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Publications of plastic surgery research 1972 through 2004: a longitudinal trend analysis of three international journals

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Summary *Background and purpose of study:* Assessment and benchmarking of research output is becoming a necessity in the quest for research funds and grants. However, reports on the trends in international research output by plastic surgeons over the years are lacking. We longitudinally analysed plastic surgery publications over the last three decades.
Materials and methods: Data on the topic of surgical interest and the anatomical region of research, the country of origin, and the origin and number of collaborating clinics were noted for each original article published in Plastic and Reconstructive Surgery, the British Journal of Plastic Surgery, and the European Journal of Plastic Surgery in 1972, 1980, 1988, 1996, and 2004.
Main findings and Conclusions: The number of articles in three international plastic surgery journals has more than doubled over the last three decades. Reconstruction of acquired defects remained the most important topic in all three journals, but an interest in rejuvenation or aesthetic surgery seems to replace that in basic research. The head and neck area remains the anatomical region of most interest to date, but this interest has decreased substantially. Most articles still originate from the USA, but the absolute and relative number of articles originating from Europe and Asia is rapidly increasing. Also, the published output of multi-national scientific collaboration is increasing. Even though authors from larger countries, in general, contribute more publications in absolute numbers, authors from small countries have a more efficient output relative to the number of inhabitants and GDP of their country.

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Innovation is the essence of plastic surgery and research is essential for its continuity and improvement. Plastic surgery research involves a wide variety of clinical and experimental studies regarding congenital or acquired defects and aesthetic or rejuvenation challenges. The scientific outcome of such research is publicly presented at congresses, symposia and workshops, and it is published in a variety of national and international journals. To date, very few studies have evaluated the scientific research output in plastic surgery,[1,2] and only one study compared the original articles that were published in Plastic and Reconstructive Surgery, the Annals of Plastic Surgery and the British Journal of Plastic Surgery, in 2002.[3] Reports on the trends of international research output by plastic surgeons over the years, however, are lacking. Because assessment and benchmarking of research output is progressively becoming a necessity in the quest for research funds and grants,[4] we longitudinally analysed the publications on plastic surgery over the last three decades. We evaluated which countries were leading, to what extent clinics collaborated, and what topics were addressed in the original contributions published in three international, peer-reviewed plastic surgery journals, from 1972 through 2004.

Materials and methods

Selection of data sources

Plastic and Reconstructive Surgery (PRS), the British Journal of Plastic Surgery (BJPS) and the European Journal of Plastic Surgery (EJPS) were selected as data sources because all feature a wide spectrum of plastic surgical topics without the restriction to a certain topic of interest like microsurgery or aesthetic surgery. To assess longitudinally the trend in research over the past three decades we sampled five publication years at 8 year intervals: 1972, 1980, 1988, 1996, and 2004. Because volumes of EJPS do not necessarily parallel calendar years, all issues that were published in the sample years were included regardless of their volume number.

For our analysis we included all original articles, case reports, ideas and innovations, and follow-ups or updates published in each sample year, in all three journals. Editorials, letters-to-the-editor or correspondence, and short reports published in the correspondence sections of the journals were excluded in line with the Institute for Scientific Information's methodology of establishing the Impact Factor of publications (ISI® Thomson Scientific, Philadelphia, PA, USA).[5]

Data acquired per publication

For each of the included publications we noted the topic of surgical interest and the anatomical region of interest,[6] the country of origin, and the number and origin of collaborating clinics. All publications were scored by one of the authors (M.P.J.L.) to prevent inter-rater bias. To score the topic of surgical interest distinction was made between five areas.

1. Basic or experimental research (e.g. animal or anatomic studies),
2. Congenital defects (e.g. cleft or club hand),
3. Acquired defects (e.g. posttraumatic or oncologic reconstruction),
4. Aesthetic and rejuvenating surgery (e.g. chemical peeling or reduction abdominoplasty), and
5. Management and philosophy (e.g. grant application or historical articles).

Whenever the article dealt with two or three separately defined topics of interest, it was accordingly scored in two or three categories. All articles that dealt with more than three topics, as well as articles featuring topics that did not fit one of the previous descriptions were scored in the 6 — 'miscellaneous or non-applicable' category.

The topic was further scored in accordance to the anatomical region of primary interest:

1. head and neck,
2. breasts,
3. abdomen,
4. rest of thorax or trunk,
5. urogenitalia,
6. upper extremity,
7. lower extremity, or
8. whole body

in case the topic concerned more than three of the anatomical regions. Again, articles that dealt with two or three anatomical regions were scored in two or three categories. For all topics that did not fit one of these definitions, e.g. in case of reports on experimental research or practise management, the region was scored as 9 — miscellaneous or non-applicable.

The country of origin was defined by the address of the first author, whereas the addresses provided for all authors were noted to establish the number and origin of collaborating clinics. A single-clinic

origin was scored in cases where all the contributing authors came from the same hospital or institute, whether from a single department or from more than one department in that institute. Hence, a multi-clinic origin was scored if the contributing authors came from more than one institute. To assess possible trends in international collaboration over the years, we noted if the addresses of the authors came from more than one country.

Statistical analysis and calculation of weighted contribution per country

All data were entered onto a computerised spreadsheet using Microsoft Excel (Microsoft Corp., Redmond, Washington, DC, USA), and statistical analyses were performed using SPSS 12.01 (SPSS Inc., Chicago, IL, USA). Observed and expected frequencies in each category were compared by chi-square test and statistical significance was determined at $p < 0.05$. To allow for weighted comparison among the countries of origin we calculated the ratio between the number of publications from a certain country and the number of inhabitants in that country, in each sample year. Finally, we calculated the ratio between any country's number of publications and its gross domestic product (GDP) in billions of US dollars for each sample year. The resident population and GDP of each country in the sample years were retrieved from the annual statistic reviews of the International Monetary Fund,[7] Eurostat,[8] and the United Nations.[9] From these data, we composed three top-10 lists for each of the five sample years: one of the 10 countries with the highest absolute number of publications in any given sample years; a second list of the 10 countries with the highest number of publications relative to their number of inhabitants; and a third list of the 10 countries with the highest number of publications per GDP. Based on the number of times a country was mentioned in these 15 listings and a comparison of the absolute and relative scores among the countries in these lists, we determined a top-10 of countries that quantitatively contributed most to the published output of plastic surgery research.

