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Employment Outcomes among Junior Researchers in Medicine in Croatia

Marko Petrovečki[1], Ljiljana Smiljanić[1], Mario Trošelj[2], Ozren Polašek[3]

[1]Medical student, Zagreb University School of Medicine, Zagreb, Croatia
[2]Croatian National Institute for Public Health, Zagreb, Croatia
[3]Andrija Štampar School of Public Health, Zagreb University School of Medicine, Zagreb, Croatia

Aim To investigate fellowship outcomes among junior researchers in medicine, supported by the Ministry of Science, Education, and Sports of the Republic of Croatia.

Methods We used the data on junior researchers whose fellowships terminated between 1999 and 2005. Employment outcomes and scientific productivity, measured by the number of published articles indexed in the Web of Science database, were analyzed for every junior researcher. The data were analyzed using χ^2 test, Mann-Whitney test, Kruskal-Wallis test, Breslow test, and logistic regression.

Results Only 12% of junior researchers obtained a degree of Doctor of Philosophy (PhD) during fellowship. At the same time, 55% of junior researchers with a Medical Doctor degree terminated the fellowship and got employed in the health system during the same month. Terminating and re-employing in same month was most common among junior researchers who got employed by clinics and hospitals (odds ratio, 7.78; 95% confidence interval, 2.22-27.24). Also, it was less common among female than male junior researchers (odds ratio, 0.50; 95% confidence interval, 0.28-0.90).

Conclusion This study suggests that junior researchers in medicine commonly used their fellowship as a short-term employment option. The direct consequence of this is the low percentage of obtained PhD degrees during the fellowship period. Additionally, this article provides an insight into the current status and future of the fellowship programs in medicine, with special emphasis placed on the potential changes that might occur as a consequence of physician shortage in Croatia.

> **Correspondence to:**
Marko Petrovečki
Remetski kamenjak 2a
10000 Zagreb, Croatia
markopetrovecki@net.hr

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Young graduates in Croatia may be employed as junior researchers. A junior researcher is a coworker on a research project that is approved and supported by the Ministry of Science, Education, and Sports (MSES) in a higher education institution, institute, or other organization registered in the Croatian Register of Scientific Organizations. Junior researchers' salaries are provided by MSES and they are employed for a six-year fellowship period in which they must complete a three-year postgraduate doctoral study program and obtain a Doctor of Philosophy (PhD) degree (1). To be selected as a junior researcher, the applicant must be among the top 10% of undergraduate students according to the grade point average. Additional requirements are shorter duration of undergraduate study and lower age (1,2). During fellowship, junior researchers develop skills and knowledge that will enable them to become independent scientists. The main goal of junior researcher during fellowship is to write a PhD thesis and obtain a PhD degree (1).

Previous studies on junior researchers have suggested rather unfavorable situation, with short employment duration, low percentage of obtained PhD degrees, and many cases of fellowship termination (3,4). These outcomes could at least partially be explained by employment characteristics, especially among junior researchers in medicine. They are, especially those in clinical departments, required to advance in both scientific and professional career, to be at the same time scientifically productive and exposed to substantial clinical workload. Furthermore, some junior researchers are obligated to take part in undergraduate and postgraduate teaching (1,5). In such a situation, various difficulties may arise, causing junior researchers to set priorities as they are unable to meet both scientific and professional requirements. Selecting professional development and the consequent lack of interest in science has been described in numerous studies (6-10), indicating that substantial clinical obligations, lack of administration-mentor support, and time for scientific research are the main obstacles to scientific production (11,12).

It was also found that junior researchers in medicine are employed for a much shorter period than their colleagues in other fields of science (4). Therefore, the main aim of this study was to investigate employment outcomes of junior researchers in medicine and also to determine whether junior researchers in medicine use the fellowship as a temporary solution until they manage to find a job within the health system.

Material and methods

Study population

Data on junior researchers were obtained from the MSES human resources database. This is a regularly updated database, maintained by the MSES staff. Several variables from the database were used in the analysis: age and gender, undergraduate successfulness (a binary indicator whether the junior researcher was among the top 10% of undergraduate students according to the grade point average), employment institution, fellowship duration, and fellowship outcome (PhD, Master of Science, or no scientific degree).

The principal inclusion criterion for the study was that the fellowship was related to medicine. Institutions that employed junior researchers were classified in three groups as follows: 1) research institutions, covering basic or applied medical research, 2) medical schools (in Zagreb, Rijeka, Split, and Osijek), and 3) hospital facilities in Croatia (in which neither research nor teaching were junior researchers' predominant activities, but they got the position related to the research grant of their su-

pervisors submitted to the MSES through the hospital facilities). An additional inclusion criterion was that the fellowship was terminated between January 1, 1999 and December 31, 2005 (regardless of the fellowship beginning or the outcome).

