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A Bibliometric Evaluation of Publications in Urological Journals among European Union Countries between 2000–2005

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Abstract

Objectives: To perform a bibliometric evaluation of publications from European Union (EU) countries in the international urological journals between 2000–2005 according to their national origin and in relation to international context.

Methods: Articles except reviews, editorials, letters, and reports published during 2000–2005 in 19 international urological journals were screened using Web of Science database. The total number of publications and the cumulative impact factor were determined for the first 15 EU member states (EU15), the USA, and the world. These data were related for every country to the population size and the socio-economic indicators gross domestic product, gross domestic expenditure on research and experimental development, and expenditure on health care.

Results: A total of 19.709 articles were published of which 6.878 (34.9%) came from the EU15 countries and 7.927 (40.2%) from the USA. About 15% of all papers from the EU15 countries were in collaboration with USA researchers. In the EU, the number of publications and the cumulative impact factor were dominated by United Kingdom, Germany, and Italy with about 52% of all papers and 50% of the cumulative impact factor. If adjusted for demographic and socio-economic factors the smaller countries Austria, Denmark, Finland, the Netherlands, and Sweden (alphabetical order) revealed a distinctly higher publication rate.

Conclusions: This study based on bibliometric analyses in urological journals demonstrated a feasible solution to validate and compare the contribution of the various EU countries towards the urological research.

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1. Introduction

Bibliometry is a valuable tool to measure scientific activities at individual, department, university, and national level mainly by assessing statistics of publications provided by medical databases. Relevant parameters include number of publications during a time period, the impact of those publications related to the impact factor of the respective journal (IF), and the citation frequency of published articles [1,2]. These criteria could be considered as indicators of the quantity and quality of research productivity although limitations of the criteria like the IF or the citation analysis should always be taken into account [1,3–5]. National and international comparison of one discipline and between disciplines delineates strengths and weaknesses thus giving objectives and implications to governments. Against the background of limited research resources benchmarking in research is progressively gaining importance. While bibliometric analyses for several biomedical disciplines in Europe have been published data on comparative publication activity in urology among European countries are to date not available [2,6–11].

In view of this situation, we decided to perform a bibliometric analysis of international urological journals between 2000–2005. For the purpose of availability and completeness of data only the original 15 member countries of the European Union (EU15) (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom) were included in this study since the other countries joined the EU in the period of evaluation. The aims were to (1) examine the quantity and quality of publications of the EU15 countries using the criteria total publication number and IF, (2) analyse these bibliometric parameters in relation to population size and the socio-economic indicators gross domestic product (GDP), gross domestic expenditure on research and experimental development (GERD), and expenditure on health care (HCE), and (3) compare the results between the EU15 countries, USA, and the world.

2. Materials and methods

2.1. *Data collection and search strategy*

Nineteen urological journals were included in our study as they met the following criteria: 1) indexed in Thomson Web of Science, Journal Citation Reports (JCR) under the subject category "Urology&Nephrology" with impact factors during 2000–2005, 2) included in the databases PubMed and Web of Science, respectively, 3) English language (Table 1). The Web of Science database has the advantage of listing the institutional addresses of all authors while PubMed only refers to the first author's institution [6,10]. Specifications were made for articles

Table 1 – List of international urological journals with their impact factors analysed in this study[a]

Journal	Journal impact factors per annum						Mean impact factor between 2000–2005
	2005	2004	2003	2002	2001	2000	
Prostate	3.602	4.331	3.278	3.151	3.407	3.754	3.587
Journal of Urology	3.592	3.713	3.297	3.030	3.190	2.896	3.286
European Urology	3.542	2.651	2.247	1.798	2.304	2.058	2.433
European Urology Supplements	3.536	2.701	–	–	–	–	3.119
World Journal of Urology	2.285	2.186	1.341	1.664	1.138	1.119	1.622
BJU International	2.247	2.089	1.642	1.613	1.426	1.690	1.785
International Journal of Impotence Research	2.186	1.987	3.063	2.539	1.950	2.413	2.356
Urology	2.139	2.585	2.782	2.456	2.762	2.489	2.536
Urologic Clinics of North America	2.070	1.721	2.484	2.222	1.949	1.710	2.026
Neurourology and Urodynamics	1.934	3.652	2.927	2.537	2.266	1.968	2.547
International Urogynecology Journal	1.907	1.510	1.911	1.415	–	–	1.686
Journal of Endourology	1.500	1.552	1.262	1.035	1.172	1.227	1.291
Urological Research	1.367	1.113	1.017	1.103	0.950	0.993	1.091
Asian Journal of Andrology	1.302	1.096	1.064	0.824	–	–	1.072
Prostate Cancer and Prostatic Diseases	1.143	1.144	0.685	0.459	0.497	0.646	0.762
Urologic Oncology-Seminars and Original Investigations	1.067	1.378	1.167	0.818	–	–	1.108
Scandinavian Journal of Urology and Nephrology	0.677	0.743	0.612	0.847	0.722	0.448	0.675
International Journal of Urology	0.629	0.670	0.683	0.485	0.509	0.817	0.632
Urologia Internationalis	0.585	0.564	0.525	0.471	0.504	0.394	0.507
Mean impact factor	1.964	1.968	1.777	1.582	1.680	1.641	1.796

[a] The journals indexed in the subject category "Urology & Nephrology" of the Journal Citation Reports of the ISI Web of Science were arranged according to their impact factors for 2005. Further details on the inclusion of these journals in this study see text.

