Publication Trends in Bariatric Surgery: a Bibliometric Study

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TITLE:

PUBLICATION TRENDS IN BARIATRIC SURGERY

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A BIBLIOMETRIC STUDY.

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CONFLICT OF INTEREST

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ABSTRACT

PURPOSES

The interest in bariatric surgery has considerably increased in the scientific community in the last two decades. We present a bibliometric analysis of scientific publications in bariatric surgery focusing on the period 2010-2014.

MATERIALS AND METHODS

We used Web of Science database as source of data. The main bibliometric indicators were applied in order to assess the increase of scientific production, the productivity of journals, authors and countries.

RESULTS

Bibliographic research retrieved 7860 papers for the period 2010 – 2014.

The scientific production in bariatric surgery has an exponential distribution (r = 97.9%). A total of 76.8% (21893/28505) of authors signed one paper and 307 (1.1%) signed 10 or more. The two most prolific journals are Obesity Surgery and SOARD, responsible of 22% of the publication. The largest contributors in absolute number of articles are USA, UK and Italy, while Sweden, Norway and Switzerland are the most prolific nations after adjustment for the number of inhabitants and prevalence of obesity.

CONCLUSION

Bariatric surgery has been a field of intense research in the last 20 years.

We observed a growing interest of non-surgical journals and an increasing participation of new countries. Nevertheless latest trends suggest a saturation of scientific production in this field.

INTRODUCTION

The last two decades have seen an exponential growth in bariatric surgery [1]. Several studies have described national trends in Europe [2-5], North America [6] and Asia [7]. Similarly, the interest of researchers in this field has been rapidly increasing. Some authors have previously reported an important increase in the number of publications on obesity with more than 50,000 references retrieved [8]. Nevertheless, little is known about scientific production in bariatric surgery, and, to our knowledge, no bibliometric analysis in this field has been published.

Bibliometrics is defined as the application of statistics and mathematics for the analysis of written publications such as books and journal articles [9]. Bibliometrics methods can be used to provide the analysis of scientific literature in a specific field in order to assess the popularity and the impact of specific publications, authors and institutions. It also permits the description of scientific networking through the analysis of relationships between academic journal citations. Several bibliometric indicators and laws are currently used to analyze the behavior of scientific production. The founding hypothesis of bibliometrics is that bibliometric indicators and scientific networks represent a mirror image of scientific activity. Thus, a bibliometric analysis of publications in bariatric surgery could outline the characteristics of research in this domain.

The aim of this study was to give an overview on scientific production in bariatric surgery with a focus over the period 2010–2014.

METHODS

Data source

The database used for data selection was Web of Science (WoS). The search strategy included the keywords “Bariatric surgery” and “Obesity surgery” with “or” as Boolean term. Only original articles and reviews published in English were retrieved. Data extraction was performed on 20 July 2015.

Economic and demographic data were collected from the World Bank database [10]. This included number of inhabitants, gross domestic product (GDP) per capita, health total expenditure and research and development total expenditure (R&D). Obesity prevalence across the world was extracted from the World Health Organization (WHO) database [11]. Data were available for the years 2008 and 2013. The impact factor (IF) and the 5-year impact factor (5y-IF) of a journal were issued from the Journal Citation Reports (JCR) in 2015.

In order to assess knowledge of the English language, we used the English First Proficiency Index (EF EPI), 2011–2014, published by EF Education First, a global language training company. The EF EPI is a score that ranks countries by the average level of English skills amongst adults. Data are collected via an English test available on the Internet. The most recent edition, released in November 2014, was compiled using test data from 750,000 test takers. In order to be included, a country was required to have at least 400 test takers in total [12-13]. The EF score was imputed to the maximum value for Native English countries.

Bibliometric indicators

Our analysis is based upon a series of bibliometric indicators and laws considered as referential.

