Survey of medical teachers' attitudes towards science and motivational orientation for medical research

Short title: Attitudes and motivation for research in medicine

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Abstract

Background: Research is an important motivating factor for pursuing a career in academic medicine, but the relation between motivation and factors involved in scientific research are not clear.

Purpose: To explore the motivational orientation for doing research and its relation with the attitudes towards science and publication practice among the faculty at a medical school.

Methods: We used a Science Attitude Survey and Work Preference Inventory (4 Likert type scales of motivation, possible range 1-5) to survey two groups of teachers at the Zagreb University School of Medicine (n=327, 66% response rate): professors, elected to tenure-track positions (n=150), and instructor/research fellows working on or just completing their thesis (n=177).

Results: Overall, teachers scored highest on the Enjoyment subscale of intrinsic motivational orientation (mean score±standard deviation 4.3±0.42 for professors vs 4.1±0.42 for instructors/research fellows, P=0.001, t-test). Professors scored higher than instructors/ research fellows on the Challenge subscale of intrinsic motivational orientation (3.8±0.55 vs. 3.5±0.64, P<0.001, t-test), whereas instructors/ research fellows scored higher than professors on the Compensation subscale of extrinsic motivational orientation (3.5±0.74 vs. 3.1±0.71, P<0.001, t-test). Multiple linear regression analysis showed that the number of publications was positively associated with the scores on the Science Attitude Survey and Challenge intrinsic motivation, and negatively associated with scores on the scale of Compensation extrinsic motivation.

Conclusions: Medical faculty differs in motivational orientation depending on their academic status, and their motivation is associated more with requirements for academic advancement than research. These findings have important implications for developing strategies for enhancing academic research production.

Zusammenfassung

Hintergrund: Forschung ist ein wichtiger Motivationsfaktor für die Verfolgung einer Karriere in der akademischen Medizin, jedoch ist die Beziehung zwischen der Motivation und den Faktoren die mit der wissenschaftlichen Forschung verbunden sind, nicht klar.

Ziel: Wir haben die Forschungmotivation, und ihren Verhältnis zu der Haltung zur Wissenschaft und der Publikationspraxis an einer medizinischen Fakultät untersucht.

Methoden: Mit Hilfe zweier Fragebögen – "Science Attitudes Survey" und "Work Preference Inventory" (4 Likert-Typ-Skalen, möglicher Umfang 1-5) - wurden zwei Gruppen der Lehrer der medizinischen Fakultät in Zagreb, Kroatien (n=327, 66% Antwortquote) befragt. In der ersten Gruppe wahren Lehrer mit abgeschlossener Dissertation, die Professoren (n=150), und in der zweiten die Instruktoren/Assistenten, die ihre Dissertation noch nicht haben oder sie kürzlich erhalten haben (n=177).

Studienergebnisse: Überall hatten die Befragten die höhsten Ergebnisse bei der Vergnügen-subskale ("Enjoyment") der intrinsischen Motivation (Mittelwert± Standardabweichung 4.3±0.42 für Professoren zu 4.1±0.42 für Instruktoren/Assistenten, P=0.001, t-Test). Die Professoren hatten höhere Ergebnisse als die Instruktoren/Assistenten bei dem "Challenge" (Herausforderung)-Teilaspekt der intrinsischen Motivation (3.8±0.55 zu 3.5±0.64, P<0.001, t-Test). Der "Compensation" (Abfindung)-Teilaspekt der extrinsischen Motivation war deutlich höher bei der Gruppe der Instruktoren/Assistenten (3.5±0.74 zu 3.1±0.71, P<0.001, t-Test). Die Ergebnisse der multiplen linearen Regression haben gezeigt, daß die Anzahl der Publikationen im positiven Bezug zu der Haltung zur Wissenschaft und zum Challenge-Teilaspekt der intrinsischen Motivation und im negativen Bezug zu dem Compensation-Teilaspekt der extrinsischen Motivation steht.