Table 2 – Data on inhabitants and socio-economic parameters used for the calculations of the adjusted values in Figs. 2 and 3. All values are mean values for the years 2000–2005 except for HCE that applies for 2003.

Country	Inhabitants (10^6)	Gross domestic product (Euro $\times$ 10^9)	Gross domestic expenditure on research and experimental development (Euro $\times$ 10^9)	Expenditure on health care (Euro $\times$ 10^9)
Austria	8.21	225.7	4.94	16.1
Belgium	10.44	273.2	5.19	20.6
Denmark	5.41	188.8	4.83	11.6
Finland	5.24	145.2	5.05	9.4
France	62.37	1,575.2	34.34	140.4
Germany	82.50	2,154.8	54.30	174.3
Greece	11.07	151.3	0.92	10.4
Ireland	4.11	133.2	1.55	9.1
Italy	58.46	1,312.7	14.57	84.9
Luxembourg	0.45	25.1	0.42	1.4
Netherlands	16.31	467.2	8.22	39.3
Portugal	10.53	135.8	1.00	8.9
Spain	40.03	761.4	7.99	46.1
Sweden	9.01	268.0	10.59	22.6
United Kingdom	60.03	1,660.7	31.22	128.7
EU, total	384.17	9,478.3	185.13	723.8

according to source title, publication year, address, and publication type. Only original articles but not editorials, reports, reviews, and letters were considered. The journal ''Current Opinion in Urology'' was excluded since its contributions were reviews.

The EU15 countries were evaluated to each other, the EU15 community as group, USA, and the world. The country of origin was defined as the country from which one author originates. The same article could be registered for more than one country thus giving credit to every participating author. To address the issue of transatlantic collaboration and collaborating publication within Europe a separate search was undertaken.

The population size, GDP, GERD, and HCE were retrieved for every country from EUROSTAT database annual statistics (http://epp.eurostat.ec.europa.eu). All values are mean values for the years 2000–2005 except for HCE that applies for 2003 (Table 2).

2.2. *Data calculation*

Each publication was counted once for every country in which the institution of the author was located. The number of articles for each journal, year, and country was additively determined so that collaborative publications were counted more than once (EU15-cumulative). To avoid multiple counting each country was singularly screened. The category EU-net subsumes publications excluding duplicates due to European cooperation. The sum of the articles published multiplied with the IF of the individual journal and year was defined as cumulative IF.

Following indicators were calculated for each country and for the EU15 and World: total number of publications and summed IF of the publications, percentage values within the groups (EU15, World), ratios of number of publications or IF to the number of inhabitants (million population), GDP (Euro $\times$ 10^9), GERD (Euro $\times$ 10^9), and HCE (Euro $\times$ 10^9).

Statistical analysis was performed with SPSS 14 for Window (SPSS Software, München, Germany). Unless otherwise stated, the Student's t-test was used.

3. Results

3.1. *Publication activity related to the numbers of publications by journal and country*

The contributions from each country in each journal were counted. Detailed information is given in Table 3 and Fig. 1. Table 4 summarizes the total number of publications for each country and shows the per cent values related to the EU15 community and World. A total of 19.709 original articles were counted. 34.9% (EU15-net:6.878) came from the EU15 and 40.2% (7.927) from USA. United Kingdom, Germany, and Italy were the leading countries with 51.7% of all EU15 publications and 20.8% of world's scientific output in urology.

Concerning the individual journals, the ''Prostate'' had 34.4% and the ''Journal of Urology'' 25.3% solely from EU15 authors. Five journals (''European Urology'', ''European Urology Supplements'', ''BJU International'', ''World Journal of Urology'', ''Scandinavian Journal of Urology and Nephrology'') were dominated by European publications with more than 50% of all publications. ''European Urology'' and ''European Urology Supplements'' published the highest number of European papers (77.1%, 75.6%). ''BJU International'' had 47.7% of their contributions from authors from UK while 49.4% of articles in ''Scandinavian Journal of Urology and Nephrology'' came from Sweden or Denmark. Interestingly, only

Table 3 – Publications between 2000–2005 in international urolological journals by urologists of the EU15 countries, USA, and the World[a]