Results

Trends in number of articles

A total of 2234 articles were assessed, with approximately twice as many articles published annually in PRS, than in both European journals together ($p < 0.001$). The annual number of articles in the three journals more than doubled from 312 in 1972, to 660 in 2004 (Table 1). This increase was strongest in EJPS (+175%), but the increase in both European journals together was lower (+89%) than that in PRS (+121%).

Table 1 Number of articles per sample year, per journal

Journal	1972	1980	1988	1996	2004	Total
PRS	219	242	246	329	484	1520
BJPS	73	84	109	102	121	489
EJPS	20	27	39	84	55	225
Total	312	353	394	515	660	2234

Trends in topics of surgical interests

The 2234 articles dealt with 2436 defined topics of surgical interest (1.14 topic/article). The single largest group of 1008 of 2436 scored topics (41.4%) dealt with surgery of acquired defects and, over the years, the relative contribution of these articles hardly increased ($p = 0.99$). This category had most interest in all three journals (Figs. 1–3).

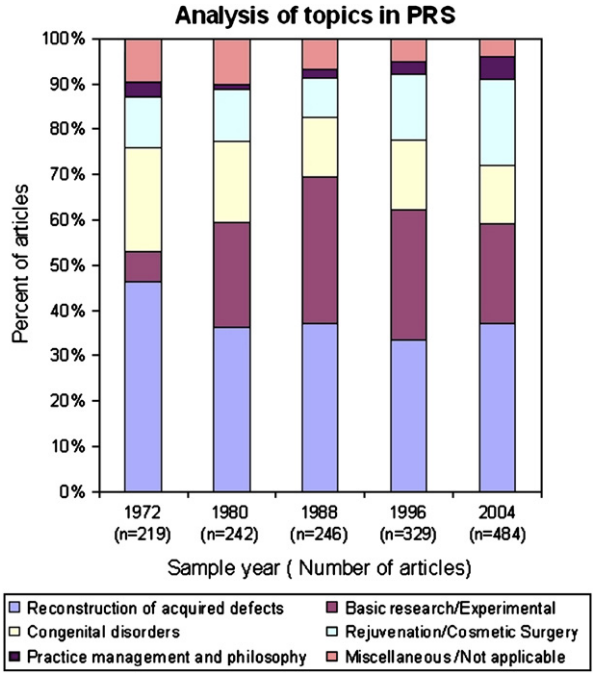

Figure 1 Analysis of articles in PRS according to the topics of surgical interest discussed, over the years. The number of articles on each category is provided as a percentage of the total number of topics scored in PRS in each sample year.

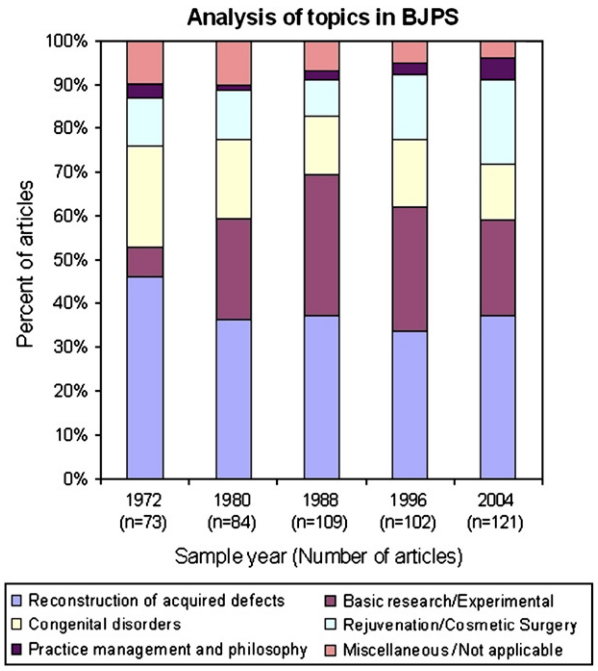

Figure 2 Analysis of articles in BJPS according to the topics of surgical interest discussed, over the years. The number of articles on each category is provided as a percentage of the total number of topics scored in BJPS in each sample year.

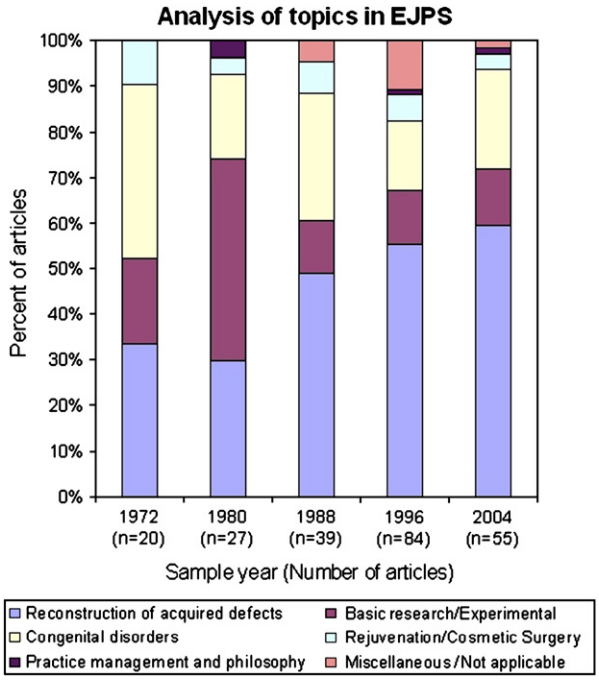

Figure 3 Analysis of articles in EJPS according to the topics of surgical interest discussed, over the years. The number of articles on each category is provided as a percentage of the total number of topics scored in EJPS in each sample year.

