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Impact assessment of oncology literature published in Serbia

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ABSTRACT

BACKGROUND: *The study evaluates publication and distribution of biomedical and oncology articles in medical journals in Serbia from 1995 to 2000 and their correlation with socioeconomic variables.*
METHODS: *Retrospective bibliometric research was done in the following medical journals: Srpski Arhiv, Vojnosanitetski Pregled, Medicinski Pregled, and Archive of Oncology.*
RESULTS: *Quantitative analysis showed that 2,468 biomedical articles were published in Serbia. Out of these 855 (30.64%) were oncology papers, which accounts for 3.6% of oncology article production in the countries of European Union. The number of oncology articles in relation to the number of inhabitants was 0.00024%, and 0.10% in relation to GDP. The analysis of key words showed that breast cancer was the leading field of research. Adryamicin was the most frequently drug used in clinical trials and apoptosis was the most investigated topic of experimental research. Standardization of key words according to MeSH was highly recommended.*
CONCLUSION: *Bibliometric analysis shows that the production of scientific oncology literature in Serbia has been very low in comparison with the same production in small and large countries of European Union. The assessment and the quality of the oncology and biomedical publications have an effect on the definition of the position and development of the strategy for scientific production in the country. Systematization of the national database for biomedical publications will help the assessment of the quality of scientific research in oncology and medicine in general.*
KEY WORDS: *Bibliometrics; Periodicals; Medical Oncology Publishing; Socioeconomic Factors; Serbia (Non MeSH)*

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INTRODUCTION

Disintegration of the former SFRY, which begun with the warfare in 1991, sanctions imposed by the United Nations towards SFRY from 1992 to 2002, and military operations of NATO countries against SRY in 1999 caused the breakup of local, national, economic, social, cultural, scientific, and technology programs and activities. These were also the reasons for a significant decline in scientific community and the number of scientific researches in biomedicine and the number of published papers from basic and clinical oncology was reduced. Only Rajko Igić in his study from 2001 has reported a bibliometric analysis of the number of published articles in journals printed in former SFRY that are cited in the *Science Citation Index* (SCI); the results of this study point to a significant fall of scientific production (1). In the countries of the European Union (EU): France, Germany, and Greece bibliometric factors show a progressive increase of the citation index and the impact factor of oncology journals in the period from 1996 to 2000; however, they also show the lagging of European biomedical and oncology publications behind those in the USA (2). Analysis of citations evaluates scientific and research work and defines the impact of this work in certain scientific filed (3). These analyses have been based on the data of the Institute for *Scientific Information* (ISI), which keeps evidence of more than 1,400 medical journals. Such reports evaluate the work of scientists, scientific units, institutions, and countries. They are valuable in the identification of the research or for the survey of the history of oncology disciplines (4).

The purpose of this study was to analyze the papers related to oncology published and the frequency of key words used in four leading medical journals in Serbia for the period 1996-2000; these bibliometric factors were correlated with socioeconomic variables (4).

MATERIALS AND METHODS

This retrospective study was based on the data on scientific papers published in the following journals: *Srpski Arhiv za Celokupno Lekarstvo*, *Vojnosanitetski Pregled*, *Medicinski pregled*, and *Archive of Oncology*, from 1995 to 2000. Bibliographic analysis included all review articles, editorials, actual problems, case reports, letters to the editor, and the contents of special supplements. All papers with foreign authors were excluded from the analysis. The frequency of used key words was also calculated. The number of inhabitants in Serbia is given in millions and gross domestic products (GDP) is expressed in million of US dollars; both parameters did not include data on Kosovo and Metohija (5).

RESULTS

Quantitative analysis showed that the total of 855 oncology articles were published in medical and oncology journals during a 5-year period (1995-2000) (Table 1). Only 55 papers were published during the NATO military operation in 1999, in SRY; this number slightly increased to 63 in 1997under the long-term UN sanctions.

In EU, a total of 4,063 articles were published in 1995 and 4,842 papers in 2000 (2,4). During the same period 2,468 biomedical articles were published in Serbia, of which 855

were oncology papers (30.64%). The largest number of papers was published in the journal Vojnosanitetski Pregled (27.99%); oncology-related papers were most numerous in the Archive of Oncology - 791 (92.51%). As compared to EU, 0.45% biomedical articles and 3.64% oncology papers were published in our country (Table 1,2).