Journal[b]	Number of publications in the respective countries and groups																		
	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Luxem-bourg	Nether-lands	Portugal	Spain	Sweden	UK	EU-cum	EU-net	USA	World
Prostate	35	16	6	23	27	68	6	11	33	0	31	4	16	58	39	373	321	519	932
J Urol	83	46	52	50	159	287	30	32	176	0	148	1	61	125	270	1520	1358	3056	5372
Eur Urol	77	83	18	28	177	279	37	9	189	0	159	12	68	66	136	1338	1022	139	1325
Eur Urol Suppl	9	16	7	0	13	28	1	2	13	0	25	1	4	4	38	161	130	34	172
World J Urol	19	7	1	2	10	108	7	0	17	1	21	0	7	13	26	239	1320	436	2308
BJU Int	41	34	57	34	87	140	19	32	115	0	108	6	36	74	715	1498	214	140	386
Int J Impot Res	1	6	9	4	18	39	8	1	47	0	18	0	24	13	40	228	722	1854	3131
Urology	97	20	14	25	82	161	34	4	114	1	92	4	24	31	112	815	31	338	378
Urol Clin N Am	7	1	0	0	8	7	0	0	2	0	6	0	0	0	5	36	160	110	350
Neurourol Urodynam	3	6	12	4	10	16	0	2	18	0	28	0	2	23	52	176	54	80	195
Int Urogynecol J	1	2	8	0	3	3	1	1	4	0	7	0	0	5	20	55	197	534	969
J Endourol	9	2	2	5	26	48	27	1	20	0	13	1	3	8	50	215	150	55	388
Urol Res	3	0	11	9	6	61	11	3	14	0	13	0	4	10	17	162	36	22	289
Asian J Androl	0	2	1	3	0	15	0	0	4	0	0	2	2	2	11	42	122	112	259
Prostate Cancer PD	2	5	4	2	14	17	1	2	12	0	15	1	8	4	65	152	20	142	183
Urol Oncol-Semin Ori	1	1	0	0	5	6	1	1	2	0	1	0	3	1	2	24	389	50	610
Scand J Urol Nephrol	4	6	73	31	12	32	9	7	29	0	20	0	22	155	62	462	66	37	1017
Int J Urol	0	1	0	0	3	11	9	4	13	0	3	0	2	1	20	67	364	40	831
Urol Int	11	4	0	4	10	97	31	0	140	0	13	0	21	1	41	373	202	229	614
All Journals	403	258	275	224	670	1423	232	112	962	2	721	32	307	594	1721	7936	6878	7927	19709

[a] Each publication was counted once for every country in which the institution of the author was located so that collaborative publications were counted more than once (grouped as EU15-cum = EU15-cumulative). These multiple counts were removed in the grouped values of EU15-net and World indicating the net total publications.
[b] Journals indicated by their abbreviations were arranged as in Table 1.

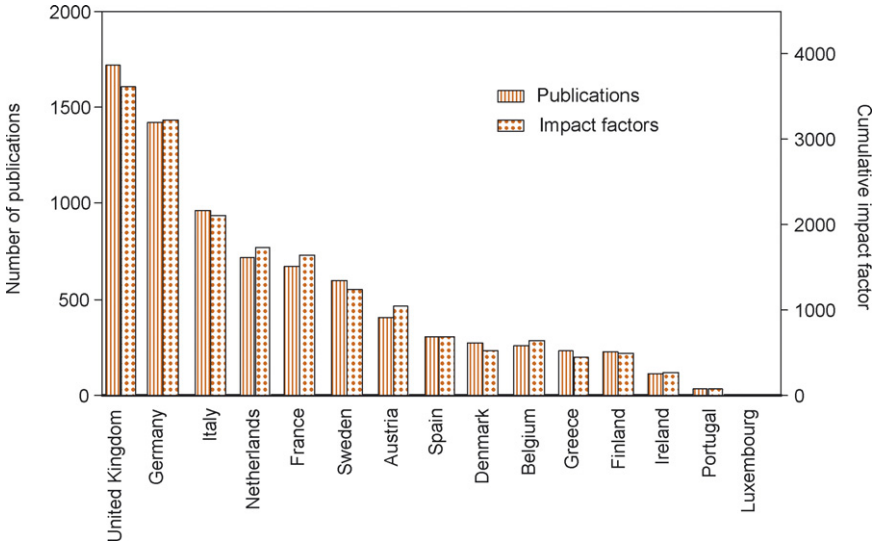

Fig. 1 – Publications and cumulative impact factors in urological journals by authors from European Union countries during 2000–2005. Values correspond to the total number for each country during this period: ▥, number of publications; ▦, cumulative impact factor. Each publication was counted once for every country in which the institution of the author was located. The cumulative impact factor of a country was calculated by multiplying the number of publications in a certain journal with the journal impact factor, for each year studied, and then summing up these data from all selected journals.

Table 4 – Publications and cumulative impact factors in urological journals among the EU15 countries during 2000–2005[a]

Country	Publications[b]			Cumulative impact factor[c]			Mean impact factor[d]
	Total	Per cent EU15[e]	Per cent world	Total	Per cent EU15[e]	Per cent world	
United Kingdom	1721	21.7	8.7	3616.5	20.3	8.1	2.101
Germany	1423	17.9	7.2	3229.5	18.2	7.2	2.270
Italy	962	12.1	4.9	2106.1	11.9	4.7	2.189
The Netherlands	721	9.1	3.7	1738.2	9.8	3.9	2.411
France	670	8.4	3.4	1639.9	9.2	3.7	2.448
Sweden	594	7.5	3.0	1245.6	7.0	2.8	2.097
Austria	403	5.1	2.0	1042.7	5.9	2.3	2.587
Spain	307	3.9	1.6	686.3	3.9	1.5	2.235
Denmark	275	3.5	1.4	529.3	3.0	1.2	1.925
Belgium	258	3.3	1.3	647.7	3.6	1.4	2.510
Greece	232	2.9	1.2	448.2	2.5	1.0	1.932
Finland	224	2.8	1.1	497.7	2.8	1.1	2.222
Ireland	112	1.4	0.6	264.1	1.5	0.6	2.358
Portugal	32	0.4	0.2	76.2	0.4	0.2	2.381
Luxembourg	2	0.0	0.0	3.9	0.0	0.0	1.941
EU15-cum	7936		40.3	17772		39.6	2.239
EU15-net	6878		34.9	15208		33.9	2.211
USA	7927		40.2	20881		46.5	2.634
World	19709			44896			2.278