The second largest category in all three journals dealt with basic and experimental research and the proportion of such articles did not differ significantly among the journals ($p = 0.46$). Over the years, the relative contribution of articles on basic research hardly increased in all three journals ($p = 0.08$) but in absolute numbers, the increase of these articles was strongest in PRS (+606%).

The third largest category of articles in PRS dealt with rejuvenation or aesthetic surgery (13.9%), but this category was significantly less represented in both other journals ($p = 0.02$). In all, the fraction of these articles increased from 33/334 scored surgical topics (9.9%) in 1972, to 107/712 (15.0%) in 2004, but not significantly so ($p = 0.43$). In contrast, the fraction of articles on congenital defects decreased from 81/334 surgical topics (24.3%) in 1972, to 107/712 topics (15.0%) in 2004. Again, this decrease was not statistically significant ($p = 0.12$).

Trends in anatomical region of interest

The 2234 articles dealt with 2369 defined anatomical regions (1.06 region/article) (Figs. 4–6). The head and neck region was and remained the anatomical region of interest in 932 of the 2369 scored anatomical regions (39.3%) but the relative contribution of these articles decreased from 169/326 in 1972 (51.8%), to 252/700 in 2004 (36,0%). This decrease was not significant ($p = 0.25$). The decrease of articles on the head and neck region was strongest in PRS (−19%).

For the second largest group of articles a categorisation in an anatomical region was not applicable, largely because they dealt with practise management and job philosophy, basic research, or miscellaneous other topics.

Over the years, the fraction of articles on the lower extremity region increased from 19/326 in 1972 (5.8%), to 64/700 in 2004 (9.1%) in all journals but, again, not significant so ($p = 0.95$). In relative numbers, this increase was strongest in EJPS (+16%).

Trends in authors' nationality and collaborations

Based on the first author's address, the 2234 articles originated from 63 different countries. Over all, 1017 of the articles (45.5%) originated from the USA. In absolute numbers, large countries such as the USA and the United Kingdom contributed more publications over the past three decades than smaller countries such as

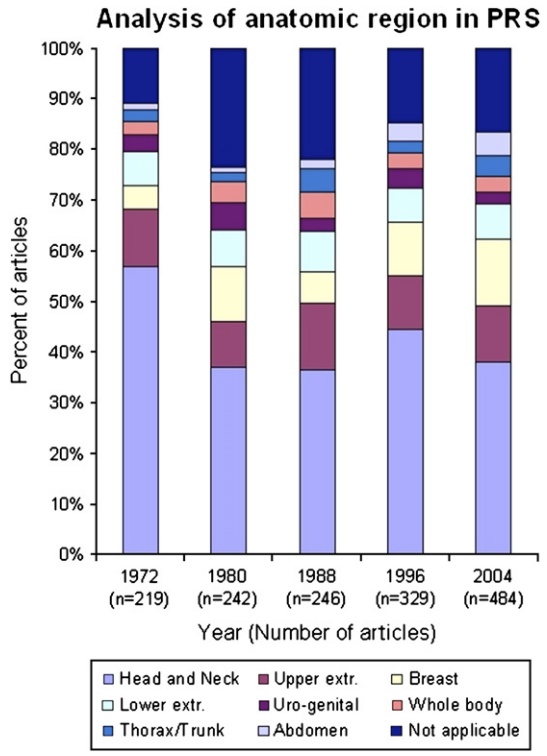

Figure 4 Analysis of articles in PRS according to the anatomical regions discussed, over the years. The number of articles on each area is given as a percentage of the total number of regions scored in PRS in each sample year.

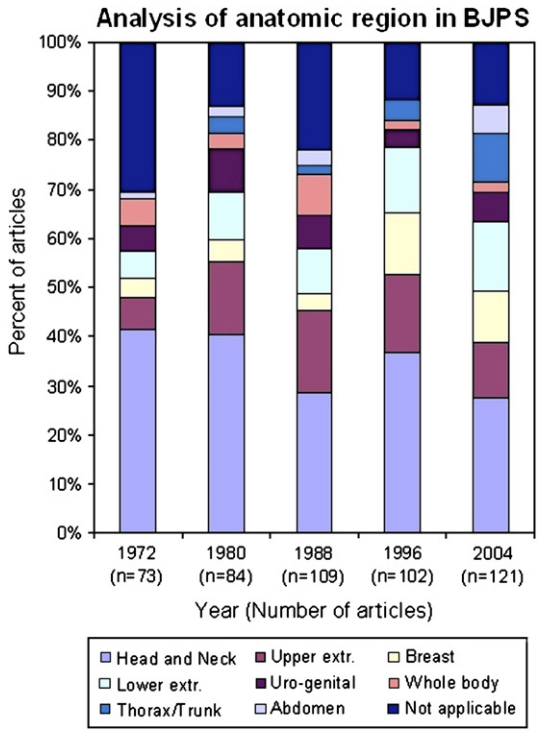

Figure 5 Analysis of articles in BJPS according to the anatomical regions discussed, over the years. The number of articles on each area is given as a percentage of the total number of regions scored in BJPS in each sample year.

The Netherlands or Austria did (Table 2). Furthermore, authors from English-spoken countries published significantly more articles in all three journals than authors from comparably large, non-English-spoken countries (e.g. authors from the United Kingdom versus those from France). Most of the articles published in PRS originated from North America, whereas most articles in BJPS and EJPS originated from European countries (Figs. 7—9). Still, Europe and Asia show the largest increase in number of articles over the years (Fig. 10).

Seven hundred and eleven of the 2234 articles (31.8%) originated from more than one clinic. The annual fraction of such multi-clinic articles increased from 79/312 in 1972 (25.3%), to 245/660 in 2004 (37.1%). This percentual increase was not significant ($p = 0.15$) (Fig. 11). Over the years, the fraction of multi-clinic articles was highest in PRS (40.3%) and authors from the USA, United Kingdom, and Canada were most often involved in writing these.

One-hundred and six of the 711 articles reflected the collaborations of authors originating from more than one country and, in absolute numbers, these multi-national contributions increased significantly in all three journals over the years. EJPS showed the highest fraction of multi-national articles (5.8%). Over all, authors from the USA most frequently co-authored the multi-national articles and they mostly collaborated with authors from Canada or Germany (Table 3).

