

## Journal Publications from Zagreb University Medical School in 1995-1999

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**Aim.** To analyze a five-year publication output of the Zagreb University Medical School in scientific journals, especially in the journals covered by the *Current Contents* (CC), bibliographic database of the Institute for Scientific Information.

**Methods.** Medical School of the Zagreb University is organized in 10 preclinical, 6 public health, and 17 clinical departments, with 359 faculty members. Research activity is important for the academic promotion, with the number of publications (especially in journals covered by CC) and their impact as a key element. Bibliographic data on the published papers by the authors affiliated to the Zagreb University Medical School in the 1995-1999 period were searched in the CC and *Biomedicina Croatica* databases, according to the official faculty name list. The collected data were classified into three groups according to the source journals: papers published in international journals covered by the CC, Croatian journals covered by the CC, and Croatian journals not covered by the CC. The publication production was measured on individual and departmental levels by using two counting schemes: a) full publication to each author/department; and b) an equal fraction of a publication (1/n) to each author/department.

**Results.** In the 1995-1999 period, the faculty published 578 papers in the journals covered by the CC, 22.6% of them in the subset of Croatian journals. The differences among departments were considerable, with publishing activity per faculty member varying from 0.25 to 6.23 papers in CC journals and from 0.0 to 15.8 in Croatian non-CC journals. Pre-clinical departments published significantly less in the Croatian journals indexed in the CC than public health and clinical departments. There was a high variance in the number of publications on the individual level, with the 15.4% of the faculty in the professor rank and 45% in the assistant rank who did not publish a single paper in journals covered by the CC in the analyzed period. On the contrary, 10.1% of professors and 6.0% of assistants published more than 10 and more than 4 CC-indexed papers, respectively. A number of authors who have been very productive in international journals indexed in the CC (11 or more papers) did not publish in Croatian journals indexed in the same database, and vice versa.

**Conclusion.** Publication output of the Zagreb University Medical School shows imbalances characteristic of a small scientific community: productivity with extreme values, relatively unsatisfactory number of papers published in the international journals covered by the CC database as compared to their importance in the process of the academic promotion, and disproportional role of certain domestic journals covered by the CC.

**Key words:** *bibliometrics; Croatia; schools, medical; periodicals; publishing*

Universities should be considered both teaching and research institutions. Research carried out at such institutions is of vital importance to the whole science, technology, and industry system and is predominantly financed by the governmental sources (1). The evaluation of the achievements of a university or a university department is important, because their policy decisions may affect scientific productivity and progress (2). The faculty is regularly evaluated on the basis of both teaching and research, but there is little doubt that promotions and tenure at universities continue to depend more on research productivity than instructional performance (3). Peer review is the most

common form of evaluation of scientific performance, but application of bibliometric measures has been proposed as a supplement (4-6). There are basically two bibliometric indicators for measuring scientific output: publication counts and citation counts. Publication output serves as an approximation to scientific activity and productivity (7). Research results in the fields of science, technology, and medicine are published mostly in the form of a standardized journal article, primarily in international journals and in English language (8). Internationalism has been established as a norm in science, and the evaluation of scientific results does not depend on any local or na-

tional evaluation criteria. Small countries with limited intellectual resources would be exposed to the risk of mediocrity if they allowed themselves to become isolated from the major centers of knowledge production. Croatia can be categorized as a small “developing” or “semi-developed” country whose scientists occasionally produce high-quality reports in influential journals. However, most of their scientific production is reported in local journals, whose quality is far below that of the mainstream journals (9,10).

The aim of our study was to analyze research output of the Zagreb University Medical School, operationalized by the number of publications published in the 1995-1999 period in the international and local journals, and to identify departmental productivity and their international visibility. Data could be useful in the institutional decision-making process (promotion, personnel, research time, facilities, and stimulation) and especially in setting priorities for the enforcement of the mainstream academic and scientific standards.

**Methods**

*Setting*

The University of Zagreb is the largest and most prominent Croatian educational and scientific institution and its Medical School is highly rated in this part of Europe. The School is organized in 10 preclinical, 6 public health, and 17 clinical departments. At the end of 2000, the faculty consisted of 359 persons, with 88 of them engaged in preclinical, 43 in public health, and 228 in clinical departments (Table 1). The admission quotas for

students are determined by the Ministry of Science and Technology, which financed 240 vacancies in the academic year 2000/01. The School provides a wide range of postgraduate courses in biomedicine and health sciences. The faculty is extensively engaged in research and the Ministry of Science and Technology finances the majority of their grants: 51 in clinical research, 29 in basic research, and 7 in public health. There are also 15 grants for the junior faculty members, which are also financed by the Ministry. Many young researchers are affiliated to the grants by separate funds (33 in preclinical, 30 in clinical, and 10 in public health departments). Academic promotion is based mainly on research ability, with the number of publications and their scientific impact as a key element in the overall academic performance assessment. According to the Croatian Law on the Scientific Research Activities (11), the minimum scientific criteria for the appointment into scientific grades are defined by the Scientific Field Council. The Scientific Field Council for Biomedicine determined 2, 4, and 8 papers published in the *Current Contents* (CC)-indexed journals for the rank of the assistant professor, associate professor, and full professor, respectively (12).