Overall productivity

In order to evaluate the overall growth of scientific production in bariatric surgery we tested Price's law [14]. This law is probably the most common bibliometric indicator for analyzing the productivity of a specific discipline. The main hypothesis of this law is that the development of science follows an exponential growth. More exactly, the growth of a scientific domain goes through four phases. The first is called the precursors' phase, where a small body of scientists begins publishing on a new field. The second phase is the proper exponential growth, when the expansion of the field attracts an increasing number of scientists, as many aspects of the subject still have to be explored. In the third

phase, we observe a consolidation of the body of knowledge, which is followed by a decrease in the number of publications. The growth of scientific production becomes linear, so, ultimately, the aspect of the curve transforms from exponential to logistic. The fourth phase corresponds to the collapse of the domain and the important reduction of publication. Furthermore, Price suggests that science production develops at a faster pace than other human activities, duplicating its size every 10–15 years [15]. Nevertheless, the time of duplication is not the same in all scientific fields, as some disciplines grow faster than others, suggesting that science is not a homogenous bloc.

Authors' activity

Lotka's law [16] studies the relation between the number of authors and the number of publications. It supposes that the author-article relation is inversely proportional to the square of published articles. The number of scientific authors who write *i* articles is equal to: $n_i = n_1/i^2$, where $i = 1,2,3, \dots i_{max}$ (i_{max} being the maximum productivity of an author) and n_1 is the number of scientists who wrote one article ("single paper authors"). Lotka's law follows a hyperbolic distribution, meaning that a large number of researchers publish a few articles (heart of the curve) and a few publish many (dispersion of the curve). If the hyperbolic distribution of Lotka's law is generally accepted, the exponent of the denominator is not always equal to two, as it can change from one domain to another.

Journals' activity

Bradford's law was used to evaluate the dispersion of information among scientific journals. According to this law, journals are sorted into zones of decreasing productivity, based on their proportion of articles on the topic. Each zone would contain the same number of articles, but the number of journals implied would increase moving from one zone to another. The first zone represents the most used or specific journals in bariatric surgery.

The impact factor (IF) is a measure reflecting the average number of citations on recent articles published in a journal. The IF for a given year is based on the ratio of total citations obtained in the previous two years over the number of articles they published in the same two years. The IF is the actual measure for ranking journals inside a specific scientific category. We specifically considered the 5-year impact factor of prolific journals, which is an average of the annual impact factor for the period studied.

Extraction per journal was used to rank the most prolific newspapers regarding bariatric surgery and then to calculate their participation index (PAI). Participation index represents the portion of scientific production of a journal in a specific field of interest with respect to global production in this field over the period.

Countries' activity

In order to assess the contribution of different countries to the scientific production, we adjusted the number of publications per country to the number of inhabitants (number of publications per million inhabitants). We then correlated this measure with several demographic and economic factors: the GDP per capita, Health total expenditure, Research and Development total expenditure, the prevalence of obesity and the EF Proficiency Index.

Our bibliographic research (with the aforementioned criteria) retrieved a first article from 1973. Therefore Price's law was assessed over the period 1973–2014. All other bibliometric indicators focused on the period 2010–2014.

Statistical analysis

Quantitative variables are described by their means (sd) and qualitative variables are described by N (%). Number of publications distribution and its log transformation were summarized by a linear univariate regression and a Pearson correlation coefficient to assess the relationship over the time. If

the log distribution fits better than initial data with the time, the trend is exponential according to Price's law. Expected distribution is predicted with coefficients from linear univariate regression.

In Lotka's graph, expected distribution is calculated by Lotka's formula: $n_i = n_1/i^2$ with n the number of authors and i the number of publications. To fit with the observed distribution, we adjust the Lotka's distribution by changing the exponent: $n_i = n_1/i^x$ (x=2 in Lotka's law). The exponent x is estimated by the mean of the observed x: $x = \ln(n_1/n_i)/\ln(i)$.

