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Implementation of various criteria for evaluating the scientific output of professional scientists and clinicians-scientists

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BACKGROUND: *Our aim was to investigate how the application of scientometric parameters, which are lacking in the Ministry of Sciences and Technology of Serbia's (MSTS) criteria for evaluating the scientists, influences the scientists' ranking.*

METHODS: *In the final report of a four-year research, supported by a MSTS grant (13M13), and realized at the Institute for Oncology and Radiology of Serbia, top twelve scientists - six full-time researchers and six clinicians - were selected from a list obtained by ranking the scientists according to the MSTS's criteria. The authors of papers published in peer-reviewed journals were evaluated by several scientometric parameters: the papers/author index (publication count); the authors/paper index (coauthorship); the numeric weighing factors based on the position of author in author list; the score of points gained by the MSTS's criteria for evaluating papers according to the impact factor of the journal they are published in. The authors were ranked according to each parameter, and each resulting rank list was compared with the starting one. The final rank list was obtained by total rating (score of points gained by the author's position in previous rank lists).*

RESULTS: *With rare exceptions, implementation of each of these criteria changed the starting authors' positions. The final rank lists, obtained by the implementation of the whole set of scientometric parameters, also differed greatly from the starting ones.*

CONCLUSION: *The changes of positions on the basis of either individual or the whole set of parameters reflect various publishing habits of the authors. The main changes, due to the implementation of the parameters lacking in MSTS's criteria, indicate that these should be incorporated in the current system of evaluating the scientists.*

KEY WORDS: *Science; Writing; Authorship; Evaluation Studies; Bibliometrics*

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INTRODUCTION

The current system of evaluating the scientists is thoroughly discussed worldwide; it is thought that it favors the simple counting of the author's papers, and that quantity outweighs quality (1). The same criticism may be addressed to our own system, formulated in the Ministry of Science and Technology of Serbia's (MSTS) criteria (2). The efforts of the scientific community to regulate the ethical climate in science resulted in the proposals for safeguarding good scientific practice (3). Some of these proposals are related to this topic: "Universities and research institutes shall always give originality and quality precedence before quantity in their criteria for performance evaluation" (3). Implementing the quality assurance in this area is the best preventive measure against the devastating consequences of the "publish or perish syndrome". Although some initiatives have already been done (4,5), this aim has yet to be achieved in our scientific community. Meanwhile, we evaluated a small sample of researchers on the basis of their productivity and contributions to this important "product" of research.

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MATERIALS AND METHODS

The final report of the MSTS's grant 13M13, carried out at the Institute for Oncology and Radiology of Serbia, included a rank list of scientists, obtained by implementing the MSTS's criteria for evaluating the scientists. For internal purposes, top ten scientists were emphasized; this list consisted of six clinicians and four professional scientists. We divided this group into two subgroups: clinicians (C, n=6) and full-time experimenters (E, n=4); the latter subgroup was completed by the addition of two subsequent professional scientists from the initial rank list. In both subgroups, the authors were ranked according to the points gained by the MSTS's criteria. The resulting two rank lists served as the referent ones when authors within each subgroup were evaluated by different scientometric parameters and compared accordingly.

Scientometric analysis. Several scientometric parameters were used:

Publication count, the number of papers (original and review articles only) published during the four-year period in national and international peer reviewed journals;

Authorship, the number of single-author papers per author;

Coauthorship, the number of authors per paper;

First authorship, the number of the first positions in multiauthor papers (percent of the total publication count);

Partial authorship I, the score of points gained by a mathematical formula based on the author's position in multiauthor papers, as follows: One paper = one point; single author = one point; two authors - first author 0.7, second author 0.3 points; multiauthor papers - first author 0.6; second author 0.3, third author position and beyond 0.1 point (1).

Partial authorship II, the score of points gained by a mathematical formula that gives credit to all authors on a descending scale, i.e., each following author receives half the credit of the previous one (start 100 points) (6);

Score of points, the sum of points obtained by adding up the points the MSTS gives according to the impact factor of a journal in which a particular paper was published, multiplied by the points gained by the author's position in the lists of authors;

Rating, the total score of points gained by the author's position (descending scale, same as for Partial authorship II) on all five previous rank lists.

RESULTS

At the beginning of the project, both clinicians and FTEs were middle-aged persons (mean age 46.2 and 46.8, respectively). During the realization of the grant, the publication count of each scientist was increasing steadily (data not shown). All but two authors (one already holding the highest academic position, and the other not yet achieving the PhD degree) got the promotion accordingly; some were promoted for two academic degrees (according to the MSTS's propositions, it is possible to be promoted for two positions thereby skipping a particular one). At the end of this period, the FTEs held slightly higher academic positions than clinicians (Table 1).