*Sample*

We used the official list from January 2000 of all of the School's teaching staff according to their departments. The academic rank (full professor, associate professor, assistant professor, and assistant – including all three ranks: junior assistant, assistant, and senior assistant) was assigned to each name. We used a “fixed” name list, regardless of the list fluctuations and the changes that occurred in the academic ranks during the analyzed period.

*Collection of Bibliographic Data*

Bibliographic data on the published papers by the authors affiliated to the Zagreb University Medical School in the 1995-1999 period were identified by searching the CC and *Biomedicina Croatica* databases. The CC database was chosen because the journals it indexes are considered to be the most important for the life sciences and (bio)medicine, and the papers

**Table 1.** Zagreb University Medical School departments and respective faculty according to their academic ranks

Departments	No. of professors			No. of assistants			Total		Total faculty
	full	assoc	assist	senior	medium	junior	professors	assistants	
All departments	68	113	46	47	75	10	227	132	359
Preclinical departments:	21	17	20	10	12	8	58	30	88
Anatomy (Anat)	3	2		1	2	5	5	8	13
Anatomy – Brain Research Institute (Anat-BR)	2		1	2			3	2	5
Biology	2		2	3			4	3	7
Medical Physics and Biophysics (Physics)		2			1	1	2	2	4
Biochemistry and Clinical Chemistry (Chemistry)	2	2	3		4		7	4	11
Histology and Embryology (Histo)	1	4	3				8		8
Physiology and Immunology (Physio)	5	2	2	2	2	2	9	6	15
Pharmacology (Pharma)	3	1	4				8		8
Pathology (Patho)	3	2	5	2	1		10	3	13
Forensic Medicine (Forensic)		2			2		2	2	4
Public health departments:	5	11	7	5	14	1	23	20	43
Microbiology (Microbio)		3	1	2	4		4	6	10
Family Medicine (Family)	1	1			2		2	2	4
Social Medicine (Social)	1	2	3		3		6	3	9
Medical Statistics, Epidemiology and Medical Informatics (Stat-Epi-Inf)	2	2	1	1	3		5	4	9
Occupational Medicine and Environmental Health (Occup-Env)		1	2	1	2	1	3	4	7
Medical Sociology and Health Economics (Sociology)	1	2		1			3	1	4
Clinical departments:	42	85	19	32	49	1	146	82	228
Internal Medicine (Internal)	10	27	3	17	10	1	40	28	68
Radiology and Oncology (Radio-Onco)	4	7	1		2		12	2	14
Urology	2	1	1		1		4	1	5
Maxillofacial Surgery (Maxillofac)	1	1	1		1		3	1	4
Orthopedics	3	1	2		2		6	2	8
Ear, Nose and Throat (ENT)	4	5		3	3		9	6	15
Ophthalmology (Ophthalmol)	1	3		2	1		4	3	7
Dermatology (Derma)	1	1		1	2		2	3	5
Infectious Diseases (Infec)	2	6		2	1		8	3	11
Neurology and Neuropathology (Neuro)	2	5			1		7	1	8
Pediatrics	4	2	3	1	8		9	9	18
Gynecology and Obstetrics (Gyn-Ob)	3	6	1	2	8		10	10	20
Psychiatry and Psychological Medicine (Psychiatry)	2	4	3	2	3		9	5	14
Surgery	2	10	2	1	5		14	6	20
Anesthesiology (Anesthes)		3					3		3
Physical Medicine and Rehabilitation (Physical)	1	1	2				4		4
Pathophysiology (Pathophys)		2		1	1		2	2	4

published in CC-journals are given decisive function in the academic promotion at the Croatian universities (12). In the analyzed period, the CC covered 7 Croatian journals, one of them strictly medical. We searched the CC database for each name on the faculty list. Only papers with at least one School address were included, because work done by the School's faculty members as the guest-scientists at other institutions or at their former institutions and published only with the address of that institution could not be considered School's papers (8). We divided the obtained data into two groups as follows: the items published in the Croatian CC journals and the items published in all other CC journals. The local bibliographic database *Biomedicina Croatica* covers all publications of the Croatian authors in the field of medicine and related fields from 1986 onward. We collected all articles published by the same set of authors in the Croatian (bio)medical journals covered by the *Biomedicina Croatica* and not covered by the CC editions. The collected bibliographic data were finally analyzed as three groups of papers published in (a) international journals covered by CC (international CC), (b) Croatian journals covered by CC (Croatian CC), and (c) Croatian journals not covered by CC (Croatian non-CC).

#### Scientific Production Indicators

The publication productivity was analyzed at three levels – general, departmental, and individual. The productivity of each author or department was measured as its total number of articles published in CC-covered (international CC and Croatian CC journals) and *Biomedicina Croatica*-covered journals (Croatian non-CC journals). The production of each author/department was measured by the total number of CC publications. The portion of international visibility belonging to the papers published in the Croatian CC-covered journals was also determined.