[a] To facilitate the legibility of data countries were arranged according to the total publications.
[b] Each publication was counted once for every country in which the institution of the author was located so that collaborative publications were counted more than once (grouped as EU15-cum = EU15-cumulative). These multiple counts were removed in the grouped values of EU15-net and World indicating the net total publications.
[c] The cumulative impact factor of a country was calculated by multiplying the number of publications in a certain journal with the journal impact factor, for each year studied, and then summing up these data from all selected journals during 2000–2005.
[d] Ratio of the cumulative impact factor to the total publication number.
[e] Percentages were related to EU15-cumulative values.

Table 5 – Shared publications in urological journals for EU countries and USA between 2000–2005[a]

Country	Publications		
	Number	Per cent of total publications[b]	Per cent of shared publications[c]
United Kingdom	215	12.5	22.2
Germany	190	13.3	19.6
France	100	14.9	10.3
The Netherlands	92	12.7	9.5
Italy	83	8.6	8.6
Sweden	82	13.8	8.5
Austria	69	17.1	7.1
Denmark	42	15.2	4.3
Finland	24	10.7	2.5
Belgium	24	9.3	2.5
Spain	20	6.5	2.1
Ireland	11	9.8	1.1
Greece	9	3.9	0.9
Portugal	6	18.5	0.6
Luxembourg	1	50.0	0.1
	All	Mean ± SD	
	968	14.5 ± 10.6	6.7 ± 6.7

[a] To facilitate the legibility of data countries were arranged according to the number of publications.
[b] Percentage values were calculated as ratios of the number of shared publications in column 2 to the total number of publications of the respective country given in Table 4.
[c] Percentage values were calculated as ratios of the number of shared publications in column 2 to all shared publications given in the last line of this table.

four journals (''Journal of Urology'', ''European Urology'', ''BJU International'', ''Urology'') contained 61.6% of all urological publications in the analysed period.

Table 5 displays shared publications with USA. About 15% of all publications of the EU15 countries were in collaboration with USA urologists. United Kingdom, Germany, France, and the Netherlands showed similar high percentage values of shared articles (12.5–14.9%).

3.2. *Impact factor-related evaluation of publication activity*

The arithmetic mean (SD; range) IF of the evaluated journals was 1.796 (0.949; 0.394–4.331) (Table 1). Comparable figures for other JCR categories were calculated considering that the evaluated journals in our study represented 80% of all journals in the subject category. Under these conditions, mean IFs of the journals in the JCR categories ''Biochemistry&Molecular Biology'', ''Oncology'', and ''Medicine, general&internal'' were significantly higher (4.034 ± 0.154; 3.211 ± 0.519; 2.52 ± 0.367; $p < 0.001$) while the IFs for ''Orthopaedics'' and ''Surgery'' were significantly lower (1.140 ± 0.160; 1.519 ± 0.111; $p < 0.0001$ and $p = 0.014$).

The cumulative IF calculated for each country is shown in Table 4 and Fig. 1. The mean IF (SD; range) of the EU15 countries was 2.239 (0.212; 1.925–2.587) with a clear tendency (t-test; $p = 0.0614$) to a higher value compared with the mean IF of the journals. The corresponding mean IF of USA was significantly higher (2.634; $p < 0.0001$, one sample t-test). The rank order of the EU15 countries was about the same for total publication output and IF with United Kingdom, Germany, and Italy on the top (Table 4, Fig. 1).

3.3. *Publication activity in relation to population and socio-economic factors*

The number of publications and the cumulative IF showed strongly significant correlations ($p < 0.001$) with the population size ($r_S = 0.78$; 0.77), GDP ($r_S = 0.93$; 0.94), GERD ($r_S = 0.90$; 0.93), and HCE ($r_S = 0.93$; 0.94). Fig. 2A–D displays the scientific output of all EU15 countries measured as total publication number and cumulative IF in relation to the population size and the socio-economic parameters GDP, GERD, and HCE. The ranking of countries after adjusting for these factors differed strikingly from the ranking by total publication number or cumulative IF. Countries dominated at total number of publications or cumulative IF (Table 4, Fig. 1) revealed lower values in this context. This shift favouring the smaller nations like Austria, Denmark, Finland, Netherlands, and Sweden becomes especially evident if population-adjusted publication data are referred to GDP, GERD, or HCE per person (Fig. 3A–C).