Regression imputation is used to replace missing data over the time. In case of data available only a single year we suppose a non-evolution. Several transformations were tested on the number of publications per habitants. Fourth root transformation distribution seems to fit well with a normal distribution. We have repeated measurements over time (from 2010 to 2014), so we use mixed model with a random slope which varying among country. Univariate and multivariate mixed model regression is performed to explain the number of publications per habitants.

All statistical analyses were performed using the R (R Foundation for Statistical Computing, Vienna, Austria.), package "nlme" and for all tests, significant level is set to 5%.

RESULTS

Bibliographic research retrieved a total of 15,260 papers from 1973 to 2014, and 7,860 for the period 2010–2014. As Figure 1 shows, we observed a significant increase in the number of publications in bariatric surgery during the study period. After adjustment to an exponential curve, we obtain a correlation coefficient *r* of 98.0%, indicating that 4.08% of variability is not explained by the adjustment. On the contrary, with a linear adjustment of the curve, the *r* coefficient is 82.3%, which means that the percentage of unexplained variability is 33.1%. These data confirm that the scientific production in bariatric surgery is closer to an exponential adjustment than a linear adjustment, as predicted by Price's law. With regard to the different phases of the law, we observe the first one (the precursors' phase) up to the beginning of the nineties. We then observe a progressive increase in the number of publications until 2013, corresponding to the second phase of exponential growth. A slightly lower increase is observed in 2014. During the exponential growth the time of duplication of the number of publications was between 3 and 6 years.

Lotka

Authors' productivity is presented in Figure 2. A total of 28,505 authors published on bariatric surgery between 2010 and 2014. Among these, 21,893 (76.8%) signed one paper, and 6,305 (22.1%) signed between 2 and 9 papers. We observed 307 (1.1%) authors signing at least 10 publications over the period studied (i.e. on average: 2 papers per year for 5 years). The distribution of the number of publications per author has a hyperbolic aspect, according to Lotka's law. Nevertheless, the observed distribution deviates from the expected distribution on the right side of the graph, corresponding to the zone of high-productivity authors. Lotka's law seems to overestimate these authors. The exponent of the denominator of the formula $n_i = n_1/i^2$ is 2.4 for the observed distribution.

Bradford

The 20 most prolific journals in bariatric surgery are listed in Table 1, with their respective 5-year IF, quartile rank, Participation Index and category. The two most prolific are *Obesity Surgery* and *Surgery For Obesity And Related Diseases (SOARD)*, which are surgical journals sub-specialized in the bariatric field. Nevertheless, these two journals published only 21.9% of bariatric papers in the study period. The mean IF is 3.70, ranging from 1.17 to 8.84. Most of the journals (13/20, 55%) rank in the first quartile of their category. Remarkably, 60% (12/20) of journals publishing on bariatric surgery are surgical, with the remaining (8/20, 40%) belonging to medical fields such as endocrinology and nutrition.

The distribution of journals into Bradford's zones is presented in Table 2. Data are presented for the years 2010 and 2014 and the mean for the entire study period. Bradford's zone 1 corresponds to journals publishing 25% of papers. In 2010, 2 journals were in zone 1 (*Obesity Surgery* and *SOARD*), while there were 4 in 2014 (*Obesity Surgery, SOARD, Surgical Endoscopy* and *PLOS ONE*). The total number of journals publishing on bariatric surgery has increased by 39.2%, rising from 453 to 631.

National activity

Table 3 presents the number of publications per country during the period 2010–2014. The number of articles is adjusted per number of inhabitants, GDP per capita, health total expenditure, R&D total expenditure and prevalence of obesity. The USA produces the highest number of publications (N=2980), followed by the United Kingdom (n=554) and Italy (n=399). After adjustment for the number of inhabitants, Sweden, Norway and Switzerland are the most prolific nations, and are also at the top of the ranking for the number of articles per obese population. Data per continent are presented at the bottom of the table. North America and Europe have a similar profile in scientific production in the bariatric field: 3,282 and 3,180 publications in the study period, which makes a mean of 1.82 and 1.56 papers per million inhabitants, respectively.