Articles arising from collaboration with researchers from other groups/departments (outside or within the School) are partially based on research efforts of other groups. The authorship credit to individual co-authors in such collaborations is a controversial issue. Some authors consider that without "inner" knowledge it is very difficult to assign to each participating author his/her proper fraction and that a full publication should be assigned to each author (13). The others are strongly in favor of a fractional counting scheme, assigning to each author a partial authorship of  $1/n$ , where  $n$  is the number of co-authors of a published paper (14). We decided to use both counting schemes: (a) a full publication credited to each co-author (AU, authorship), and b) each co-author charged by a fraction of the publication distributed equally among co-authors (FRA, fractional authorship). Primary and secondary roles in research are often indicated by the position of authors on a scientific paper. Typically, it is the first author who is responsible for conceiving, designing, and carrying out the experiments and writing up the results. Thus, a preponderance of first authored papers may carry more weight for a scientist (15). Therefore, we determined also productivity derived from papers in which an author is first in the byline (FA, first authorship). Thus, one paper published by  $n$  co-authors gave one AU and  $1/n$  FRA to each of them (or their departments) and one FA to the first author only (number of FAs comprise a portion of

number of AUs). In case of a paper written by a single author, the author was given one point per each of the three variables.

Data were analyzed according to the academic ranks and departments, identifying the highest/lowest productive authors and departments.

Total and average productivity for departments and academic ranks (or the School as a whole) was calculated as a sum of all authorships (AUs) or fractions (FRAs) of a department or academic rank and divided by the corresponding number of affiliated faculty members.

#### Statistical Analysis

Descriptive statistics included data tabulation, calculation of distribution parameters (minimum, maximum, median, and means), and graphical presentation. Time trends for total yearly productivity measured by number of published papers and total fractional authorship were calculated and drawn as linear regression lines (five years span) for two categories of papers. The regression line slopes were investigated and the null hypothesis that the true slope is zero was tested by calculation of the test statistics which follows the t-distribution on  $n-2$  degrees of freedom (test statistics = slope/SE(slope), where SE(slope) is the standard error of the slope). Differences in productivity among the three groups of faculty members were tested using Kruskal-Wallis ANOVA. The differences were considered statistically significant if they did not exceed  $p=0.05$ .

## Results

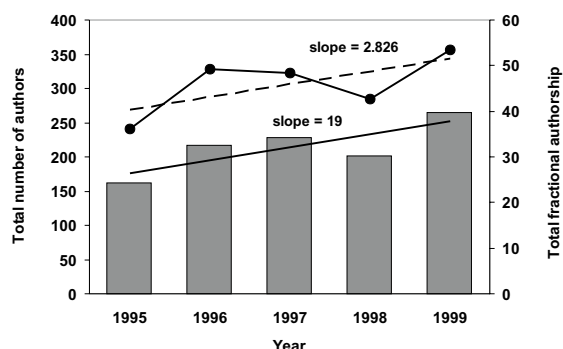
### General Productivity

In the 1995-1999 period, the authors affiliated to the Zagreb Medical School published 578 papers in the CC-covered journals (1.6 publications per faculty member). As many as 447 out of 578 (77.3%) papers were published in international CC journals (Table 2). Of the remaining 131 (22.6%) papers published by four Croatian CC-covered journals, *Društvena Istraživanja* and *Croatica Chemica Acta* published together only 4.6%, and the *Croatian Medical Journal*, which began to be covered by CC only in 1999, published 11.5% papers. Thus, the majority of the School's papers published in the Croatian CC journals were published in *Collegium Antropologicum* (110/131 or 84%). In 1999, for example, *Collegium Antropologicum*, *Croatian Medical Journal*, and two other Croatian CC journals (*Croatica Chemica Acta* and *Društvena Istraživanja*) published 25, 15, and 1 papers or 61.0%, 36.6%, and 2.4%, respectively. The number of the School's authors (AU) publishing in the same set of journals was 50, 21, and 1, respectively, meaning that the two journals (*Collegium Antropologicum* and *Croatian Medical Journal*) shared the

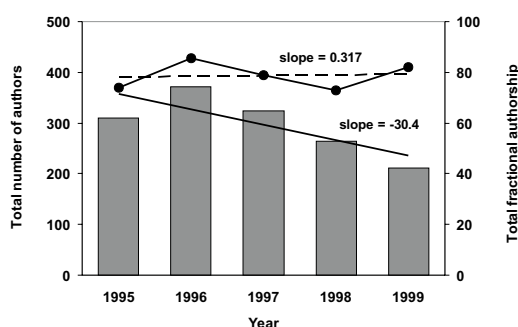
**Table 2.** Papers published in journals covered by the *Current Contents* in the 1995-1999 period, with total number of their authors affiliated to the Zagreb University Medical School