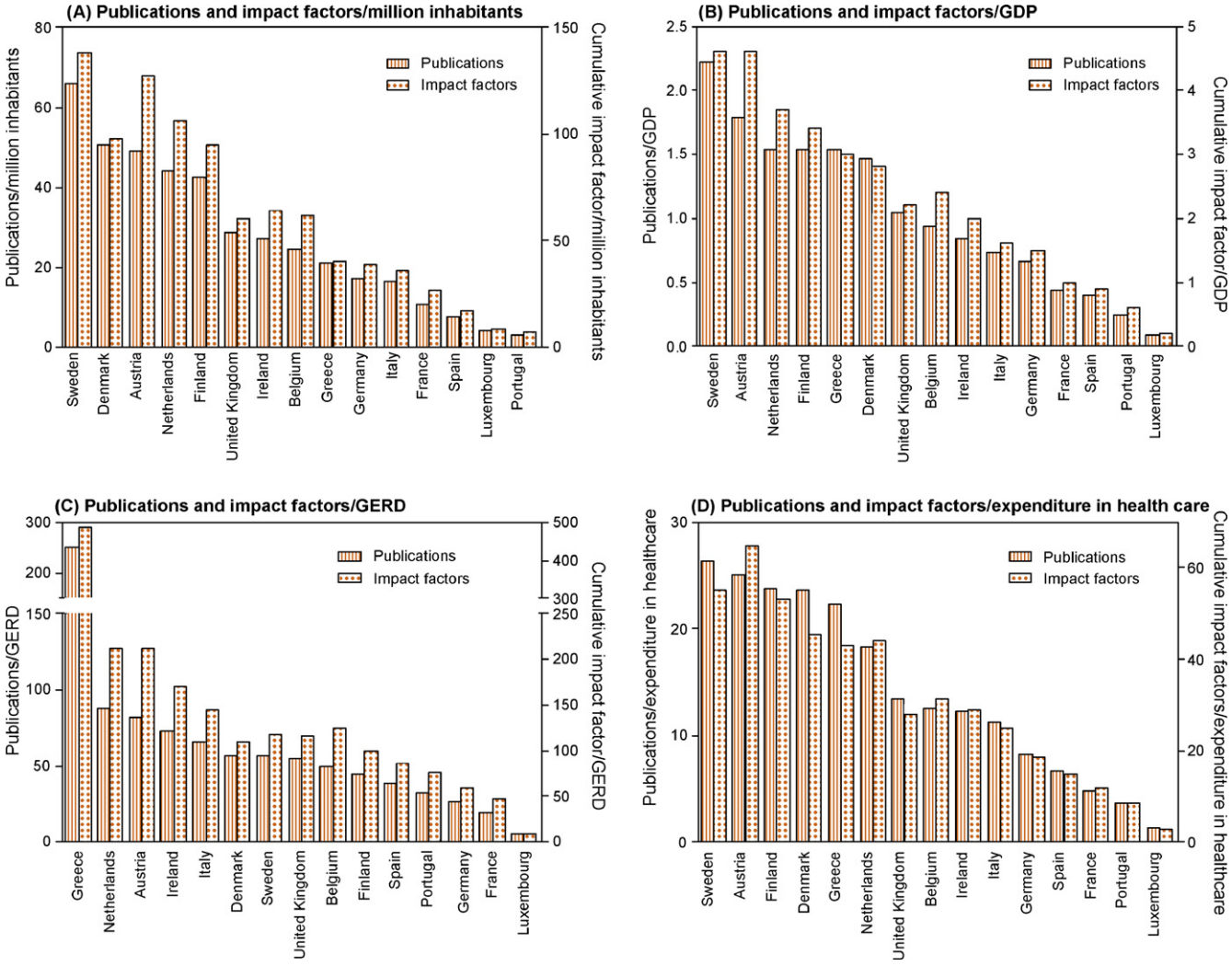

Fig. 2 – Publications and cumulative impact factors in urological journals by authors from European Union countries during 2000–2005 (A) per million inhabitants, (B) per gross domestic product (Euro × 10^9), (C) per gross domestic expenditure on research and experimental development (Euro × 10^9), (D) per expenditure on health care (Euro × 10^9). Values correspond to the total number for each country during this period: ▥, number of publications; ▭, cumulative impact factor. Each publication was counted once for every country in which the institution of the author was located. The cumulative impact factor of a country was calculated by multiplying the number of publications in a certain journal with the journal impact factor, for each year studied, and then summing up these data from all selected journals.

4. Discussion

This is to our knowledge the first published study evaluating the publication output in urology among European countries, USA, and the world. As outlined in the Introduction results of bibliometric analyses should always be critically interpreted due to their general and specific limitations to characterize research output. In order to assess the results of our study correctly various limitations should be considered and briefly discussed.

First, only urological journals of the JCR subject category ''Urology&Nephrology'' were taken into account whereas articles with urological data are also published in non-urological journals. Those articles either refer to problems of general clinical interest or are significant contributions to basic science research. Authors may submit their articles to other than urological journals in order to achieve a higher IF. However, all these topics are generally published, often in a more specifically urological connection, in urological journals if they are really important for urology. That phenomenon of publication characteristics was also shown in surgical journals [12]. In addition, searching after articles with urologic content in the highly-ranked journals ''Lancet'', ''New England of Medicine'', ''British Medical Journal'', and ''JAMA'' resulted in only about