The results of univariate and multivariate analysis for the association between the number of publications and the aforementioned covariates are presented in Table 4. We observe that Health total expenditure and obesity prevalence are the 2 factors with the strongest association with the Number of articles. English proficiency and R&D total expenditure are not significantly associated with the number of publications in multivariate analysis.

DISCUSSION:

This study outlines the profile and the trends of scientific production in bariatric surgery over the period 2010–2014. First, we observed an exponential increase in the number of publications over the study period. The distribution of this growth shows a first phase of slow progression (corresponding to Price's phase 1, the "precursors' phase") up to the beginning of the nineties. We suggest that two major events probably helped the acceleration of the number of publications at that time: the creation of the first journal specialized in bariatric surgery (Obesity Surgery, first issue March 1991) and the rapid diffusion of laparoscopy. In fact, the number of articles published on laparoscopy went from 65 in 1990 to 504 in 1994. The second phase of Price's law, the real exponential growth, begins around 1991–1993. This phase corresponds to the period where the discipline is still a *terra incognita* of science. The number of researchers increases constantly, and the progression of knowledge opens new fields of interest. Furthermore, the exponential increase of publications presents a time of duplication of between 3 and 6 years, which is almost three times faster than predicted by Price's law.

Nevertheless, since 2010 the number of publications is lower than expected with an exponential distribution. Probably bariatric surgery is entering the third phase of Price's law, where the growth of the number of publications shifts from exponential to linear. The third phase corresponds to the consolidation of knowledge of a domain becoming familiar, where the number of researchers remains steady, and some subfields of research are cut off and lose interest [17]. If the publication trend is really shifting to linear, we'll observe around 2,050 articles in 2015 and 2,150 in 2016.

With regard to the number of publications per author, the observed distribution is hyperbolic according to Lotka's law. Nevertheless, the curve deviates from the expected distribution in the right part of the graph corresponding to prolific authors. Indeed, if the aspect of the curve is not discussed, the formula remains debated [18-19]. In particular, some authors believe that the formula proposed by Lotka overestimates prolific authors [20], as the exponent of the denominator in the formula n_i=n_1/i^2 is probably higher than 2. Rostaing [21] suggests that the exponent depends on the field of study, showing that, for instance, the distribution of pharmacological and electronic patents has an exponent of 2.71 and 3.04, respectively. Hence, a more general formula of the equation would rather be n_i=$n_1/i^{(1+a)}$, with the coefficient a depending on the field of study. In our case, we found an exponent of 2.4. The number of authors publishing on average 2 publications per year for 5 years was 307 (1.1%). Consequently we could assert that bariatric surgery is a field with few active researchers and many occasional writers.

The most prolific journals (Bradford zone 1, accounting for 25% of publications) went from 2 in 2010 to 4 in 2014. Not surprisingly, Obesity Surgery and SOARD, the two sub-specialized surgical revues in this field, are the most prolific. Nevertheless, we observed a growing interest in bariatric surgery among other revues, in particular non-surgical ones. The metabolic effect of weight loss may explain the interest of medical journals in this surgical discipline. Hence, our analysis can help specialists concerned with bariatric surgery to identify the most relevant journals among a large panel.

North America and Europe are the world's leading areas in scientific production on obesity. Despite a lower number of total publications, the Pacific area (Australia and New Zealand), after adjustment, has a profile very close to that of Europe and North America. Not surprisingly, the USA publishes the greatest absolute number of studies. Interestingly, after adjustment for total population and obese population, Sweden, Norway and Switzerland produce more scientific research than other countries. Vioque et al. [8] have already reported the important contribution of Scandinavian countries in obesity

research [7]. With regard to the adjustment for economic factors (GDP per capita, health total expenditure and R&D total expenditure), the most effective countries are Greece, Israel and Kuwait.

Multivariate analysis shows that several factors are related to the number of publications in bariatric surgery. Health total expenditure presents the strongest association, suggesting that the amount of resources allocated to health is associated with scientific production. Inversely, R&D expenditure and English proficiency are not statistically significant.