Journal	No. of	No. of papers with the School's authors per year and total number of the School's authors					1995-99
		1995	1996	1997	1998	1999	
<i>Collegium Antropologicum</i>	papers	15	37	21	12	25	110
	authors	31	68	54	27	50	230
<i>Croatian Medical Journal</i> *	papers	–	–	–	–	15	15
	authors	–	–	–	–	21	21
<i>Društvena istraživanja</i>	papers	1	1	0	1	1	4
	authors	2	1	0	2	1	6
<i>Croatica Chemica Acta</i>	papers	1	0	1	0	0	2
	authors	1	0	1	0	0	2
Croatian CC journals	papers	17	38	22	13	41	131
	authors	34	69	55	29	72	259
International CC journals	papers	79	84	97	92	95	447
	authors	128	148	173	172	193	814
All CC journals	papers	96	122	119	105	136	578
	authors	162	217	228	201	265	1073

\**Croatian Medical Journal* was included in the CC in 1999.



**Figure 1.** Publishing in CC-indexed journals, both international and Croatian, in the 1995-1999 period: bars show the total number of authors affiliated to the Zagreb Medical School (AU, left scale); line with circles is the respective fractional authorship (FRA, right scale). Corresponding trends are presented as straight lines (full and broken line, respectively) with denoted slopes.



**Figure 2.** Publishing in Croatian non-CC journals in the 1995-1999 period: bars show total number of authors affiliated to the Zagreb Medical School (AU, left scale); line with circles is the respective fractional authorships (FRA, right scale). Corresponding trends are presented as straight lines (full and broken line, respectively) with denoted slopes.

authorships of the School faculty members with the ratio 7:3, whereas the portion belonging to the other two journals was negligible (Table 2).

The number of authors publishing in CC covered journals, both international and Croatian, increased steadily in the analyzed period, with the exception of 1998 (Table 2, Fig. 1). The total number of authors of CC papers rose from 162 in 1995 to 265 in 1999,

showing the increase of 63.6%. Total fractional authorship in these years was 36.1 and 53.5, respectively, showing an increase of 48.2%. The trends of both the number of authors and total fractional authorship showed an increasing pattern but were not statistically different from zero-slope due to fluctuations during the five-year period ( $t = 2.289, p = 0.10$ ; and  $t = 1.52, p = 0.225$ , respectively).

The number of authors publishing in Croatian non-CC journals reached its maximum in 1996 and markedly decreased since then (Fig. 2), giving a negative trend but not significantly different from zero ( $t = -2.198, p = 0.115$ ). Total fractional authorship followed the total number of papers per year with the exception of the last year (1999), when it again rapidly increased, while the number of authors decreased. This gave a steady five-year trend.