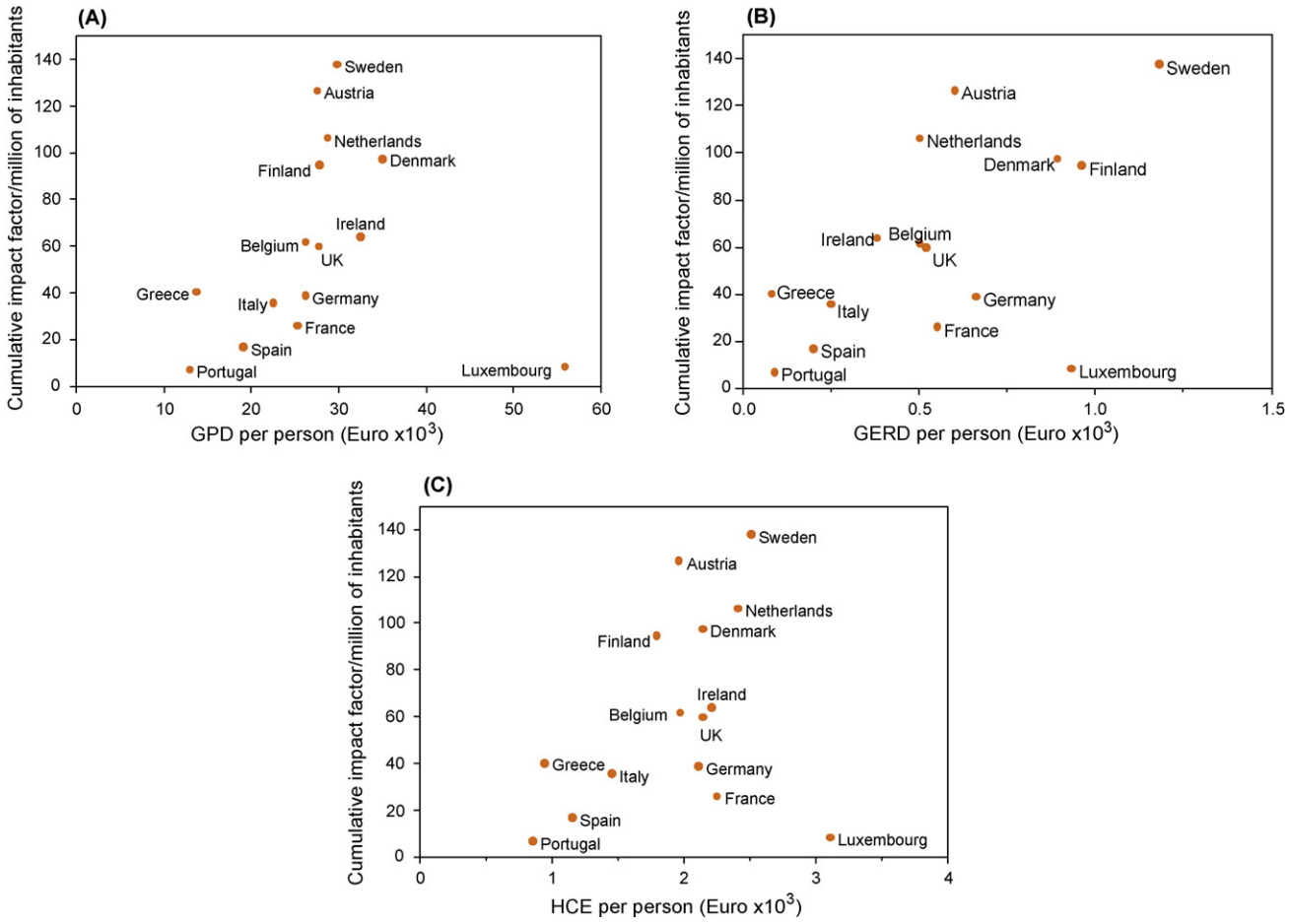

Fig. 3 – Publication activity of the European Union countries in urological journals during 2000–2005 shown as function of the national socio-economic factors. The publication activity, measured as the ratio of the cumulative impact factors to million of inhabitants is shown as function of the (A) gross domestic product, (B) gross domestic expenditure on research and experimental development and (C) health care expenditure, in each case per person. Further details see text and Fig. 2.

1% of all articles published by the EU15 countries in urological journals during 2000–2005. Bibliometric analyses in other clinical disciplines similarly proved that results of category-oriented assessments of publications would not be substantially changed if discipline-specific articles published in other journals were additionally considered [13,14]. Therefore, it can be assumed that the publication activity in the urological journals provides valuable information concerning the research in urology. Second, only English-language journals were considered. Nonetheless, good research work may be published due to language limitation in non-English speaking journals. That fact, for example, may mainly put Germany and France at disadvantage in comparative studies whose journals ''Urologe'', ''Aktuelle Urologie'', ''Progress en Urologie'', and ''Annales D Urologie'' were not considered. A distortion of results should be disregarded because the last three journals have only 6 annual issues and all these journals are primarily devoted to further education and transmission of practical information but not to original research. In contrast, ''BJU International'' and the ''Scandinavian Journal of Urology'' as journals with 40–50% of all contributions from UK and Nordic countries, respectively showed a bias towards these countries due to their certain local relatedness. Third, although bibliometric data are generally used to evaluate science activities, no standard is available. Different evaluation methods give different results. Citation frequency analysis often regarded as reliable approach is essentially influenced by the counting methods, the national bias in citations, and journal prestige [3,4,15,16]. We used the simple approach based on the quantity of publications combined with the IF. There are serious objections to use IF as indicator for research output [4,5,17]. But a detailed discussion about the advantage and disadvantage of this criterion is beyond the aim of this article [5]. Alternative criteria instead of IF have been recom-