Table 1. The scientists' characteristics

Group	Age 1996 ($x \pm SD$)	Promotion (1996-1999)	Academic position 1999
Clinicians (C)			
C1		C1 ↑↑	
C2		C2 ↑	Full Professor = 3
C3	46.2 (9.2)	C3 ↑↑	Assoc. Professor = 1
C4	Range: 33-56 yrs.	C4 ↑	Assist. Professor = 1
C5		C5 ↑	Fellow = 1
C6		C6 →	
Full-time experimentators (FTE)		E1 ↑↑	
E1		E2 →	Full Professor = 3
E2	46.8 (4.4)	E3 ↑	Assoc. Professor = 2
E3	Range: 42-53 yrs.	E4 ↑	Assist. Professor = 1
E4		E5 ↑	Fellow = 0
E5		E6 ↑	
E6			

↑ promotion
↑↑ promotion for two academic positions

The clinicians were more productive than the FTEs (mean publication count 35.8 and 19.7, respectively); in each subgroup, the total publication count of the first authors was much greater than that of the others. The mean numbers of coauthors were approx. five and four in the clinician and FTE subgroups, respectively. Only two scientists in each subgroup published a modest number of single-author papers (Table 2).

Table 2. Publication count, authorship and coauthorship of clinicians (C) and full-time (FTE) experimenters (E)

Group	Publication count	N° of authors	N° of authors/ publication count		Single author papers (%)
Clinicians (C)					
C1	95	421	4.4		3.2
C2	27	114	4.2		0
C3	27	166	6.1	(4.9 ± 0.7)	0
C4	26	135	5.2		11.5
C5	20	97	4.9		0
C6	20	94	4.7		0
Experimentators (FTE)					
E1	37	180	4.1		6.8
E2	22	64	2.9		9.1
E3	14	75	5.4	(4.3 ± 1.1)	0
E4	16	57	3.6		0
E5	12	72	6.0		0
E6	10	38	3.8		0

The rank lists based on the publication counts were similar to those obtained by the MSTS's criteria, giving credit also to the conference papers, abstracts, monographs etc. (Figure 1).

The rank lists based on the first authorships (percentage of the total publication count of each author) differed greatly from the referent ones; all but one (E2) highly ranked authors exchanged their positions with the lowly ranked ones (Figure 2).

The rank lists obtained according to the points gained by the position in the author list (mathematical formula I), differed more (clinicians) or less (experimenters) from the starting ones (Figure 3). A similar pattern was obtained when the mathematical formula II was applied (Figure 4). In this regard, two extremes emerged: the clinician C3 was on the third position or beyond in almost 90% of papers, while the third position of the E2 was only 4% (Figure 5). When the points gained by the author's positions were multiplied by the points the MSNS gives to a paper (depending on the impact factor of the journal), the resulting score of points changed both rank lists to a great extent (Figure 6).

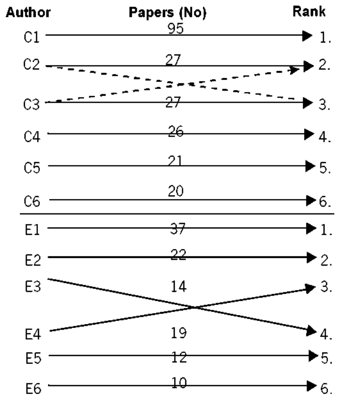

Figure 1. Ranking the authors according to their total publication count

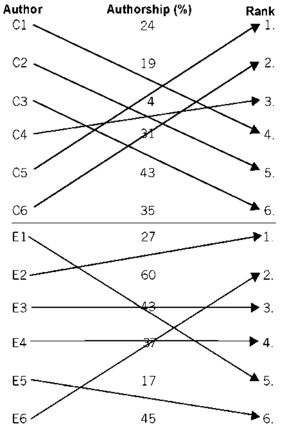

Figure 2. Ranking the authors according to the first authorships (percentage of total publication count)

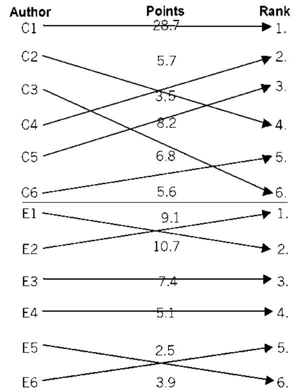

Figure 3. Ranking the authors according to the coauthors' position (mathematical formula I)

