction was true for suture/flap in wounds only but not for amputation/replantation. Generally, the countries that showed some higher discrimination between the scenarios of this analysis were accompanied by a greater choice of DRGs for hand surgical pathologies. Germany, Spain and the UK offered a choice of 10, 9 and 10 DRGs respectively, in contrast to Austria (6 DRGs), Italy and Sweden (8 DRGs each). In connection with this, it is worth pointing out that the total number of German and British DRGs is more than twice of that in Italy and around one quarter higher than that of Austria and Sweden. Spain was the only exception, thus showing an overrepresentation of hand surgical DRGs in relation to all DRGs in this country.

## Total proceeds

Spain reached the highest total of proceeds with 2.25 million €, followed by 1.79 million € in Germany and the United Kingdom, 1.75 million € in Austria, 1.63 million € in Sweden, 1.22 million € in Italy. The main drivers of total revenue were flap coverage of wounds in Germany, Austria, and Spain, scaphoid nonunion in Italy and the UK, and trapeziometacarpal arthritis in Sweden. Consideration of purchasing power parities (PPPs) caused the largest increase of total proceeds in Italy without changing the relation above.

Patient mobility gives rise to some fundamental information requirements about the nature of the services offered in different countries. Furthermore, international comparison of detailed data is an important tool for learning from best practice within and between countries. However, many of the required data is not routinely available for individual treatments and no universally accepted methodology exists. Up to now, comparisons have been usually

made at an aggregate level from a macro-economic view and analysis of services at a micro-level have not been considered. In this respect, we were able to show for the first time the differences in six European countries regarding hand surgery.

The comparison of reimbursement by DRG between countries was made difficult through numerous variables such as different structural conditions, human resources and factors related to efficiency and organisation. The numbers above are identified by calculation, without being able to take the “soft facts” into account. No correlation was found between quantitative macroeconomic key figures and our data. This, we believe, is due to the fact that health care systems normally do not underlie the principles of free economic markets and prices are influenced by decision makers and lobbyism, thus they are partially “politically wanted”. In summary, the results leave the impression that the German, Austrian and British DRG-systems have higher levels of discrimination than the other three countries, which often do not distinguish between cases of different resource consumption.

The consequences of international differences are hard to decipher. Within the scope of proceeding globalization of health care services, local and regional situations could lead to exploitation of price differences and finally to equalization [21]. Assimilations already exist in some EU countries with common borders, which are mostly facilitated by low monetary and non-monetary transaction costs (short distance, language, information advantage) [22]. Furthermore, transparency of health services within the EU is of growing interest. If DRG-based information is relevant regarding this matter, it must be analysed.

## Conclusion

In today’s dynamic world of health care, the consideration of international data for the benchmarking and refinement of a national compensation system should be a useful instrument and each country should learn from the other. Political decisions and country specific cost data have been the golden standard for countries, but with growing globalisation of the world’s economies, an international approach is inevitable.

Our data suggests that the differences among the countries might undergo some growing equalization, especially in view of the progressing integration of European healthcare systems coupled with the increasing influence of free market mechanisms in the healthcare sector.

## Notes

### Competing interests

All named authors hereby declare that they have no conflicts of interest to disclose.

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