Table1. Number of published biomedical papers in Serbia

Country	Biomedical papers 1995	1996	1997	1998	1999	2000	Total No.	%
World	309,684	350,661	349,766	361,563	365,892	370,784	1,798,666	
USA	118,565	130,338	128,383	129,886	129,589	130,771	64,967	
EU	116,224	131,184	130,555	135,107	136,569	136,301	609,716 (E=100)	
Serbia	594	597	250	356	249	435	2,468 (ser=100)	0.40
Srp Arch	111	88	74	71	57	106	504	20.43
Vojnosanit Pregl	189	244	53	43	63	109	691	27.99
Med Pregl	105	42	71	74	85	105	482	19.53
Arch Oncol	189	223	52	168	44	115	791	32.05

Table 2. Number of oncology papers published in Serbia

Country	Oncology papers 1995	1996	1997	1998	1999	2000	Total No.	%
World	11,117	12,610	12,634	13,129	13,745	13,903	66,021	
USA	4,523	4,893	4,882	5,111	5,463	2,564	25,646	
EU	4,063	4,697	4,602	4,545	4,843	23,462	23,462 (E=100)	
Serbia	201	235	63	180	55	121	855 (ser=100)	33.64
Srp Arch	6	6	10	6	6	6	40	4.69
Vojnosanit Pregl	4	5	1	6	3	-	19	2.22
Med Pregl	2	1	-	-	2	-	5	0.58
Arch Oncol	189	223	52	168	44	115	791	92.51

One hundred and ninety-nine oncology articles were published in Serbia in 1995 and that was more than in Spain (117), Denmark (106), Belgium (97), Austria (93), Finland (91), Greece (91), Norway (91), Ireland (26), Portugal (13), and Luxembourg for the same year (2). However, in the year 2000 one hundred and seventeen articles were published in our country; behind were Denmark (115), Austria (110), Finland (115), Norway (90), and Ireland, Portugal and Luxembourg with almost unchanged number of published papers in comparison to 1995.

The ratio between the number of published oncology articles and the number of inhabitants for the observed period is presented in Table 3.

Table 3. Ratio between the number published papers and the number of inhabitants in Serbia

Country	Number of published oncology papers 1995	1996	1997	1998	1999	2000	Mean value
World	2.2	2.5	2.4	2.3	2.4	2.4	2.4
USA	17.3	18.8	19.3	20.0	20.0	19.5	19.5
EU	10.9	12.6	12.3	12.1	12.7	12.9	12.5
Serbia *	0.00022	0.000063	0.00016	0.000050	0.00011	0.00024	0.00031

* No data about the number of inhabitans in Kosovo and Metohija have been included

In the USA the same ration was19.5, in the EU 12.5, and in it was Serbia 0.00024, which put us behind Portugal and Luxembourg (2,4). The ration between published papers and GDP showed the score of 0.6 in the EU, 0.7 in the USA, and 0.10 in Serbia (Table 4) (4).

Table 4. Ratio between the number of publishe papers and Gross Domestic Products (GDP) in Serbia

Country	Number of published oncology papers 1995	1996	1997	1998	1999	2000	Mean value
World	0.5	0.6	0.5	0.5	0.5	0.5	0.5
USA	0.7	0.8	0.7	0.7	0.7	0.7	0.7
EU	0.5	0.6	0.6	0.5	0.6	0.6	0.6
Serbia *	0.14	0.15	0.04	0.12	0.04	0.11	0.10

* No data about the number of inhabitans in Kosovo and Metohija have been included

Research topics

In oncology text the authors used the total of 5,130 different key words, approximately 6 words per paper. Among them the most frequent were 1,266 key words such as: breast cancer (20.77%), radiotherapy (10.3%), immunohistochemistry (14.3%), colorectal cancer (6.32%), apoptosis (4%), etc. (Table 5). Apart from standard key words nonstandard key words were also used, e.g. synonyms (cancer vs. carcinoma, apoptosis vs. cell death or programmed cell death), spelling variations (tumor vs. tumor) specific terminology (tumor suppressor gene vs. p53), and abbreviations (MRI/NMRI, 5-FU, BRCA-1)

The key words were the basis for identification of references, which enabled the tracking of the trends in researching. Table 5 shows the top key words related to diseases, antitumor drugs, treatments, and research topics and related techniques.

Table 5. Analysis of key words for oncology publication

		Number of occurences
Diseases	Breast cancer	263
	Colorectal cancer	80
	Lung cancer	48
	Prostate cancer	32
	Ovarian cancer	23
	Lymphoma malignum	23
	Uterine cancer	19
	Sarcoma	12
	Thyroidea cancer	5
	Head and neck cancer	2
		506
Drugs	Doxorubicin	24
	Cisplatin and platinum comp.	16
	Docetaxel	8
	Methotrexat	8
	5-Fluorouracil	7
	Inteferon	6
	Interleukins	6
		73
Treatments	Radiotherapy	131
	Surgery	58
	Chemotherapy	53
	Combined therapy	28
	Immunotherapy	8
	Chemoprevention	3
	Paliative care	1
	Hormonal therapy	1
		283
Research topics and related techniques	Immunocitochemistry	172
	Apoptosis	50
	Tumor marker	26
	Epidemiology	23
	p53	19
	Quality of life	18
	MRI	17
		325
	Angigenesis	14
	Fulerens	13
	MRS	10
	Telemedicine	10
	Vaccines	7
	Antioxidants	7
	BRCA1	6
	PCR	5
	Cell cycle	3
	ras, ret	4
		79

DISCUSSION

During the period 1995-2000 the number of the published biomedical papers in Serbia was modest - 2,468, which presented 0.40% of biomedical production in the EU. The percent of published oncology papers in comparison to EU was 3.64; the majority of these papers (92.7%) were published in the *Archive of Oncology*.