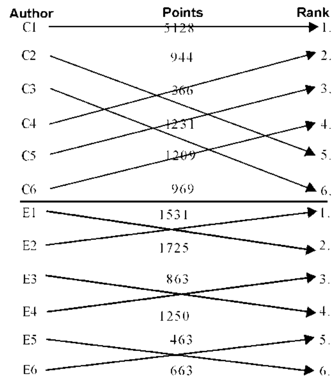

Figure 4. Ranking the authors according to the author position (mathematical formula II)

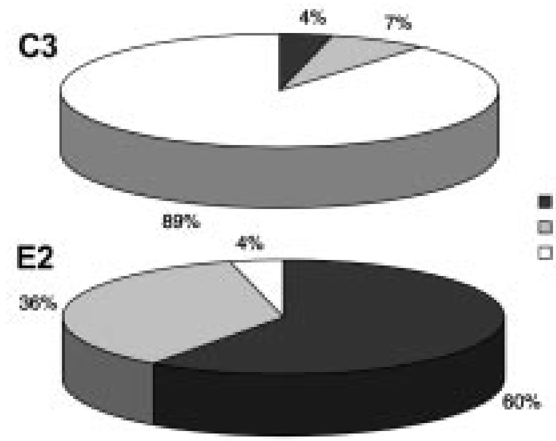

Figure 5. The contribution (%) of the first, the second and the third positions in publications of a clinician (C3) and an experimentator (E2)

The final rang lists, obtained by implementing all these parameters and weighing the positions of authors in five previous rank lists on the descending manner, also differed from the starting ones.

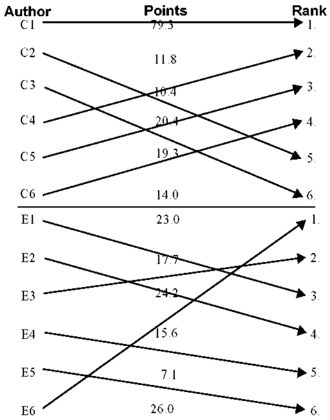

Figure 6. Ranking the authors according to the score of points (multiplying the points gained by the Ministry criteria by those gained by the author's position)

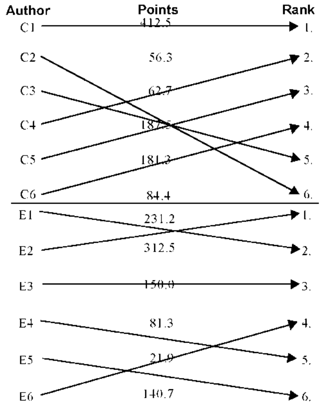

Figure 7. Final rating list according to the score of points gained by the authors' positions on five previous rank lists

Except for one clinician, who remained in the first position, the positions of all others were significantly changed. The FTE list was changed to a lesser extent: the first two authors replaced their starting positions, the third remained in his place, while the last one raised to the fourth position (Figure 7).

DISCUSSION

This analysis was undertaken in order to compare the criteria of the MSTS (2) with those proposed in scientometrics for evaluating the scientific output (1,6). Although scientometrics evaluates the science (7), the scientometric parameters are also applied in evaluating the scientists (8). The basic rule in scientometrics is to compare "apples to apples" (9,10); that is why we divided the scientists into two groups and compared the individuals within each subgroup.

The simplest way for evaluating the scientists is to count their papers and to compare them on the basis of productivity (7,9). In many cases, the publication count is the primary factor in professional advancement (1); the same is true for our scientific community, since the MSTS's criteria are mainly based on this principle. This fact explains the similarity, unique in this analysis, of the starting and our rank lists.

However, the simple counting of publications is not sufficient for evaluating a scientist. Since multiauthorship is now the norm (11,12), it has been suggested that the first authorship of scientific papers is the most suitable quantitative measure of research productivity (13); some of deserved credit is given to second authors, but very little to the third-author position and beyond (1).

The scientific community is divided about how to valuate the order of authors. "Some scientists contend that an author's place does not matter because credit is equal; the others emphasize that, on the contrary, it does indeed matter because the system works like the prizes at a golf tournament: each successive finisher receives half the credit of the one ahead, down to 5…”(6). The MSTS’s criteria adhere to the former: the first author position does not get any more weight than any other, nor the MSTS practices to valuate the positions differentially; thus, the prevalence of authorship and the specific contribution of coauthors are ignored. This is the primary cause for the dramatic changes in the authors’ positions on the rank lists that had taken into account these parameters.

Such a situation is criticized worldwide, resulting in broad action to define true biomedical authorship (12,14,15), which is probably the greatest ethical problem in the gray zone between scientific misconduct and good scientific behavior (16). The academic promotion is more dependent on publications than on clinical activity or teaching excellence: “… all that counts is the end product; in considering a scientist for promotion, the guiding rule is “productivity”, and quantity outweighs quality”(17). Such a situation generates the “publish or perish syndrome," thus corrupting the science by the need to produce (17); the system that values more publication count than actual contributions exacerbates the problem (6).