Trends in weighted contribution per country

Large countries such as the USA, the United Kingdom, Japan, Canada, Germany, and Australia were found to attribute most consistently to the plastic surgery scientific output, but smaller countries like Israel, The Netherlands, and Switzerland also kept a respectable output (Table 4).

In terms of research output per million inhabitants or per billion GDP, smaller countries in general even contributed more articles per annum than larger ones did (Tables 5 and 6). Based on their ranking in the 15 listings of Tables 4, 5—6, small countries like The Netherlands, Austria, and Switzerland are among the countries that most efficiently contributed to publications in all three journals, over the last three decades (Table 7).

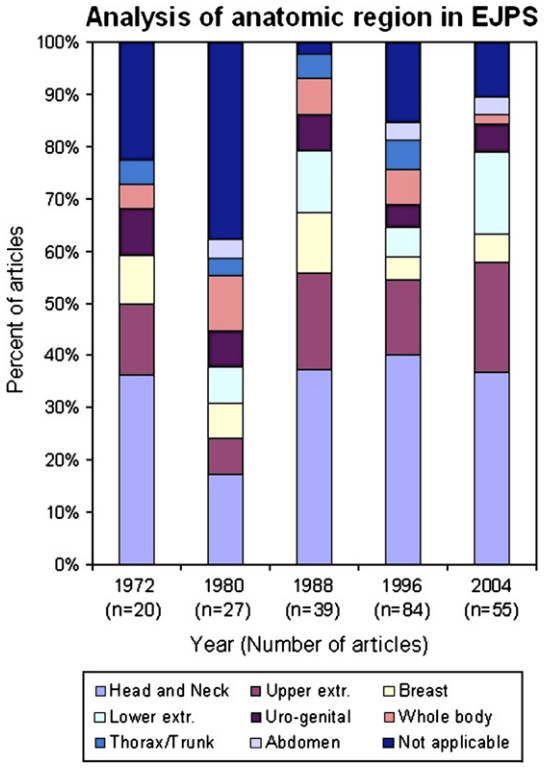

Figure 6 Analysis of articles in EJPS according to the anatomical regions discussed, over the years. The number of articles on each area is given as a percentage of the total number of regions scored in EJPS in each sample year.

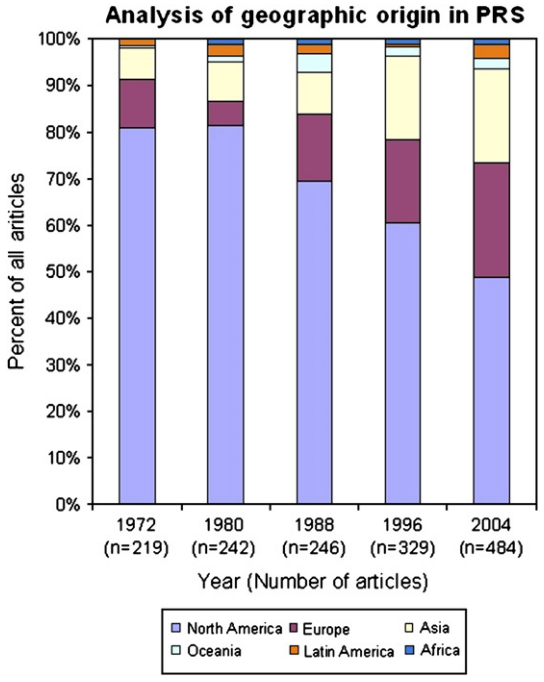

Figure 7 Analysis of articles in PRS according to their geographical region of origin, over the years. Six regions are given: North America, Latin America, Europe, Asia, Africa, and Oceania (Australia and New Zealand). The number of articles from a geographical region is shown as the percentage of all articles in PRS in that sample year.

Table 2 Top-20 of countries with the highest number of articles published in the three journals, 1972—2004

Country	Number of articles
USA	1017
United Kingdom	249
Japan	141
Canada	81
Australia	74
Turkey	70
Germany	62
Taiwan	54
Italy	51
India	48
The Netherlands	44
Austria	41
Israel	41
France	34
Switzerland	32
Belgium	30
South Korea	27
China	26
Sweden	24
Brazil	19

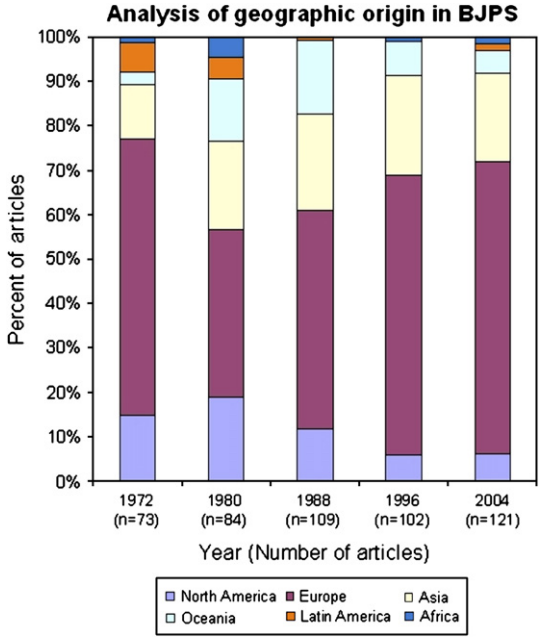

Figure 8 Analysis of articles in BJPS according to their geographical region of origin, over the years. The number of articles from a geographical region is shown as the percentage of all articles in BJPS in that sample year.