This study presents several limitations. First, although the keywords we used for our search ("obesity surgery" and "bariatric surgery") seem logical and pertinent, the search was not exhaustive. We observed a lack of completeness, especially for the oldest articles (the first one identified by our search criteria was published in 1973). We think that the 2 keywords "obesity surgery" and "bariatric surgery" do not identify exhaustively the oldest publications because these terms become relevant for this discipline with time. Nevertheless, this limitation concerns only the indicator of overall growth of publications (Price's law), which shows that up to the nineties, publications in bariatric surgery were limited. Second, we decided to limit our search to English language literature because most relevant journals are published in English. In addition, our analysis suggests that English proficiency is not associated with the number of publications per country. This means that the degree of knowledge of the English language is not a limitation or an enhancement for publishing in English revues.

Finally, our analysis is essentially quantitative as the indicators we used are based on the number of publications (per year, per author, per journal and per country). No qualitative analysis was performed on the retrieved articles. A qualitative analysis would adjust the number of publications with their scientific impact, based on the number of citations for any single article. This is undoubtedly an interesting field for further studies.

CONCLUSION

Bariatric surgery research has undergone impressive development in the last two decades. Nevertheless, the latest trends could suggest a saturation of scientific production in this field. The next few years will enlighten this point. Interestingly, the interest in this discipline seems to overcome the boundaries of the surgical community as several medical journals publish regularly on this topic. North America, Europe and Australia are historically the leaders in scientific production in bariatric surgery, yet we observed a growing interest in several countries, especially Eastern Asia and the Middle East.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

ETHICAL APPROVAL

"This article does not contain any studies with human participants or animals performed by any of the authors."

INFORMED CONSENT

Does not apply.

REFERENCES

[1] Buchwald H, Oien DM. Metabolic/bariatric surgery worldwide 2011. Obes Surg 2013 Apr;23:427-36. PubMed PMID: 23338049.

[2] Burns EM, Naseem H, Bottle A, et al. Introduction of laparoscopic bariatric surgery in England: observational population cohort study. BMJ 2010;341:c4296. PubMed PMID: 20798224.

[3] Stroh C, Birk D, Flade-Kuthe R, et al. A nationwide survey on bariatric surgery in Germany—results 2005–2007. Obes Surg 2009;19:105–12. PubMed PMID: 18941846.

[4] Marsk R, Freedman J, Tynelius P, Rasmussen F, Näslund E. Antiobesity surgery in Sweden from 1980 to 2005: a population-based study with a focus on mortality. Ann Surg 2008;248**:**777–81. PubMed PMID:18948804.

[5] Lazzati A, Guy-Lachuer R, Delaunay V, Szwarcensztein K, Azoulay D. Bariatric surgery trends in France: 2005–2011. Surg Obes Relat Dis 2014;**10**(2)**:**328–34. PubMed PMID: 24209875.

[7] Lomanto D, Lee WJ, Goel R, et al. Bariatric surgery in Asia in the 598 last 5 years (2005–2009). Obes Surg 2012;22**:**502–6. PubMed PMID: 22033767.

[8] Vioque J, Ramos JM, Navarrete-Muñoz EM, García-de-la-Hera M. A bibliometric study of scientific literature on obesity research in PubMed (1988-2007). Obes Rev. 2010 Aug;11(8):603-11. PubMed PMID: 19754632.

[9] Pritchard, Alan, 'Statistical Bibliography or Bibliometrics?', Journal of Documentation, 25(4) 1969, 348-349. Available from : https://www.academia.edu/598618/Statistical_bibliography_or_bibliometrics

[10] The World Bank. Indicators [Internet]. Available from: http://data.worldbank.org/indicator

[11] World Health Organization. Global Database on Body Mass Index [Internet]. Available from: http://apps.who.int/bmi/index.jsp

[12] EF English Proficiency Index. Methodology [Internet]. Available from: http://www.ef.co.uk/epi

[13] Wikipedia.com. EF English Proficiency Index [Internet]. Available from: https://en.wikipedia.org/wiki/EF_English_Proficiency_Index

[14] Price DJS. Little science, big science. Columbia University Press : New York 1963.