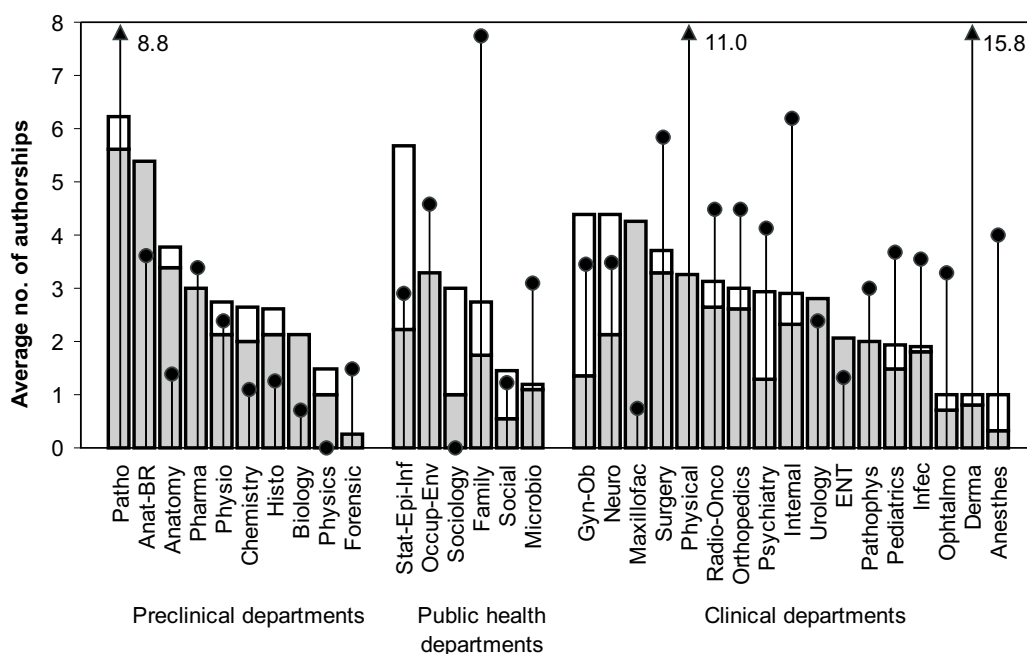
#### Departmental Productivity

The productivity of the School's departments in the 1995-1999 period was analyzed with respect to the number of faculty members in each department (Fig. 3), with three groups of departments sorted in descending order by the average number of authorships in CC-covered journals (both international and Croatian). We calculated the average departmental productivity as a ratio of the sum of all authorships and total number of departmental faculty members (all ranks), regardless if they published or not in the analyzed period. The differences among the departments were considerable, with CC publishing activity ranging from an average of 6.23 for the Department of Pathology to 0.25 for the Department of Forensic Medicine. The differences were even greater when the Croatian non-CC papers were considered, varying from 15.8 for the Department of Dermatology to 0.0 for the departments of Medical Physics and Medical Sociology and Health Economics. Publishing in the Croatian CC group of journals prevailed (> 50% of all CC indexed papers) in 3 public health departments (Medical Statistics, Epidemiology, and Medical Informatics, Medical Sociology and Health Economics, and Social Medicine) and 4 clinical departments (Gynecology and Obstetrics, Neurology and Neuropathology, Psychiatry and Psychological Medicine, and Anesthesiology). The analysis on the departmental level showed that preclinical departments published significantly less in Croatian CC journals than public health and clinical departments (Table 3, Fig. 3). Preclinical departments published predominantly in international CC journals. Publishing in Croatian non-CC

**Table 3.** Departmental productivity in the 1995-1999 period with distribution parameters and percentages for professors (all ranks) and assistants (all ranks)\*

Faculty	No.	Authorship				Croatian non-CC	
		CC (international and Croatian)	CC (international and Croatian)	% FA	% int	median	mean
Professors:	227	3	3.89	22.8	75.3	3	5.25
preclinical departments	58	2	4.34	19.0	86.9	2	3.29
public health departments	23	3	4.24	19.6	64.9	3	4.74
clinical departments	146	3	3.65	25.1	72.7	4	6.11
Assistants:	132	3	1.45	34.0	49.2	1	2.18
preclinical departments	30	1	1.40	40.5	56.7	1	1.87
public health departments	20	0	1.25	44.0	55.0	0	1.10
clinical departments	82	1	1.51	29.8	45.1	2	2.56

\*Abbreviations: FA – first author; int – international.



**Figure 3.** Average departmental productivity in the 1995-1999 period: number of authorships was divided by number of faculty members (all ranks) affiliated to a certain department (abbreviations used for departments are given in Table 1). Bars represent number of CC papers published per faculty member: closed bars show authorship of papers in international CC journals and open bars show authorship in Croatian CC journals; bullets represent average number of Croatian non-CC authorships.

journals was evident especially in 2 clinical departments, Dermatology (15.8 on average) and Physical Medicine and Rehabilitation (11.0 on average).

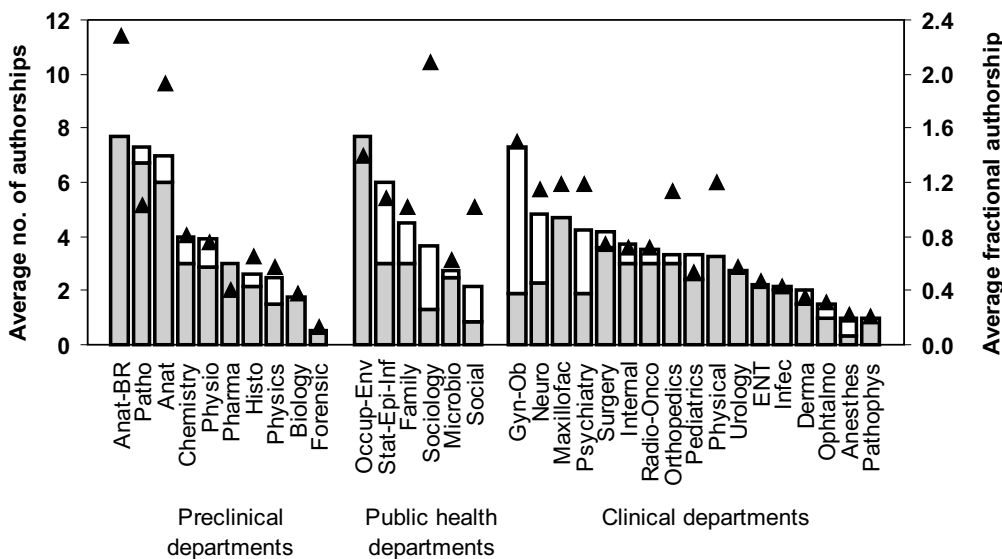
High variability was visible not only among departments but also within departments and especially between professors and assistants. Therefore, we presented distribution parameters (medians and means) for both, the number of papers (AU) and portions of first authorships (FA) in all CC-covered journals and Croatian non-CC journals for professors and assistants separately according to three groups of departments (Table 3).