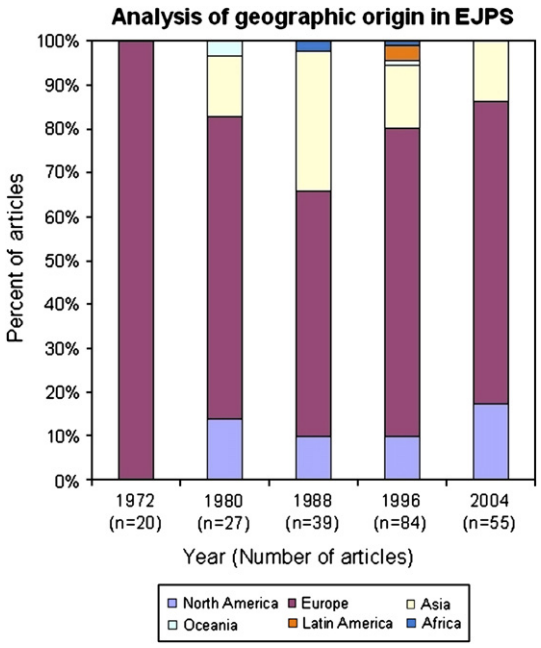

Figure 9 Analysis of articles in EJPS according to their geographical region of origin, over the years. The number of articles from a geographical region is shown as the percentage of all articles in EJPS in that sample year.

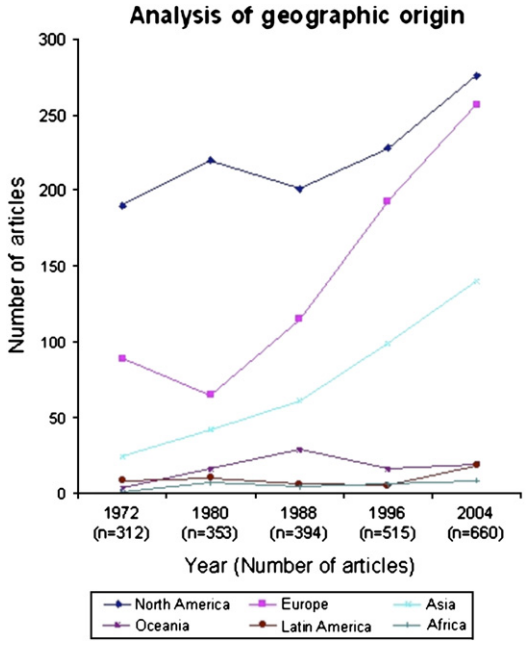

Figure 10 Analysis of articles in the three journals according to their geographical region of origin, over the years. Six regions are given: North America, Latin America, Europe, Asia, Africa, and Oceania (Australia and New Zealand).

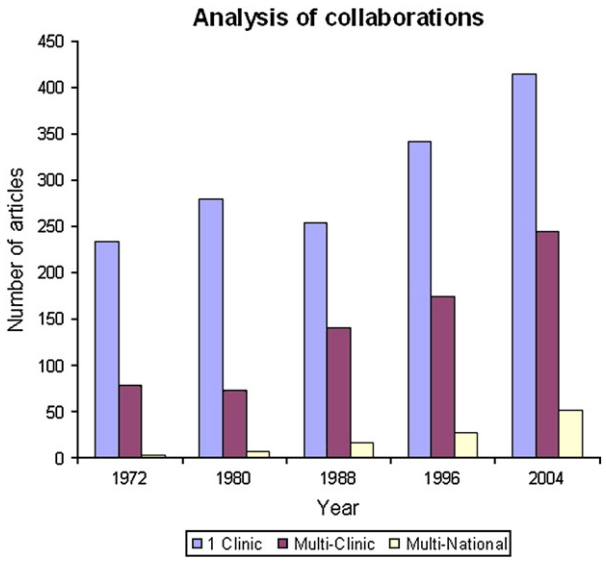

Figure 11 Fraction of articles in all three journals resulting from multi-clinic or multi-national collaborations over the years.

Discussion

Pressure is mounting on health-care systems throughout the developed world as expectations and demands exceed what can be delivered. The main reason for this is clear: the escalating growth of science and its success in offering potential benefits, coupled with a greater life expectation.[10] One of its consequences seems to be the inverse relation between market pressures on health-care delivery and research activity in medical schools.[11,12] In recent years, economic restrictions have increasingly forced governments, classically the primary supporter of basic research, to adopt policies that link science and technology programmes more closely to broad societal goals. Therefore, the assessment of research output is progressively developing and becoming a priority issue for the scientific community.[13] Although

Table 3 Analysis of 106 multi-national articles in all three journals, over the five sample years

Countries	Number of articles
USA and Canada	10
USA and Germany	5
USA and Australia	4
USA and Taiwan	4
USA and United Kingdom	4
USA and Japan	3
USA and Brazil	3
Other combinations	73
Total	106

Table 4 Alphabetically ordered top-10 of countries with the highest absolute number of articles in each of the five sample years

Country	1972	1980	1988	1996	2004
Australia		15	28	15	15
Austria	10	7			
Brazil	4				
Canada	17	12	18	19	15
China			6		
France			7		
Germany	10	7	7		26
India		11	12	14	
Israel	11	8	6		
Italy				17	24
Japan	8	22	26	47	38
Korea					20
Mexico	5				
The Netherlands			8	14	15
Switzerland	6	7	6		
Taiwan				13	36
Turkey				28	37
United Kingdom	44	22	52	60	71
United States	168	205	183	204	257

Note that the number of articles from a country is not provided when that country was not in that year's top-10.

Table 5 Alphabetically ordered top-10 of countries with the most articles relative to millions of inhabitants, in each of the five sample years

Country	1972	1980	1988	1996	2004
Australia		1.03	1.71	0.820	
Austria	1.33	0.927		0.990	1.72
Belgium				1.08	1.16
Canada	0.761	0.489	0.668		
Czech Republic	0.304				
Finland			1.01	0.780	
Ireland		0.588	0.850		2.02
Israel	3.58	2.13	1.39	0.909	1.71
Lebanon	0.383	0.375			
The Netherlands	0.225		0.542	0.900	
New Zealand	0.683				1.03
Puerto Rico			0.578		
Qatar					6.56
Singapore				0.836	0.941
Sweden				1.13	
Switzerland	0.957	1.11	0.894	0.839	0.976
Taiwan					1.59
United Kingdom	0.798	0.396	0.921	1.04	1.20
United States	0.785	0.886	0.730		
Uruguay		0.687			