mended [18–20]. However, the IF remains an easily accessible measure. Moreover, the use of IF as quality indicator of research output becomes questionable if and only if that criterion is applied to compare different research fields or scientific disciplines due to the range of variation of IF [15]. Comparative figures calculated for other subject categories as shown in the Results confirmed that disciplines more basic science-oriented have higher IFs, but the mean IF of top urological journals is rather higher than the IF of the comparable disciplines like orthopaedics or surgery. Although the bibliometric comparison between different disciplines was not the aim of our study, that aspect of discipline-dependent IF has to be considered. In our study, the cumulative IF can be generally expected to be more suitable in characterizing the quality achieved by the corresponding nation than by using only the publication number. Furthermore, there was a strong correlation between the number of publications and the cumulative IF (Figs. 1 and 2). Finally, the study included only the E15 countries in comparison with the USA and the world. While the contributions of authors from the new member and candidate EU countries might be limited, there were numerous urological articles from Switzerland and Norway. A citation analysis of German-speaking urologic authors during 1998–2000 proved a high number of citations of articles of Swiss authors [21].

Despite all these shortcomings, this study provides verifiable information and deeper insight into the publication activity as indicator of urological research among EU15 countries. The main findings of this survey can be summarized as follows: 1. More than one third of all original articles in international urological journals were contributed by authors from the EU15 countries while about 15% of contributions were in collaboration with USA institutions. 2. About 50% of all EU15 publications and of cumulative IF came from United Kingdom, Germany, and Italy. 3. The publication output of the smaller countries as Austria, Denmark, Finland, the Netherlands, and Sweden (alphabetical order) related to population and socio-economic parameters exceeded that of large nations.

More than 75% of articles in the leading urological journals came from the EU15 countries and USA. The remarkable proportion of 15% of publications done in transnational cooperation refers to a merging scientific landscape in urology research. The EU15 countries contributed to about 35%, the USA about 40% of the worldwide urological publication during our study period. Similar contributions of 32–40% by the EU countries were also observed in other medical disciplines like oncology, rheumatology, neurology, virology, respiratory and critical care medicine, cardiopulmonary and infectious diseases, and epidemiology between 1995 and 2003 (reviewed in [22]). A recent bibliometric study comparing the publications of the EU15 countries and USA in nine biomedical fields (biology and biochemistry; clinical medicine; immunology; microbiology; molecular biology and genetics; multidisciplinary; neuroscience and behaviour; psychiatry and psychology, pharmacology and toxicology) showed a proportion of 51.5% in favour of USA (EU15: 48.5%) [2].

Focussing on the distribution of the urological publications among the EU15 countries the large nations provided the highest shares resembling the values reported in other disciplines (Table 4). For example, most publications in clinical chemistry, biomedicine, and oncology in the EU15 countries between 1995–2003 were from United Kingdom (19.8, 24.2, 19.1%), Germany (15.1, 19.6, 14.3%), Italy (11.0, 10.2, 18.7%), and France (9.6, 14.1, 13.7%) [2,7,10]. There are only two, but very limited reports evaluating the publication activity of urologists from other countries [23,24]. The contribution of Spanish urologists evaluated only in 1992 was 1.18% of all articles published in the journals ''Journal of Urology, ''Urology'', and ''British Journal of Urology''. The results are similar to our data (Table 4). Japan's publication output between 1991–2000 was evaluated in the three ''Prostate'', ''Journal of Urology'', and ''Urology'' [24]. Japan's share accounted for 6% of all articles comparable with its contribution of 6.6%–11.4% in journals of basic medical science, cardiovascular diseases, orthopaedics, and nuclear medicine [25–28].

The rank order of the EU15 countries completely changed, when the publications were normalized by adjustments to population size or the socio-economic variables GPD, GERD, and HCE (Figs. 2 and 3). Small countries (Austria, Denmark, Finland, Netherlands, Sweden) had a higher normalized publication output than larger ones, such as United Kingdom or Germany. These data are consistent with figures ascertained in other disciplines such as clinical chemistry, rheumatology, respiratory and infectious diseases between 1995–2003, but also with regard to the total biomedical publications in the EU during 1990–1998 [9–11,29]. A concentrated allocation of funds to specific research areas and a better utilisation of resources in these countries might be the reason for this effect. Since the subsidies especially awarded for the urological research in the various countries are not known, further conclusions are not reasonable. Besides the socio-economic parameters the number of urologists may influence the research activity of a country. But

insufficient data did not allow investigating that problem.

Using the parameter cumulative IF instead of the publication number, both as absolute number or normalized, similar ranking results were obtained (Figs. 1 and 2). This phenomenon is due to the very narrow range of IF between the various EU15 countries (Table 4). Such a uniform IF distribution as found in our study is only typical in well-focused, clearly defined medical specialities [15]. The higher mean IF of EU15 countries compared with that of the evaluated journals (2.239 vs. 1.796) proved the preference of EU 15 urologists to publish in journals with higher impact factors. But they did not reach the values of the USA urologists (2.239 vs. 2.634). This observation corresponds to findings in other medical fields, such as infectious diseases, rheumatology, and anaesthesia [9,11,30].