Since the "fixed" name list was used, we took into account only the publishing activity of the higher academic ranks (professors), ie, their publications in both all CC-covered and Croatian non-CC journals, to obtain more objective analysis of departmental productivity (Figs. 4 and 5). The average number of papers in these groups of journals ranged between 0.5 and 7.7, and 0 to 24.5, respectively, whereas the average fractional authorship ranged from 0.13 to 2.4. Interestingly, the average number of published papers was almost the same in leading departments of all three groups (7.7, 7.7, and 7.3, respectively), but the portions published in Croatian CC journals differed (Fig. 4). Average productivity in the Croatian non-CC journals spanned from 0 to an extreme value of 24.5 papers per professor in the Department of Dermatology (fractional authorship spanned from 0 to 7.8) (Fig. 5). The ratio between scales showing departmental averages of number of papers (left scale) and fractional authorship (right scale) was 5:1 (Fig. 4) and 3:1 (Fig. 5) and allowed graphical comparisons. Compar-

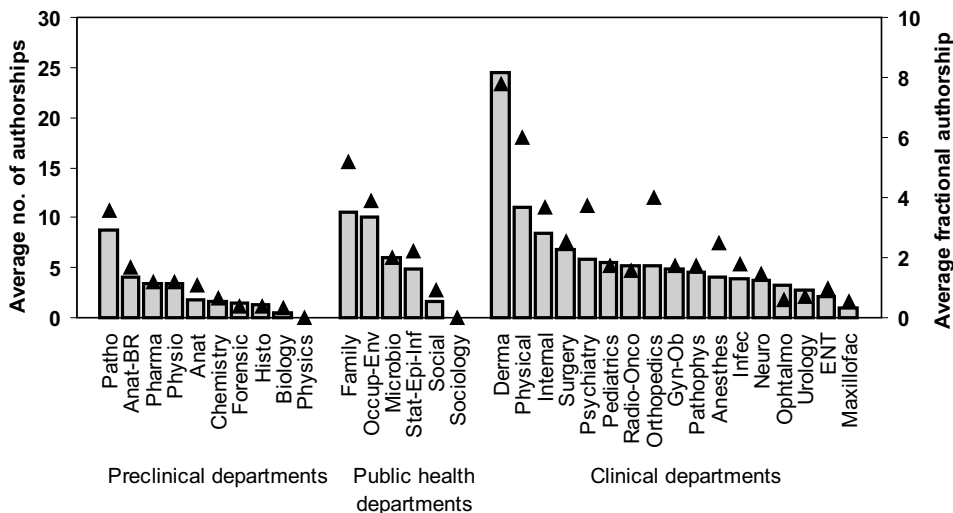
ing the left and right scale for CC-papers (Fig. 4) it was easy to notice that both figures coincided for the majority of the departments, meaning that each paper had five authors (on average). The exceptions (greater fractional authorship and thus smaller average number of authors per paper) were found in two preclinical departments (Anatomy and Anatomy-Brain Research Institute), two public health departments (Medical Sociology and Health Economics, and Social Medicine) and two clinical departments (Orthopedics, and Physical Medicine and Rehabilitation), whereas the average number of authors per paper slightly deviated in the opposite direction (more than five authors per paper) in two preclinical departments (Pathology and Pharmacology). In case of papers published in Croatian non-CC journals, averages of fractional authorship ranged from one-third to a half of the average number of papers, meaning that an average paper has between two and three authors (Fig. 5).

#### Individual Productivity

A high variance in publishing activity was observed both among and within the departments (Table 4; for detailed individual productivity for professors according to their departmental affiliation see web-extra table). There were 35 out of 227 (15.4%) professors who did not publish a single paper in CC-covered journals (20.7% of those affiliated to preclinical departments, 17.4% in public health, and 13.0% in clinical departments). On the other hand, 23 out of 227 (10.1%) published more than 10 CC papers. Highly productive in category of CC papers (>10 CC papers in five years) was every sixth preclinical professor (10/58), every eighth in public health (3/23),



**Figure 4.** Average departmental productivity in CC-covered journals in the 1995-1999 period for professors only: number of authorships (professors only, all ranks) was divided by number of professors affiliated to a certain department (abbreviations used for departments are those given in Table 1). Bars (left scale) represent average number of CC papers published per professor: dark bars show authorship of papers in international CC journals and white bars show authorship in Croatian CC journals; triangles (right scale) represent the respective fractional authorship of CC papers, both international and Croatian together.



**Figure 5.** Average departmental productivity in Croatian non-CC journals in the 1995-1999 period for professors only: number of authorships (professors only, all ranks) was divided by number of professors affiliated to a certain department (abbreviations used for departments are those given in Table 1). Bars (left scale) represent average number of authorships and triangles (right scale) respective average fractional authorship.

and one out of 15 clinicians (10/146). Publishing in Croatian non-CC journals was predominant among professors in the group of clinical departments: 130 out of 146 (89%) of them published at least one paper in this category, whereas the respective percentage was around 70% in other two groups of departments.

Figure 6 shows the distribution of the individual productivity of the School's professors who published 6 or more papers in the CC-covered journals. A number of the authors who have been productive in the international CC journals did not publish in the Cro-

atian CC journals and vice versa. For example, 3 pre-clinical professors with 11 or more papers in the international CC journals did not publish a single paper in the Croatian CC journals and 4 clinical professors with 6 or more papers in the Croatian CC journals did not publish a single paper in the international group of CC journals (Fig. 6).