Note that a country's ratio is not provided when that country was not in that year's top-10.

there are several bibliometric studies on national research performances,[4] the assessment tools to quantify and weigh research results are still subject of debate.[13]

Methodological limitations

Before we discuss the implications of our observations, some potential methodological limitations of our study need to be considered. First, we limited our study to three plastic surgery journals. Of these, PRS and BJPS were selected because both steadily featured the highest impact factor for plastic surgery journals over the study period.[5,14] Unlike Huemer and co-workers,[3] we did not include Annals of Plastic Surgery as it was first published only in 1978. We rather chose EJPS because our first sample year, 1972, was the first full calendar year when EJPS was published, albeit as Chirurgia Plastica (the name changed when Ian T. Jackson became editor-in-chief in 1986). Furthermore, EJPS was selected to try and obtain a more balanced comparison of articles in an American journal (PRS) versus those in European journals (BJPS and EJPS). This way, the influence of a broader scope of practical and surgical philosophies on publication trends could be assessed.

Second, we sampled only 5 years of the three-decades period. By including only a limited fraction of years we were able to calculate an estimate of trends rather than accurate fluctuations in publications. Consequently, we may have under- or overestimated actual publication trends. Still, the observed trends were consistent over the sample years and, therefore, we accept our observations as adequate indicators of reality.

Third, all articles were categorised only once and by one author. We did not assess potential bias

Table 6 Alphabetically ordered top-10 of countries with the most articles relative to billions of US dollars GDP, in each of the five sample years (countries that were only in one year's top-10 are not listed)

Country	1972	1980	1988	1996	2004
Australia		0.090	0.102	0.036	
Austria	0.467	0.088			
Canada	0.155		0.037		
India			0.040	0.036	
Ireland		0.096	0.083		
Israel	1.32	0.340	0.123	0.048	0.094
Lebanon	0.479	0.245			
Taiwan				0.043	0.092
Turkey			0.044	0.154	0.152
United Kingdom	0.274			0.050	
Yugoslavia				0.062	0.103

Note that a country's ratio is not provided when that country was not in that year's top-10.

Table 7 Meritocratic ordered top-10 of countries based on the number of citations and their absolute or relative values as mentioned in Tables 4—6

Country	Acquired defects	Congenital defects	Basic research	Cosmetic surgery	Practise management	Miscellaneous
1. Israel	0.49	0.15	0.12	0.12	0.00	0.12
2. United Kingdom	0.45	0.21	0.16	0.06	0.04	0.09
3. Australia	0.42	0.13	0.33	0.06	0.00	0.06
4. Canada	0.40	0.14	0.24	0.10	0.01	0.10
5. United States	0.35	0.16	0.24	0.15	0.04	0.07
6. Switzerland	0.37	0.14	0.23	0.09	0.09	0.09
7. Austria	0.54	0.20	0.22	0.02	0.02	0.00
8. The Netherlands	0.23	0.26	0.26	0.04	0.11	0.11
9. Turkey	0.48	0.28	0.19	0.01	0.00	0.04
10. Taiwan	0.68	0.16	0.05	0.05	0.00	0.05

The number of articles on each topic of surgical interest is given as a fraction of the total number of articles from that country in all three journals in the five sample years.

caused by possible inter-rater or intra-rater disagreement on the categorisation as this was not the aim of our study. Last, even though the choice of categories was inspired by the headings of the topical content page of PRS,[6] this choice is arbitrary and some articles were found to represent a combination of topics of surgical interest (e.g. an animal study and some clinical case reports to introduce a surgical technique), or of anatomic regions (e.g. the reconstruction of combined urogenital and abdominal defects by one technique). Consequently, the sum of articles scored in the various anatomical or topic categories was larger than the actual number of assessed articles. This was accepted to prevent more use of the 'miscellaneous or non-applicable' categories, enabling a more accurate reflection of the actual topics of plastic surgical research.

Trends in number of articles

The annual number of articles in the three journals increased with 112% during our 32-years assessment period. This compares to the 58.9% increase observed in the British Journal of Surgery during the 16-year period from 1983 to 1998, but it contrasts the 15.1% decrease observed in five high-rated US surgical journals during the same period.[15] An increase in published articles probably reflects an increased production of, and interest after, research data. Alternatively or additionally, it may reflect the publishers' economical interest to increase their markets by allowing more printing space to their primary clients, who are often readers and writers in one. Rather than limiting the total of pages in their journals for financial reasons, the publishers of the journals we assessed to date allowed for more pages per issue and more issues per annum. Furthermore, authors were increasingly encouraged over the years to limit the number of pages per article, allowing for more articles per issue. Moreover, items that do not contribute to the rise of the journal's ISI Impact Factor (international abstracts, congress proceedings, etc) were increasingly banned from the journals as were case reports that generally generate few to no citations, leaving more printing space for so-called ISI source items.[16]

Trends in topics of surgical interests

The choice of subjects featured in a journal reflects both the interest of the authors who submit their work, and the preference of the members of the editorial board. Over the past three decades, the fraction of articles on basic research raised from 10.5% in 1972 to 28.3% in 1988 to drop again to 19.9% in 2004. The awareness of the benefits of such research as a possible source for clinical improvement and funding resulted in a sizeable increase in the fraction of related publications during the seventies and eighties. However, after this 'publish or perish' attitude settled, the amount of reports on basic research decreased again. This compares to the basic research reports in general surgery journals, the number of which decreased with the significant decrease in government funding combined with an increase of clinical demands, from 1988 to 1998.[15,17] The pressure of managed care on academic faculty may very well have contributed to this trend.[15] This compulsory shift from basic academic research to clinical work, however, did not result in an increase of reports on clinical research (260/334 scored clinical

surgical topics (77.8%) in 1972, versus 507/712 (71.2%) in 2004).