Schlüsse: Die Lehrer der medizinischen Fakultät unterscheiden sich in ihrer Motivation abhängig von ihrem akademischen Grad. Ihre Motivation ist mit den Voraussetzungen für die akademische Förderung gebunden. Diese Befunde sind für die Entwicklung von Strategien wichtig, die wissenschaftliche Produktion der Lehrer fördern würden.

Introduction

Along with teaching and clinical care, scientific research is one of the three traditional roles of academic medicine [1]. Although there is a general consensus about the importance of research, a decline in the number of clinical academics active in research has been observed in some countries [2,3]. Academic researchers are increasingly concerned about the challenges they face, such as the lack of protected time for research [4,5] or long duration of training at relatively low wages [6]. On the other hand, results of recent studies suggest that research is still an important motivating factor in medical careers. A systematic review has identified the desire to do research as a key incentive to enter and stay in academic medicine [7]. Another study reported a progressively larger fraction of medical students and graduates who expressed serious interest in research careers [6]. Our research group showed that teaching research methodology is associated with increase in positive attitudes towards science among medical students [8], and that among family medicine practitioners there was a positive association between attitude toward science and opinion of research methodology training as a mandatory part of the medical curriculum [9].

Motivation for scientific research cannot be seen as a single phenomenon. Researchers differ not only in the strength of their motivation, but also in the orientation of their motivation [10]. Both intrinsic and extrinsic motivations are related to underlying attitudes and reasons for undertaking an action [10]. In the context of academic medicine, Barnett and colleagues explored the effect of sex on the orientation of career motivation in a sample of full-time faculty of US medical schools [11], and Wright and Beasley looked at the factors that motivate clinician-investigators and clinician-educators in their work [12]. However, these studies did not attempt to analyze possible differences related to the faculties' teaching ranks or assess the attitudes of faculty towards science and research.

We explored the motivational orientation for doing research and its relation with the attitudes towards science in different ranks of medical faculty across different research fields. Our hypothesis was that the motivational orientation of junior faculty would be more extrinsic (i.e. related to the compensation and acknowledgement that come as a result of the research activity), while the motivational orientation of senior faculty would be predominantly intrinsic (i.e. related to challenge and enjoyment of doing research).

Subjects and Methods

The study was conducted at the Zagreb University School of Medicine. We surveyed all teaching staff, including full, associate and assistant professors (defined as group of "professors"), and junior staff, who worked on their DrSc thesis recently or defended it (defined as group of "instructors/research fellows"). In 2006 there was a total of 495 teaching staff employed at the School: 62 full professors, 134 associate professors, 77 assistant professors, 87 instructors and 135 research fellows. They were also grouped according to the type of department with which they were affiliated: basic sciences, clinical sciences and public health; this grouping was performed regardless of the profession and highest degree of participants.

Empty questionnaire sheets were handed out personally to each respondent, and the filled questionnaires were collected in a sealed cardboard box, which ensured the anonymity of respondents. Out of a total of 327 teachers who answered the questionnaire (66.1% response rate), 150 were professors (54.9% response rate) and 177 were instructors or research fellows (79.7% response rate) (Table 1).

The study was approved by the Ethics Committee of the Zagreb University School of Medicine.

Questionnaire

The questionnaire consisted of three parts (Appendix). The first part collected demographic data of the respondents: teaching rank, scientific degree, research field, specialty, year of birth, sex, and the number of articles published in international journals, regardless of the position on the byline. Publications were defined as articles published in journals indexed in *Current Contents*® or *Web of Science*® databases of Thomson Reuters, as these are the major requirement for academic promotion at university medical schools in Croatia.

The second part of the questionnaire was an adapted, 24-item, version of the Science Attitude Survey, the instrument developed in the previous study [13]. The instrument was designed to measure attitude towards science and scientific methodology and was validated on student population [8]. We analyzed the psychometric characteristics of the instrument in terms of discriminant validity of the 24 items. Item-total correlations were all satisfactory and ranged from 0.3 to 0.5. Inter-item correlations ranged from 0.1 to 0.5 and revealed no items that were tautological (ie, correlating highly with other items) or did not belong to the scale (ie, had zero-correlations with other items). The internal consistency of the instrument was high (Cronbach α=0.87).