Junior researchers were divided in three groups according to their employment outcome as follows: 1) those employed by the MSES (fellows who were predominantly involved in teaching and research), 2) those who terminated the fellowship program or were not employed by the MSES after the fellowship terminated, and 3) junior researchers with other employment outcomes (those who terminated fellowship due to health reasons or were fired). Junior researchers were additionally divided in three groups according to the medical field in which they were employed as follows: 1) those employed in basic medical research, 2) those employed in clinical departments, and 3) those employed in public health (the latter group covered junior researchers employed by the Andrija Štampar School of Public Health).

Measures

To search for the scientific articles published by junior researchers, we used the Web of Science database (WOS; *http://wos.irb.hr*). This database was selected on the basis of accessibility and international visibility and importance. For every junior researcher, we counted the articles published in the following three periods: 1) prior to the employment (ie, undergraduate student publications), 2) during the fellowship period, and 3) after the fellowship termination (covering the period from the actual fellowship termination to the year 2005). For measurement of the scientific production after the fellowship termination, only researchers whose fellowships were terminated up to 2004 were included, in order to allow sufficient post-fellowship period for the annual productivity calculation. Afterwards, the number of articles that were published during and after the fellowship termination was divided by the each period duration, in order to obtain a standardized measure insensitive to the fellowship duration (or post-fellowship period duration). Articles that were in press during each of the three periods were not included in the analysis.

The data set was later merged with the Croatian National Public Health Institute registry of health professionals, which collects data on human resources in medicine. We performed a merged search to find junior researchers who terminated the fellowship program in the same month in which they found a job in the health system.

Statistical analysis

Categorical variables were analyzed with χ^2 test, while continuous variables were analyzed with Mann-Whitney U test for differences between two groups and Kruskal-Wallis for differences between multiple groups. Employment duration was analyzed with Breslow test. Logistic regression was used in the analysis of factors associated with terminating the fellowship program and entering the health system within the same month. Statistical Package for Social Sciences, version 12.0.0 (SPSS Inc., Chicago, IL, USA) was used, with the significance level set at $P<0.05$.

Results

A total of 260 junior research fellowships in medicine were terminated during the investigated period (1999-2005). More than a half of these were awarded to women (164; 63%). Most junior researchers were employed in clinical science (148; 56.9%), followed by basic science (109; 41.9%), and public health (3; 1.2%). A total of 34 (12%) junior researchers obtained a PhD degree during the fellowship

period, while the majority of junior researchers terminated the program without obtaining a scientific degree (Table 1). A total of 111 (43%) of junior researchers were among the top 10% of undergraduate students according to grade point average

Median fellowship duration was 34.0 months (interquartile range [IR], 32.0 months). We detected significant gender differences, with shorter employment in men who were employed a median of 26.5 months (IR, 29.0), as opposed to women who were employed 40.0 (IR, 36.0) months (Breslow $P<0.001$). No differences in the employment duration were recorded between junior researchers who were among the top 10% of undergraduate students according to the grade point average and those who were not (Breslow $P=0.085$).

Table 1. Fellowship outcomes among junior researchers whose fellowship was terminated between 1999-2005*

Fellowship outcomes	No. (%)
PhD degree	32 (12.3)
employed by MSES	20 (7.7)
employed outside MSES	12 (4.6)
others	0 (0.0)
MSc degree	50 (19.2)
employed by MSES	9 (3.5)
employed outside MSES	39 (15.0)
others	2 (0.8)
No scientific degree	178 (68.5)
employed by MSES	5 (1.9)
employed outside MSES	163 (62.7)
others	10 (3.8)
Total	260 (100.0)

*Abbreviations: MSES – Ministry of Science, Education, and Sports; PhD – Doctor of Philosophy; MSc – Master of Science.

A total of 788 authorships and co-authorships by junior researchers were recorded in the study population in the period from 1999 to 2005. Less than a fifth of all junior researchers published a scientific article before the beginning of the fellowship (47; 18.1%), with a strong male predominance (26 men [27%] vs 21 [12%] women; $\chi^2=8.3$; $P=0.004$). We did not detect significant differences in average annual productivity between research areas (basic sciences, clinical sciences, or public health) ($P=0.377$), although junior researchers from the basic sciences were most productive (median 0.3; IR 1.0), followed by fellows in clinical sciences (median 0.2; IR 1.0), while those in public health were least productive (median 0.0; IR 0.0). Also, we did not detect significant gender differences in average annual productivity between the period of fellowship ($P=0.399$) and the period after the fellowship termination ($P=0.078$). Average annual productivity did not exhibit significant differences between the junior researchers who obtained a PhD degree and those who did not ($P=0.133$). Finally, we did not detect significant differences in average annual productivity between junior researchers who remained employed by the MSES and those who terminated the fellowship program (Mann-Whitney $P=0.682$).