However, the publication of scientific papers in EU countries was higher than in the USA and showed a continuous increase since 1981, mainly due to the growing number of clinical trials (2). The most productive publication of oncology papers among the EU countries is in England, Germany, France, Italy, and The Netherlands. It should be noted that in small-

er EU countries, such as Greece, Belgium, and Spain, the publication of oncology texts is continuously increasing. Contrary to these trends the publication of biomedical and oncology articles in Serbia during the observed period was LOW due to UN sanctions and military operations of NATO countries in 1999.

According to Igic the biomedical publication in the countries of the former SFRY, including Serbia, was diminished because of the warfare in Bosnia and Herzegovina, Croatia, and Slovenia. Therefore, we could say that bibliometric indicators are very sensitive in tracing of local and international political issues including warfare (1). The declining trend in the publication of biomedical articles was also caused by the brain drain, publication of papers in foreign journals, and insufficient financial support for scientific research in biomedicine. I believe that Serbian, the language used for writing the majority of biomedical papers, and English, the language in which the majority of papers are printed in the *Archive of Oncology*, did not have any impact on the scope of oncology publication.

However, the languages of great European nations such as French or German do have an impact to the bibliometric assessment and ranging because journals printed in these countries are not registered in the ISI database, which is entirely in English.

The ratio between oncology papers published in Serbia and the number of inhabitants is 0.00031%. This ration is not real because the number of the inhabitants in Kosovo and Metohija, which is under the protectorate of the UN since 1999, has not been included in the calculation. Such low publication production has also been recorded in Luxembourg in 1995 and 1998 and in Portugal in 1998 (2). In the EU the percent of the oncology publications is 12.5 and leading countries are those from Scandinavia and the Netherlands.

In Serbia the ratio between the number of oncology papers and GDP is very low - only 0.10% due to low publishing production.

In the countries of EU the ratio is 0.6%. The greatest is in the Scandinavian countries, the Netherlands, Greece, UK, and Italy. Small countries of the EU have a high ratio between the published papers and GDP due to high GDP (2,4).

Serbia is a small European country with a surface of 5,783,745 km^2. In 2000, GDP in Serbia was 1,935 US dollars per citizen (5); the highest GDP was in 1997 - 1,549 US dollars per citizen (5).

The analysis of the frequency of key words showed a great dispersion. About 30.5% of key words were used more than once and only 1% very rarely. This problem has been noticed in the biomedical production in different disciplines, both in the EU and in the world (2,6). The most frequently used key words were: breast cancer, colorectal cancer, and carcinoma of the bronchi. The same sequence of key words frequency has been found in the oncology papers published in the countries of the EU (2,4). Key words from the field of chemotherapy point to the current clinical settings. In the oncology journalism in Serbia the most frequently used key word is radiotherapy (RT); the next are surgery, chemotherapy, or combined treatment regimens. The same frequency has been observed in the scientific journalism in the EU countries (2,4). In clinical trials the most frequently applied are the immunohistochemical methods (14.3%); apoptosis was the most investigated topic of experimental research.

This study is insufficient and limited. The obtained data are neither based on ISI database nor there is a database of biomedical and oncology journals of the Republic of Serbia. Such database is currently in the process of creation (personal communication, Pero Šipka, Faculty of Philosophy, University of Novi Sad). The second limitation is related to presented and published oncology papers in basic disciplines, e.g., immunology, genetics, and biochemistry, and published papers from clinical oncology - the branches of maxillofacial surgery, respiratory and digestive system, uropoietic system, hematopoietic system, and CNS. All data have been published in the proceedings, with a heterogeneous assessment of the form, contents, and the use of key words.

Third limitation refers to the publishing outside Serbia, in leading European or world journals. These data have been mostly collected from the university centers in Serbia (Belgrade, Novi Sad, Nis, and Kragujevac) and there is no and accessible database. Database at the level of the republic is being in the process of creation.

This analysis was deficient because it was not possible to express impact factor, which is an important bibliometric parameter for all journals. The analyzed journals published in Serbia are not referred in ISI database and have a low citation index; the *Archive of Oncology* has been published for 8 years only (7). It is expected that the national biomedical database will be the source of citation, impact factors, and other resources for valid bibliometric analysis of journals and comparative with the contents of Eurostat.

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