[15] Price DJS. Science since Babylon. Yale University Press : New Haven 1962, p.119.

[16] Lotka A.J. The frequency distribution of scientific productivity. Journal of the Washington Academy of Sciences 1926 ;**16**(12) :317–32.

[17] Price DJS. Quantitative Measures of Development of Science Arc Int Hist Sci (Paris) 4(14):85-93, January 1951.

[18] Radhakrishnan T, Kernizan R. Lotka's Law and Computer Science Literature. J AM Soc Inf Sci 1979 ;30(1) :51-54

[19] Voos H. Lotka and information science, J AM Soc Inf Sci 1974;25:270–72 . Available from: http://onlinelibrary.wiley.com/doi/10.1002/asi.4630250410/abstract

[20] Price DJS. Science et Suprascience. Traduction française de G. Lévy, Paris, Fayard, 1972, p. 70.

[21] Rostaing H. Veille technologique et bibliométrie : concepts, outils, applications [Internet]. Available from: http://quoniam.info/competitive-intelligence/PDF/PhDs_Guidance/PhD_Herve_Rostaing.pdf

FIGURES LEGEND

Figure 1. Number of publication on bariatric surgery per year: observed and expected distribution according to Price's law.

Figure 2. Number of publication on bariatric surgery per author: observed and expected distribution according to Lotka's law.

TABLES

Table 1. Most prolific journals in bariatric surgery, 2010–2014

	JOURNAL	N° articles	PaI	5-year IF	Quartile rank	Journal category
1	OBESITY SURGERY	1135	14.453	3.435	Q1	Surgery
2	SURGERY FOR OBESITY AND RELATED DISEASES	587	7.475	3.973	Q1	Surgery
3	SURGICAL ENDOSCOPY AND OTHER INTERVENTIONAL TECHNIQUES	233	2.967	3.327	Q1	Surgery
4	OBESITY	128	1.630	4.377	Q2; Q1	Endocrinology and metabolism; Nutrition and dietetics
5	PLOS ONE	95	1.210	3.702	Q1	Multidisciplinary sciences
6	JOURNAL OF CLINICAL ENDOCRINOLOGY METABOLISM	92	1.172	6.544	Q1	Endocrinology and metabolism
7	ANNALS OF SURGERY	92	1.172	8.844	Q1	Surgery
8	INTERNATIONAL JOURNAL OF OBESITY	79	1.006	5.283	Q1; Q1	Endocrinology and metabolism; Nutrition and dietetics
9	JOURNAL OF GASTROINTESTINAL SURGERY	65	0.828	2.806	Q1; Q2	Surgery; Gastroenterology & Hepatology
10	JOURNAL OF THE AMERICAN COLLEGE OF SURGEONS	56	0.713	5.263	Q1	Surgery
11	SURGICAL LAPAROSCOPY ENDOSCOPY PERCUTANEOUS TECHNIQUES	50	0.637	1.282	Q3	Surgery
12	AMERICAN JOURNAL OF SURGERY	49	0.624	2.744	Q2	Surgery
13	PLASTIC AND RECONSTRUCTIVE SURGERY	48	0.611	3.374	Q1	Surgery
14	OBESITY REVIEWS	48	0.611	8.532	Q1	Endocrinology and metabolism
15	SURGERY	45	0.573	3.772	Q1	Surgery
16	NUTRICION HOSPITALARIA	44	0.560	1.169	Q4	Nutrition and dietetics
17	JSLS	44	0.560	1.157	Q3	Surgery
18	OBESITY FACTS	41	0.522	2.234	Q3; Q3	Endocrinology and metabolism; Nutrition and dietetics
19	BARIATRIC SURGICAL PRACTICE AND PATIENT CARE	40	0.509	0.150	Q4	Nursing
20	JOURNAL OF SURGICAL RESEARCH	38	0.484	2.076	Q2	Surgery

PaI: Participation Index; IF: Impact Factor.