A total of 206 (79%) junior researchers were identified in the Registry of Health Professionals. Out of these, 190 (92%) were physi-

Table 2. Logistic regression that predicted the factors associated with fellowship termination and employment in the health system within the same month (referred factors are presented with OR = 1)

Associated factors	*P*	Odds ratio (95% confidence interval)
Gender:		
male		1.00
female	0.021	0.50 (0.28-0.90)
Junior researcher was among the top 10% of undergraduate students:		
no		1.00
yes	0.624	1.15 (0.65-2.04)
Junior researcher published a WOS* indexed article as an undergraduate student:		
no		1.00
yes	0.178	1.65 (0.80-3.42)
University:		
Zagreb	0.302	1.00
Rijeka	0.375	0.63 (0.23-1.75)
Split	0.208	0.46 (0.14-1.54)
Osijek	0.263	2.06 (0.58-7.31)
Institution type:		
research	0.004	1.00
medical schools	0.029	3.44 (1.14-10.43)
clinics and hospitals	0.001	7.78 (2.22-27.24)
Employment area:		
basic medicine		1.00
clinical medicine	0.815	0.91 (0.42-2.00)
Mentor's gender:		
male		1.00
female	0.962	1.02 (0.54-1.91)

*Web of Science.

cians. A total of 105 (55%) of junior researchers terminated the fellowship program in the same month in which they were employed in the health system. Multivariate analysis indicated that these junior researchers were employed by the medical schools (OR, 3.44; 95% CI, 1.14-10.43) and clinics (OR, 7.78; 95% CI, 2.22-27.24), and were less likely to be women (OR, 0.50; 95% CI, 0.28-0.90) (Table 2). No significant difference was found between junior researchers who were among the top 10% of undergraduate students (OR, 1.15; 95% CI, 0.65-2.04) and those who published scientific articles indexed in WOS as undergraduate students (OR, 1.65; 95% CI, 0.80-3.42). The university in which the junior researcher graduated and employment area also showed no significant contribution to the regression model.

Discussion

This study demonstrated that over half of junior researchers in medicine used their fellowship as a temporary employment solution until they managed to ensure a position within the health system. Multivariate analysis indicated that employment in medical schools and hospital facilities and male gender were associated with increased odds of job change during the same month.

A low percentage of obtained PhD degrees in biomedicine has already been reported (4). Coupled with the employment pattern, it seems that junior researchers in medicine aim to obtain their PhD degrees later in their career, especially after their fellowship was terminated. The main reason for terminating the fellowship program is the necessity to advance in the professional career by obtaining a residency. This presents the major disadvantage for junior researchers in medicine, as they are required to advance in both scientific and professional way, which almost inevitably requires them to make a choice between one of these career options. Given that residence has a limited duration (of usually four years) and that there is a much longer time period for PhD submission (of ten years), it seems that most junior researchers choose to advance in professional career and leave the completion of the PhD degree for later career stages.

However, there is an additional negative indicator for junior research fellowships in medicine. More than half of junior researchers terminated the fellowship program and found a job within the health system during the same month. Given that job change is a laborious task, it suggests that most of them had been actively seeking other job opportunities during the fellowship. This was most common among junior researchers employed in clinics and hospitals, indicating that this might be the usual career pattern for clinical junior researchers. This career pattern was probably attractive to young graduates who were unable to secure the specialty of their interest. Male junior researchers were employed for a shorter period of time and entered health system more often than their female counterparts. This indicates that there are substantial gender differences in the employment pattern among junior researchers. Previous studies have demonstrated that final-year medical students were not satisfied with their career opportunities (13), often expressed the feeling of resignation (14), and even considered emigration (14,15). However, recent changes in the physician market marked by a potentially serious shortage of physicians in Croatia (16) seem to have positively changed students' perception (17). Eventually, fewer junior researchers might consider entering fellowship program and using it as a temporary employment option, since they will have more opportunities to be employed as physicians within the health system. In the worst case scenario, this might

cause a shortage of potential candidates for junior researchers in medicine, as most of young graduates might be attracted to better paid jobs within the health system.

This study suggests that junior researchers who terminated the fellowship program were equally scientifically productive as those who remained. This suggests that, despite terminating the fellowship program, these fellows remained scientifically active and productive. Therefore, we can be satisfied with the current finding, as it does not support a common view that terminating the fellowship program causes brain waste, ie, the loss of academic professionals from the academy or the loss of interest in research among physicians (6-10).