That research follows the money may, furthermore, explain the simultaneous relative and absolute increase in the number of articles on rejuvenation or aesthetic surgery. Increasing numbers of plastic surgeons are identified as aesthetic surgeons, whereas the number of plastic surgeons who would identify themselves as reconstructive or academic surgeons is decreasing.[18] In general, the growing social interest, its reflection in the media, and the increasing number of private clinics may enhance the increased scientific interest in aesthetic surgery but, in our study, this increase was predominately explained by the increase of such articles in PRS. Again, this equally reflects a shift of interest of the editorial board of PRS as it actively made the choice in favour of such articles, in 1999, when a separate Cosmetic Section was introduced and expanded. By March of 2000, this section encompassed more than 150 of the annual pages of the journal and included an Introduction Essay, a collection of Original Articles, and additional groups of articles labelled Techniques, Special Topics, and Follow-Up.[18]

While articles in PRS seem increasingly to deal with aesthetic and rejuvenation challenges, BJPS and EJPS over the years featured an increasing fraction of articles on reconstructive surgery. Since its last change of editorship, in 2003, BJPS is even being marketed as an international journal of surgical reconstruction.[19] That both European journals feature a larger fraction of non-US articles may further explain the (still-existing) relative lack of articles on rejuvenation or aesthetic surgery. Still, the recent change of name of BJPS to the Journal of Plastic, Reconstructive and Aesthetic Surgery may well induce more interest to publish such articles.

A typical subject distribution of articles seems to have developed among authors from different countries. While 15% of all articles from the USA could be categorised as dealing with rejuvenation or aesthetic surgery, Australia had the largest ratio of publications on basic or experimental research (33%), whereas no less than 11% of all articles from The Netherlands appeared in the category 'practice management and philosophy' (Table 7).

Trends in anatomical region of interest

The head and neck region most often was the anatomical region of interest over the past three decades. This reflects plastic surgeons' interest in a highly complex region of the human body, with clinical challenges varying from reconstruction of congenital (craniofacial or velopharyngeal) or acquired (e.g. oncologic or posttraumatic) defects, to aesthetic or rejuvenation surgery. The substantial decrease of the fraction of articles on the head and neck region over the three decades, however, may reflect that other specialists such as ENT-surgeons, ophthalmologists, maxillary surgeons and even dermatologists are taking over from plastic surgeons in this anatomical region.[2]

Trends in first authors' nationality

Although US authors in the studied journals dominated the research output during the past three decades and although the absolute number of articles originating from the USA increased significantly from 168 in 1972 to 257 in 2004 ($p = 0.001$, chi-square test), the relative contribution from these authors is decreasing. Consequently, the trend line of European publication will likely cross that of the USA within the next 10 years (Fig. 10).[3] The increase of the fraction of European and Asian contributions to US based journals over the last decades, likewise, occurred in general surgical journals[15] and orthopaedic journals,[20] and comparable shifts were observed in publications on oncology,[13] dermatology,[21] neurology,[22] epidemiology,[23] anaesthesia,[24] and infectious diseases.[25] In our study, the increase of European articles mainly derived from the United Kingdom, Turkey, and Germany, while the increased number of Asian articles mainly originated from Japan and Taiwan.

We found that most articles in PRS originated from North America, whereas both European journals mainly published European contributions. The fraction of Asian publications is similar in all three journals (PRS 14.2%; BJPS 19.6%; EJPS 15.9%). Again, this may be explained by a difference in submission policy among authors, as well as by a level of bias among reviewers and editors.[3,15] Previously we showed that most articles on urogenital topics submitted to PRS originated from Turkey,[26] but there are indications that European authors mainly submit to European journals, whereas US authors mainly submit to American journals.[3] More data are required to prove these indications but this was beyond the aim of our current study.

Editorial bias, either in favour or against 'foreign' authors, may also play a role in the difference in countries of origin of articles between journals. The editorial board of PRS consists of Americans, whereas those of BJPS and EJPS consist mainly of Europeans. The lists of guest reviewers

of all three journals show a more international diversity but peer reviewers in general assess non-US submissions less favourably.[27] Increase of the geographic diversity among editorial board members does not correlate with an increase of the number of published 'foreign' articles.[15] Researchers from developing countries feel that a substantial editorial bias against their work exists,[28] and members of an editorial board are mostly recruited from high-income countries.[29] However, the theory that a low proportion of editorial advisers from developing countries is evidence of such a bias is still to be proven.[30] The low number of submitted manuscripts from foreign countries may, then, even prove to have a higher probability of acceptance, resulting in a relative increase of published articles from those countries.[3] But even when editorial bias does not actually exist, the anticipation of it may influence the submission policy of authors.

Trends in multi-clinical and multi-national collaborations

We observed an increase in multi-clinically and multi-nationally collaborating authors. Such collaborations feature various benefits. First, a multi-clinical setting may enlarge the number of patients included in a study and this might produce statistically more valid results. Second, expertise may be combined to enhance discussion and increase the article's scientific level. As holds true for other collaborations, together each achieves more in research. International collaboration, furthermore, increases the exchange of professional philosophies that tend to differ among different cultures. For non-English-speaking authors, moreover, international collaboration is a useful way to improve the linguistic qualities and, thereby, the acceptance rate of their submissions.[26,27]

In absolute numbers, US authors are most often involved in multi-national publication collaborations and in 30 out of 106 multi-national articles, a US author even acted as first author. Linguistic arguments or research affiliation with top US hospitals may be the prime motive for non-US authors, but it remains unclear what the main reasons for US authors are to seek such collaboration. Relative to the number of articles from their country, international collaboration was most often sought by authors from Jamaica (1/1 or 100%), Kenya (idem), Tanzania (idem), Honduras (idem), and Denmark (3/4 or 75%), and least practised by authors from the USA and Japan (66/1017 or 6.5% and 9/141 or 6.4%, respectively).