Table 2. Distribution of the journals in Bradford's zones

Bradford's Zones	2010		2014		2010–2014	
	No. journals	No. articles	No. journals	No. articles	No. journals	No. articles
1	2	312	4	484	*3*	*1955*
2	34	312	43	481	*52*	*1965*
3	116	312	154	483	*224*	*1966*
4	301	313	430	483	*1089*	*1967*
TOT	*453*	*1249*	*631*	*1931*	*1368*	*7853*

Table 3. Number of publications in bariatric surgery, 2010–2014, and adjustments per socioeconomic factor

COUNTRY	No. of publications						English proficiency
	Total	per inhabitant*	per GDP[$]	per Health expenditure[€]	per R&D expenditure[£]	per Obesity prevalence[#]	
USA	2980	1.9	36.92	2.11	13.42	5.75	70
UNITED KINGDOM	554	1.74	41.81	4.5	24.31	6.99	70
ITALY	399	1.33	37.05	4.04	28.9	6.84	51.28
CANADA	302	1.74	34.03	3.11	19.38	7.6	70
GERMANY	297	0.73	16.24	1.43	5.57	2.99	58.46
BRAZIL	290	0.29	24.14	2.58	19.69	1.73	48
FRANCE	290	0.88	21	1.8	9.31	4.49	52.9
SPAIN	272	1.17	38.4	4.15	29.14	5.21	52.8
AUSTRALIA	239	2.11	33.85	3.67	14.15	7.42	70
SWEDEN	180	3.79	65.79	6.85	19.85	19.57	67.68
NETHERLANDS	164	1.96	38.44	3.08	18.86	12.76	67.2
PEOPLE'S R CHINA	158	0.02	3.77	0.7	1.91	0.66	48.9
SWITZERLAND	133	3.33	39.63	3.51	15.65	18.6	56.4
JAPAN	132	0.21	4.91	0.49	1.47	5.59	54.14
POLAND	99	0.52	38.6	5.72	45.52	2.42	58.44
SOUTH KOREA	99	0.4	15.9	2.17	3.9	6.09	54.36
BELGIUM	98	1.77	38.14	3.51	17.06	8.03	59.48
TAIWAN	98	0.84	41.41	6	13.8	4.97	34.76
GREECE	89	1.6	67.38	7.13	93.32	7.98	NA
TURKEY	89	0.24	22.69	3.76	25.5	0.89	45.12
AUSTRIA	87	2.07	41.85	3.71	14.82	10.48	60.92
NORWAY	87	3.48	35.51	3.73	21.06	18.12	66.34
DENMARK	82	2.93	49.3	4.53	16.37	14.91	67
ISRAEL	81	2.05	60.49	8.16	15.64	8.57	NA
FINLAND	72	2.67	54.76	5.96	15.24	12.31	62.76
IRELAND	66	2.87	56.94	6.56	32.5	12.11	70
CHILE	62	0.71	48.87	6.63	117.47	2.62	46.88
INDIA	51	0.01	5.5	1.39	6.82	0.24	52.42
PORTUGAL	39	0.74	33.77	3.44	32.04	3.18	55.24
NEW ZEALAND	34	1.55	38.83	3.86	30.72	5.35	70
MEXICO	32	0.05	5.41	0.88	12.18	0.19	50.14
CZECH REPUBLIC	30	0.57	28.43	3.83	16.08	2.37	54.82
SINGAPORE	29	1.09	20.53	4.56	10.22	17.06	58.58
EGYPT	27	0.07	20.91	4.18	45.26	0.19	47.52
SAUDI ARABIA	27	0.19	7.92	2.37	60.91	0.55	44.78
ROMANIA	20	0.2	22.11	4.12	49.36	1.01	NA
KUWAIT	17	1.06	20.96	7.73	222.95	2.11	47.88
ARGENTINA	16	0.08	5.72	0.73	8.3	0.35	54.8
SERBIA	13	0.36	60.19	5.72	61.92	1.81	NA
THAILAND	13	0.04	7.21	1.71	2.34	0.43	43.76
CROATIA	11	0.51	37.35	5.26	48.25	2.32	NA
LEBANON	10	0.45	47.85	6.5	NA	1.67	NA
SLOVAKIA	9	0.33	18.94	2.34	9.4	1.43	53.76
North America	*3282*	*1.82*	*51.2*	*14.23*	*2.25*	*27.92*	*70*
Europe	*3180*	*1.56*	*38.1*	*9.35*	*1.82*	*21.35*	*59.51*
Asia	*580*	*0.37*	*21.97*	*6.06*	*2.61*	*7.08*	*49.56*
South & Central America	*400*	*0.28*	*12.5*	*7.68*	*0.69*	*23.62*	*49.95*
Pacific	*273*	*1.83*	*51*	*9.63*	*1.83*	*28.65*	*70*
North Africa & Middle East	*162*	*0.76*	*24.28*	*5.16*	*1.14*	*34.36*	*46.73*