This applies to our scientific community as well: lack of explicit criteria for evaluating the actual contribution of authors of the scientific articles predisposes the current system of evaluation to abuse and therefore needs radical changes (3,6,15,18).

Many initiatives to promote good authorship practices include synergistic efforts of all institutions of science - universities, professional societies, scientific journals, and outstanding researchers (3,19,20,21). These efforts, aimed to overcome the lethargy of the academic bureaucracy (22,23), will soon result in obligations of the scientific community to adopt an ethical code called Good Scientific Practice (5,21,24). This is expected to ameliorate the ethical climate of scientific endeavor on the whole.

REFERENCES

1. Slone RM. Coauthors’ contributions to major papers published in the AJR: frequency of undeserved coauthorship. Amer J Radiol 1996;167:571-9.
2. Criteria for obtaining research titles and evaluation of the research. In: Uzunović R, ed. Science and Technological Development in the Republic of Serbia. Belgrade: Ministarstvo za nauku i tehnologiju Republike Srbije; 1997. p. 107-18.
3. Website: http://dfg.de
4. Vučković-Dekić Lj. Good Scientific Practice. Arch Oncol 2000;8 (Suppl 1):3-5.
5. Group of authors. Good Scientific Practice - Ethical codex of science. Belgrade: Institute for Oncology and Radiology of Serbia and Institute for Medical Research, January 2001.
6. Rennie D, Yank V, Emanuel L. When authorship fails: A proposal to make contributors accountable. JAMA 1997;278:579-85.
7. Garfield E, Welljams-Dorof A. Citation data: their use as quantitative indicators for science and technology evaluation and policy-making. Current Contents 1992;49:5-13.
8. Cindro N. Contemplations on scientometry in assessment of the research work and researches in Croatia. In: Poček D, ed. Visible and Invisible Academia. Zagreb: Institute of Social Sciences Ivo Pilar; 1998. p. 99-101.
9. Garfield E. Expected citation rates, half-life, and impact ratios: Comparing apples to apples in evaluation research. Current Contents 1994;37:3-5.
10. Herak M. Evaluation of the Research from the aspect of geology. In: Poček D, ed. Visible and Invisible Academia. Zagreb: Institute of Social Sciences Ivo Pilar; 1998. p. 131-6.
11. Vučković-Dekić Lj. Multiauthorship in three oncologic scientific journals. Arch Oncol 2000;8:109-10.
12. Gaeta TJ. Authorship: “Law” and order. Acad Emerg Med 1999;6:297-301.
13. Chew FS. The scientific literature in diagnostic radiology for American readers: a survey and analysis of journals, papers, and authors. Amer J Radiol 1986;147:1055-61.
14. International Committee of Medical Journal Editors. Uniform requirements for manuscripts submitted to biomedical journals. Med Educ 1999;3:66-78.
15. Vučković-Dekić Lj. Lj. Multiauthorship - what is it, and does it matter? (Letter to the Editor). Arch Oncol 2000; 8:139.
16. Riis P. Misconduct in clinical research. The Scandinavian experience and actions for prevention. Acta Oncol 1999;38:89-92.
17. Wenger NS, Korenman SG, Berk R, Berry S. The ethics of scientific research: An analysis of focus groups of scientists and institutional representatives. J Invest Med 1997;45:371-80.
18. Klaić B. Scientometry or peer review? In: Poček D, ed. Visible and Invisible Academia. Zagreb: Institute of Social Sciences Ivo Pilar; 1998. p. 85-96.
19. Cavalli F. What has prevented Annals of Oncology from reaching an impact factor of 6? (Editorial). Ann Oncol 1999;10:1403-4.
20. Savić J. Evaluation of the scientific work. In: Savić J, ed. How to write, publish and valuate the scientific work in biomedicine. Belgrade: Kultura; 1996. p. 81-91.
21. Medical Research Council. Good Research Practice (Available on MRC’s website: www.mrc.ac.uk).
22. Silobrčić V. Assessment of the scientific work - point of view of the natural scientist. In: Poček D, ed. Visible and Invisible Academia. Zagreb: Institute of Social Sciences Ivo Pilar; 1998. p. 139-41.
23. Hoen WP, Walvoort HC, Overbeke JPM. What are the factors determining authorship and the order of authors names? A study among authors of the Netherlands Tijdschrift voor Geneeskunde (Dutch Journal of Medicine). J Amer Med Assoc 1998;280:217-8.
24. Schneider C. Safeguarding Good Scientific Practice: New institutional approaches in Germany. Science Engineering Ethics 2000;6:49-56.