Trends in weighted contribution per country

That we found large countries to contribute more publications in absolute numbers than small countries is in accordance with a previous observation that authors from the United Kingdom, Germany, France, and Italy dominate the number of publications originating from Europe.[31] Likewise, that small countries do better in terms of publications per million of inhabitants and per GDP is in accordance with previous observations that the highest scientific output per country population in 1990 came from small countries like Israel, Sweden, and Switzerland,[32] and that the gross domestic research expenditure for research in 1989 was the highest in New Zealand, Denmark, Spain, Canada, and The Netherlands.[33] Although the reasons why smaller countries have a higher scientific output than larger ones are not actually known, a higher percentage of GDP allocated to research, better utilisation of resources, and a clustering of specific diseases have been suggested to explain this.[13]

We conclude that the number of articles in three international plastic surgery journals has more than doubled over the last three decades. Most articles still originate from the USA, but the absolute and relative number of articles originating from Europe and Asia is rapidly increasing. Likewise, the published output of multi-national scientific collaboration is increasing. Surgery of acquired defects remained the most important topic in all three journals and an interest in rejuvenation or aesthetic surgery seems to replace that in basic research. Authors and editors of PRS seem to increasingly favour aesthetic topics, whereas the European journals tend to publish more articles on reconstructive surgery. The head and neck area still remains the anatomical region of most interest, but this interest has decreased substantially. Even though authors from larger countries, in general, contribute more publications in absolute numbers, authors from small countries have a more efficient output relative to the number of inhabitants and GDP of their country.

References

1. Kang N, Sanders R. Plastic surgery research in the UK. *Br J Plast Surg* 2002;**55**:463—8.
2. Ismael Y, McLean NR, Kelly CG. Head and neck oncology: the UK experience. Who is publishing what? *Br J Plast Surg* 2002;**55**:570—3.
3. Huemer GM, Bauer T, Gurunluoglu R, et al. Analysis of publications in three plastic surgery journals from the year 2002. *Plast Reconstr Surg* 2004;**114**:1147—54.

4. Adams J, Griliches Z. Measuring science: an exploration. *Proc Natl Acad Sci USA* 1996;**93**:12663–70.
5. Institute for Scientific Information. *JCR: Journal Citation Reports 2003*. Philadelphia, PA: Institute for Scientific Information; 2004.
6. Rohrich RJ. Journal enhancements: an evolution. *Plast Reconstr Surg* 2005;**115**:643–5.
7. International Monetary Fund Statistics Dept, Washington DC. *International financial statistics (IFS)*. http://ifs.apdi.net/imf/ [accessed March 20, 2005].
8. Eurostat Statistics, Luxembourg. *Eurostat demographic statistics and national accounts*. http://epp.eurostat.cec.eu.int/ [accessed March 20, 2005].
9. United Nations Statistics Division, New York. *National accounts main aggregates database 1970-2003*. http://unstats.un.org/unsd/snaama/[accessed March 20, 2005].
10. Swales JD. Science and health care: an uneasy partnership. *Lancet* 2000;**355**:1637–40.
11. Moy E, Mazzaschi J, Levin RJ, et al. Relationship between NIH research awards to US medical schools and managed care market penetration. *JAMA* 1997;**278**:217–21.
12. Campbell EG, Weissman JS, Blumenthal D. Relationship between market competition and the activities and attitudes of medical school faculty. *JAMA* 1997;**278**:222–6.
13. Mela GS, Cimmino MA, Ugolini D. Impact assessment of oncology research in the European Union. *Eur J Cancer* 1999;**35**:1182–6.
14. Dellon AL, Scally AL, Kuhlemeier KV. Impact of the journal Plastic and Reconstructive Surgery. *Plast Reconstr Surg* 1992;**90**:717–22.
15. Tompkins RK, Ko CY, Donovan AJ. Internationalization of general surgical journals: origin and content of articles published in North America and Great Britain from 1983 to 1998. *Arch Surg* 2001;**136**:1345–52.
16. Hecht F, Hecht BK, Sandberg AA. The journal ''impact factor'': a misnamed, misleading, misused measure. *Cancer Genet Cytogenet* 1998;**104**:77–81.
17. Ko CY, Whang EE, Longmire Jr WP, et al. Improving the surgeon's participation in research: is it a problem of training or priority? *J Surg Res* 2000;**91**:5–8.
18. Lineaweaver WC. Standards for cosmetic surgery articles. *Plast Reconstr Surg* 2001;**108**:251–3.
19. Kay SP. Spot the difference – editorial. *Br J Plast Surg* 2003;**56**:315–6.
20. Rahman M, Sakamoto J, Fukui T. Japan's share of articles in orthopedics. *J Orthop Sci* 2002;**7**:607–9.
21. Dunst KM, Burgdorf WH, Huemer GM, et al. Analysis of original contributions in three dermatology journals. *J Am Acad Dermatol* 2005;**52**:355–9.
22. Jamieson PW. Neurology research: a journal survey, 1980–1990. *Ann Neurol* 1992;**32**:87–93.
23. Rahman M, Sakamoto J, Fukui T. Publications in epidemiology journals: Japanese perspectives. *J Epidemiol* 2003;**13**:96–8.
24. Boldt J, Maleck W, Koetter KP. Which countries publish in important anesthesia and critical care journals? *Anesth Analg* 1999;**88**:1175–80.
25. Bliziotis IA, Paraschakis K, Vergidis PI, et al. Worldwide trends in quantity and quality of published articles in the field of infectious diseases. *BMC Infect Dis* 2005;**5**:16.
26. Loonen MPJ, Hage JJ, Kon M. Who benefits from peer review? An analysis of the outcome of 100 requests for review by Plastic and Reconstructive Surgery. *Plast Reconstr Surg* 2005;**116**:1461–72.
27. Link AM. US and non-US submissions: an analysis of reviewer bias. *JAMA* 1998;**280**:246–7.
28. Horton R. North and South: bridging the information gap. *Lancet* 2000;**355**:2231–6.
29. Tutarel O. Composition of the editorial boards of leading medical educational journals. *BMC Med Res Methodol* 2004;**4**:3.
30. Wilkinson G. How international are the editorial boards of leading psychiatry journals? *Lancet* 2003;**361**:1229.
31. Anderson A. Science in Europe. *Science* 1992;**256**:472.
32. Benzer A, Pomaroli A, Hauffe H, et al. Geographical analysis of medical publications. *Lancet* 1993;**341**:247.
33. Hausen A, Reibnegger G, Wachter H. Geography of medical publications. *Lancet* 1993;**341**:634.