The main shortcoming of this study was the heterogeneity in career paths of junior researchers, which may have increased the heterogeneity of the study sample (1). Additionally, more information could have been collected on junior researchers in medicine, especially on their employment outcomes within the health system, but this information was not available in a systematic way. This could be obtained by linking the MSES and health system data sets and monitoring the junior researchers' career advancement in order to increase the effectiveness in both research and health system. One of the ways to improve the present study would be to perform a survey measuring the willingness of junior researchers to use fellowship as a temporary solution. However, the willingness to terminate the fellowship program can change over time, while our study measured a true drop-out and provided a complete overview of junior researcher career outcome. Also, it is worth noting that the term research trainee might better reflect the nature and characteristics of the population under study. However, we used the term "junior researcher," which appears to be the official translation used by the Ministry of Science, Education, and Sports of Republic of Croatia (18).

Given that Croatian health system will be experiencing a serious shortage of physicians (16), it will be very interesting to see whether the observed fellowship pattern will continue in the years to come. The shortage of physicians might cause fewer and fewer junior researchers to apply for the fellowship and possibly use it as a temporary employment option. This might mean that we may expect that fellowships will be more often awarded to those candidates who have a true interest in science.

References

1 Law on Scientific Activity and Higher Education [in Croatian]. Narodne novine. 2003;(123). Available from: *http://www.nn.hr/clanci/sluzbeno/2003/1742.htm*.Accessed: January 24, 2008.

2 National Council for Science. Criteria of the National Council for Science for scientific organizations in applying for research fellows on scientific projects to the Ministry of Science, Education and Sports [in Croatian]. Available from: *http://www.nvz.hr/index.php?option=com_content&task=view&id=41&Itemid=5*. Accessed: January 24, 2008.

3 Prpić K. Size, structure and dynamics of research and development personnel. In: Švob-Đokić N. editor. Research and development policies in the southeast European countries in transition: Republic of Croatia. Zagreb: IMO; 2002. Available from: *http://www.imo.hr/culture/publics/svob01/3.doc.* Accessed: January 24, 2008.

4 Polašek O, Petrovečki M, Primorac D, Petrovečki M. Factors of scientific success of research fellows in Croatia. Društvena Istraživanja. 2007;6:1127-50.

5 Polasek O, Kolcic I, Buneta Z, Cikes N, Pecina M. Scientific production of research fellows at the Zagreb University School of Medicine, Croatia. Croat Med J. 2006;47:776-82. Medline:17042070

6 Bosman FT. Academic medicine: dream or nightmare? Croat Med J. 2004;45:371-4. Medline:15311406

7 Berkow R, Cohen J. The Cri$i$ in academic medicine. Croat Med J. 2005;46:4-9. Medline:15726669

8 Rosenberg L. Physician-scientists – endangered and essential. Science. 1999;283:331-2. Medline:9925491 doi:10.1126/science.283.5400.331

9 Littlefield JW. The need to promote careers that combine research and clinical care. J Med Educ. 1986;61:785-9. Medline:3761339

10 Brinkley WR. Disappearing physician-scientists. Science. 1999;283:791. Medline:10049119 doi:10.1126/science.283.5403.791b

11 Ullrich N, Botelho CA, Hibberd P, Bernstein HH. Research during pediatric residency: predictors and resident-determined influences. Acad Med. 2003;78:1253-8. Medline:14660429 doi:10.1097/00001888-200312000-00014

12 Webster JB, Parker JC, Moore DP, Johnson JC. Research activities and perspectives of individuals completing a research enrichment program for physiatrists. Am J Phys Med Rehabil. 2003;82:403-9. Medline:12704282 doi:10.1097/00002060-200305000-00017

13 Polasek O, Kolcic I, Dzakula A, Bagat M. Internship workplace preferences of final-year medical students at Zagreb University Medical School, Croatia: all roads lead to Zagreb. Hum Resour Health. 2006;4:7. Medline:16579857 doi:10.1186/1478-4491-4-7

14 Kolcic I, Polasek O, Mihalj H, Gombac E, Kraljevic V, Kraljevic I, et al. Research involvement, specialty choice, and emigration preferences of final year medical students in croatia. Croat Med J. 2005;46:88-95. Medline:15726681

15 Polasek O, Kolcic I. Croatia's brain drain. BMJ. 2005;331:1204. Medline:16293858 doi:10.1136/bmj.331.7526.1204

16 Bagat M, Sekelj-Kauzlaric K. Croatian physician labor market. Croat Med J. 2006;47:376-84. Medline:16758515

17 Polasek O, Kolcic I, Cikes N. Specialty preferences among final-year medical students at Zagreb University Medical School [in Croatian]. Lijec Vjesn. 2007;129:118-23. Medline:17695190

18 Overview of achievements January 2004 May 2007. Ministry of Science, Education and Sports. Available from: *http://public.mzos.hr/fgs.axd?id=13274*. Accessed: January 30, 2008.