Almost 45% of the assistants (59/132, data not shown) did not publish a single paper in the CC journals. On the other hand, some of them (8/132) were very productive (5 and more published papers), 5 of

**Table 4.** Productivity of professors (all ranks) by number of published papers in the 1995-1999 period for three groups of departments (details available at [www.cmj.hr](http://www.cmj.hr))

Department	No. of professors	No. of published papers													
		total published (CC + Croatian non-CC)				CC (international and Croatian)					Croatian non-CC				
		0	1-5	6-10	>10	0	1	2-5	6-10	>10	0	1	2-5	6-10	>10
All departments:	227	10	89	66	62	35	35	111	23	23	40	24	96	36	31
preclinical departments	58	5	27	12	14	12	10	20	6	10	17	10	22	4	5
public health departments	23	2	8	8	5	4	2	12	2	3	7	2	8	2	4
clinical departments	146	3	54	46	43	19	23	79	15	10	16	12	66	30	22

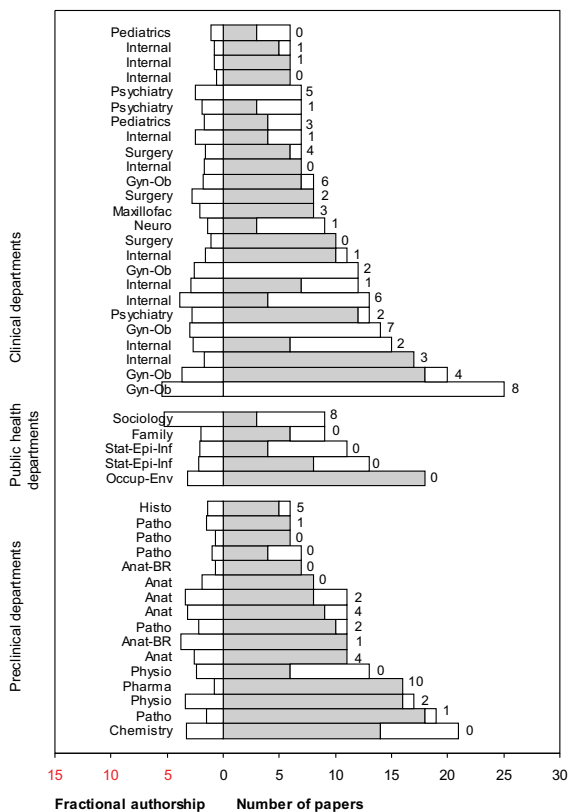
them having published all the papers in the international CC journals) (Fig. 7).

Individual productivity in two categories of papers (CC and non-CC) was compared among three groups of departments separately for professors and assistants (Table 5). No difference was found among professors, either in authorship or in the fractional authorship of CC papers ( $p=0.951$  and  $p=0.509$ , respectively). Significant differences were found in both the number of papers and fractional authorship in the category of Croatian non-CC papers ( $p=0.001$  and  $p=0.002$ , respectively), clinicians being most productive. Among assistants, there were no significant differences in the authorship of CC papers, although those affiliated to public health departments were

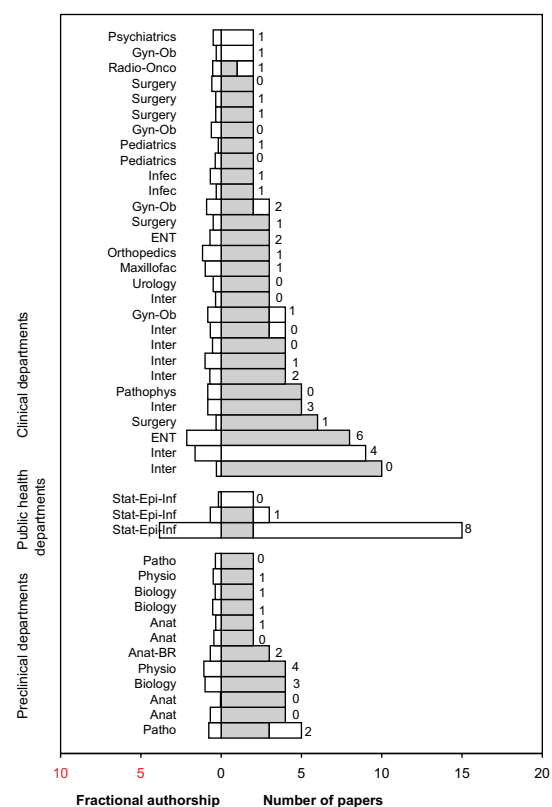
least productive ( $p=0.214$  and  $0.245$ ). The difference in the number of papers published in Croatian non-CC journals was statistically significant ( $p=0.017$ ) while the difference in fractional authorship was not ( $p=0.138$ ) showing as the most productive the assistants in clinical departments.