5. Conclusions

This survey demonstrated that a bibliometric analysis of publications in international urological journals can serve as a useful rational approach to benchmark the research activities among European nations. Geographical distribution of scientific performance must not only be analysed in absolute terms but also in relation to complementary variables such as population, GDP, GERD, HCE in order to provide a more realistic view. The study accredited the great significance of European research in urology. The knowledge of the substantial role that European research plays in urology could help to consolidate confidence of researchers promoting and launching future projects.

Conflict of interest

The authors declare no conflicts of interest.

References

[1] King DA. The scientific impact of nations. Nature 2004; 430:311–6.
[2] Soteriades ES, Falagas ME. Comparison of amount of biomedical research originating from the European Union and the United States. BMJ 2005;331:192–4.
[3] Grange RI. National bias in citations in urology journals: parochialism or availability? BJU Int 1999;84:601–3.
[4] Schulman CC. What you have always wanted to know about the impact factor and did not dare to ask. Eur Urol 2005;48:179–81.
[5] Brown H. How impact factors changed medical publishing–and science. BMJ 2007;334:561–4.
[6] Skram U, Larsen B, Ingwersen P, Viby-Mogensen J. Scandinavian research in anaesthesiology 1981–2000: visibility and impact in EU and world context. Acta Anaesthesiol Scand 2004;48:1006–13.
[7] Mela GS, Cimmino MA, Ugolini D. Impact assessment of oncology research in the European Union. Eur J Cancer 1999;35:1182–6.
[8] Garcia-Rio F, Serrano S, Dorgham A, et al. A bibliometric evaluation of European Union research of the respiratory system from 1987–1998. Eur Respir J 2001;17:1175–80.
[9] Mela GS, Cimmino MA. An overview of rheumatological research in the European Union. Ann Rheum Dis 1998; 57:643–7.
[10] Fuentes-Arderiu X, Lacambra MJ. Publications in clinical chemistry journals in the European Union. Clin Chim Acta 2005;362:189–91.
[11] Ramos JM, Gutierrez F, Masia M, Martin-Hidalgo A. Publication of European Union research on infectious diseases (1991–2001): a bibliometric evaluation. Eur J Clin Microbiol Infect Dis 2004;23:180–4.
[12] Adusumilli PS, Chan MK, Ben-Porat L, et al. Citation characteristics of basic science research publications in general surgical journals. J Surg Res 2005;128:168–73.
[13] de Jong JW, Schaper W. The international rank order of clinical cardiology. Eur Heart J 1996;17:35–42.
[14] Boldt J, Maleck W, Koetter KP. Which countries publish in important anesthesia and critical care journals? Anesth Analg 1999;88:1175–80.
[15] Epstein RJ. Journal impact factors do not equitably reflect academic staff performance in different medical subspecialties. J Investig Med 2004;52:531–6.
[16] Bakkalbasi N, Bauer K, Glover J, Wang L. Three options for citation tracking: Google Scholar. Scopus and Web of Science. Biomed Digit Libr 2006;3:7.
[17] Bollen J, Rodriguez MA, Va de Sompel H. Journal status. Scientometrics 2006;69:669–87.
[18] Barnaby DP, Gallagher EJ. Alternative to the Science Citation Index impact factor as an assessment of emergency medicine's scientific contributions. Ann Emerg Med 1998;31:78–82.
[19] Ramirez AM, Garcia EO, Del Rio JA. Renormalized impact factor. Scientometrics 2000;47:3–9.
[20] Hirsch JE. An index to quantify an individual's scientific research output. Proc Natl Acad Sci U S A 2005;102:16569–72.
[21] Neumann R. Zitationsvergleich 1998–2000: Urologie. http://www.biotech-europe.de/rubric/ranking/R03_06/start.html (Accessed April 22, 2007).
[22] Falagas ME, Michalopoulos AS, Bliziotis IA, Soteriades ES. A bibliometric analysis by geographic area of published research in several biomedical fields, 1995–2003. CMAJ 2006;175:1389–90.
[23] Perez Arbej JA, Cameo Rico MI, Arnaiz EF, et al. Impact of Spanish-language urological publications in periodicals in the English language. Arch Esp Urol 1997;50:427–32.
[24] Rahman M, Sakamoto J, Fukui T. Japan's share of research output in urology and nephrology. Int J Urol 2003;10:353–5.

[25] Rahman M, Sakamoto J, Fukui T. Japan's contribution to nuclear medical research. Ann Nucl Med 2002;16: 383–5.
[26] Rahman M, Sakamoto J, Fukui T. Japan's share of articles in orthopedics. J Orthop Sci 2002;7:607–9.
[27] Hayashino Y, Rahman M, Fukui T. Japan's contribution to research on cardiovascular disease. Circ J 2003;67: 103–6.
[28] Rahman M, Sakamoto J, Fukui T. Japan's share of research output in basic medical science. Keio J Med 2004;53:172–7.
[29] Hefler L, Tempfer C, Kainz C. Geography of biomedical publications in the European Union, 1990–98. Lancet 1999;353:1856.
[30] Figueredo E, Sanchez PG, Munoz BF. International publishing in anaesthesia - how do different countries contribute? Acta Anaesthesiol Scand 2003;47:378–82.