*Number of publications per million population.
[$]Number of publications per 1000$ of Gross Domestic Product per capita.
[€]Number of publications per 1000$ of Health expenditure per capita.
[£]Number of publications per 1000$ of Research and Development expenditure per capita.
[#]Number of publications per million obese population.

Table 4. Multivariate analysis: association between socioeconomic covariates and the number of publications in bariatric surgery per inhabitant

	Univariate		Multivariate	
Covariate	Coefficient	p-value	Coefficient	p-value
(Intercept)	-	-	0.175	0.178
GDP	0.009	<0.001	0.008	<0.001
Health expenditure	0.053	<0.001	0.024	0.011
Research & Development	0.031	0.278	0.009	0.737
Obesity prevalence	0.007	0.052	0.009	0.002
English proficiency	0.003	0.138	0.000	0.985

GDP: gross domestic product; Health expenditure: health total expenditure; Research and Development: Research and Development total expenditure; English Proficiency according to the EF EPI score.

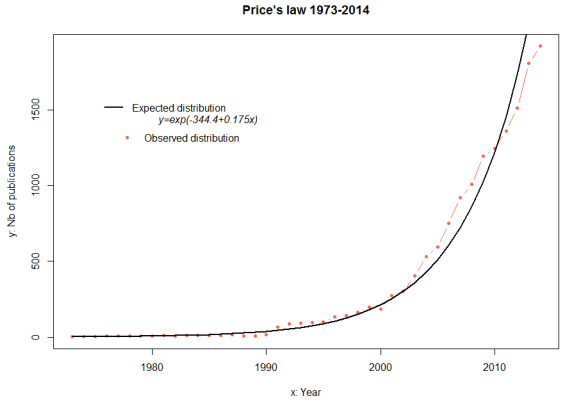

Figure 1

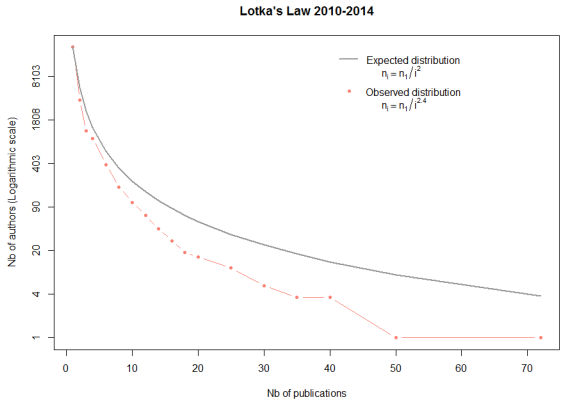

Figure 2