**Discussion**

Publishing in internationally recognized and peer-reviewed scientific journals is extremely important for the scientific vitality of a medical academic institution in a scientifically peripheral country (9). The analysis of the Zagreb Medical School research output showed that the number of papers published in the international journals covered by the CC had in-



**Figure 6.** Individual productivity of professors (all ranks): bars represent number of CC papers published in the 1995-1999 period for authors with 6 and more papers (individual results are denoted by their departments' names abbreviated as in Table 1); number of papers published in international CC journals (closed bars) and in Croatian CC journals (striped bars) are presented together with fractional authorship (dotted bars on the left, negative side). Labels denote number of first authorships.



**Figure 7.** Individual productivity of assistants (all ranks): bars represent number of CC papers published in the 1995-1999 period for authors with 2 and more papers (individual results are denoted by their departments' names abbreviated as in Table 1); number of papers published in international CC journals (closed bars) and in Croatian CC journals (striped bars) are presented together with fractional authorship (dotted bars on the left, negative side). Labels denote number of first authorships.

**Table 5.** Comparison of productivity in five-year period (1995-1999) among three groups of departments for professors and assistants

Faculty	N	Authorship (mean rank)			
		CC	CC fractional	Croatian non-CC	Croatian non-CC fractional
Professors (all ranks):					
preclinical departments	58	111.0	112.5	87.3	89.4
public health departments	23	116.7	129.0	105.2	106.3
clinical departments	146	114.4	112.2	125.0	124.0
p*		0.951	0.509	0.001	0.002
Assistants (all ranks):					
preclinical departments	30	70.2	70.1	58.3	58.3
public health departments	20	53.5	54.0	50.3	57.0
clinical departments	82	68.3	68.2	73.5	71.6
p*		0.214	0.245	0.017	0.138

\*Kruskal-Wallis ANOVA.

creased over the analyzed period, but compared to the number of potential School's authors the output was still inadequate: 0.32 papers/faculty member or 0.6 authorships/faculty member per year. This means that on average each faculty member authored 3 CC papers in five years.

#### Departmental Productivity

Publishing activity of preclinical departments was the highest in international CC-covered journals, although there were extremely low productive departments. The portion of preclinical papers published in the Croatian CC-covered journals is rather small or nonexistent, whereas it prevailed (> 50% of all CC indexed papers) in 3 out of 6 public health departments and 4 out of 17 clinical departments. The differences in the publication activity in CC-covered journals were generally less pronounced among clinical departments, although highly productive departments (Gynecology and Obstetrics, Neurology and Neuropathology, and Maxillofacial Surgery) had on average 4.4 times more published papers than the lowest productive ones (Anesthesiology, Dermatology, and Ophthalmology). This imbalance was partly field specific, but probably also depended on departmental staff structure, such as academic rank and age.

Some of the public health and clinical departments published more in the Croatian non-CC journals than in the CC journals. Two clinical departments (Dermatology and Physical Medicine and Rehabilitation) published far more intensively (on average of 15.8 and 11.0 respectively) in this group of journals. It can be assumed that the reasons were in the specialized journals affiliated to the respective departments (16).

#### Individual Productivity

There are different opinions on how many papers a scientist can publish per year (17,18). If we look at the total School's production, less than one half of the faculty members had one journal publication per year. The variance of productivity on individual and departmental level was great, but this has also been noted in other settings. Krumland and colleagues argued (19) that, on the average, senior faculty members were more productive than junior faculty members, and members of basic science departments were more productive than members of clinical departments. Our results are comparable only on

the rank level. However, three groups of departments showed no difference in publishing in CC-covered journals, whereas the clinicians were the most productive in the Croatian non-CC journals.

Paradoxically, the most productive authors among professors and assistants (Figs. 6 and 7) were usually isolated cases in their relatively non-productive departments (e.g., Pharmacology, Physiology, and Medical Statistics and Epidemiology).

#### Croatian CC-covered Journals

Although scientific information could find its way to the respective global audience even if it is published in a local journal and local language (20), it is an exception rather than a rule. Publishing in English and coverage by relevant indexing and abstracting services are the aims of the editorial boards of all scientific journals in the small communities (9). We, therefore, analyzed separately the share of the Croatian journals covered by CC in the total the School's publication output. The School's authors published in 4 Croatian journals covered by the CC. Two of them (*Croatica Chemica Acta*, *Društvena Istraživanja*) belong to other scientific disciplines and cover medicine only occasionally. The *Croatian Medical Journal* entered the CC during the last analyzed year and its role in publishing the School's papers is expected to grow. Therefore, *Collegium Antropologicum* participated with 84% in the total published by the Croatian journals. Moreover, *Collegium Antropologicum* published almost one fifth of the total School's publication output in the five-year period (110/578 papers). Further investigation would be needed to reveal if the pattern of publication behavior is the same in the following years, as well as at the other Croatian medical schools. Discussing language biases in the Institute of Scientific Information databases, van Leeuwen and colleagues (21) raised the question whether domestic language journal publications, although covered by ISI and thereby having a certain (international) status, mainly serve a domestic goal. Our results may raise the similar question: does the disproportional share of a domestic CC-covered journal in total School's publication output is just a matter of editing characteristics and quality of the journal or a matter of lacking of self-regulatory mechanisms in the scientific community of a small country (16)?



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