The third part of the questionnaire was the 30-item Work Preference Inventory (WPI), designed to assess the intrinsic and extrinsic motivational orientations [14]. The items of the instrument were translated into Croatian and the opening instruction was formulated in terms of medical faculty's motivation for scientific work. The instrument consists of four secondary subscales which represent measures of two primary motivational orientations. Subscales Enjoyment (10 items, Cronbach α=0.65) and Challenge (5 items, Cronbach α=0.62) represent intrinsic motivational orientation, whereas subscales Outward (10 items, Cronbach α=0.62) and Compensation (5 items, Cronbach α=0.65) represent extrinsic motivational orientation. Cronbach alpha for the entire scale was 0.67. This was not high given the total number of 30

items, but lower internal consistency was expected from a multidimensional scale such as WPI. According to the author, the meaning of the subscales is as follows [14]:

1. high Enjoyment scores characterize people who "tend to be strongly motivated by curiosity and self-expression in their work and who get so absorbed in their work that they forget about everything else. They prefer to figure things out for themselves and set their own goals. They want to learn from their work and feel it is very important to enjoy what they do;"
2. high Challenge scores characterize people who "enjoy solving new, difficult, and complex problems, who are not satisfied by straightforward tasks and who prefer work that stretches their abilities;"
3. high Outward scores characterize people who "tend to be motivated by recognition. They are sensitive to others' opinions of their work and ideas. They tend to judge their success relative to other people and prefer to work with clear goals and procedures;"
4. high Compensation scores characterize people who "tend to be strongly motivated by the compensation they receive for their work. They are keenly aware of their income and promotion goals."

The items in the second and third part of the questionnaire were 5 point Likert-type scales with the following categories: 1 – completely disagree, 2 – mostly disagree, 3 – can not decide, 4 – mostly agree, 5 – completely agree. Summative scores on these scales were divided with number of items in each scale so all the overall scores had the possible range from 1 to 5, which made comparisons between the scales possible.

Statistical analysis

Kolmogorov-Smirnov test was used to test the normality of distributions. Arithmetic mean and standard deviations were used for the description of normally distributed data, and

median and interquartile range were used for non-normally distributed data. T-test for independent samples was used to compare the scores between professors and instructors/research fellows, as well as between male and female teachers. One-way ANOVA with Sheffe post hoc was used for comparison of scores between teachers from different research fields (basic sciences, clinical sciences and public health). For statistically significant differences Cohen's d was calculated as a measure of effect size [15]. Effect sizes around 0.3 were interpreted as medium [15]. The distribution of published articles differed significantly from normality, therefore Mann-Whitney test was used for comparisons of professors and instructors/research fellows, and the Kruskal-Wallis test for comparison of number of published articles between teachers from different research fields. After bivariate analysis, multiple linear regression analysis was performed to investigate multivariate relationships between motivational orientations, attitude scores and number of publications. We used a log transformation for number of publications in these analyses to obtain normal distribution. The level of statistical significance was set at $p<0.05$ and all analyses were performed using SPSS 13 for Windows (SPSS Inc.; Chicago IL, USA).

Results

Generally, all teachers had the highest score on the Enjoyment subscale of intrinsic motivational orientation (Table 2). Professors had more positive attitudes towards science in Science Attitude Survey and higher intrinsic motivational orientation both on Enjoyment and Challenge subscales, whereas instructors and research fellows had higher average score on the Compensation subscale of extrinsic motivation (Table 2). Cohen's d values (Table 2) indicated medium sized effects of these differences. As expected, professors had significantly more published articles than instructors and research fellows (median (C) ± interquartile range

(Q)=14.0±11.5 for professors vs. 2±3 for assistants and research fellows; p<0.001, Mann-Whitney U test).

There were no sex differences in attitudes towards science or motivational orientations (Table 3). Male and female teachers also did not differ in the number of published articles, after controlling for the faculty rank (C±Q=4±7 for men vs. 2±5 for women professors, *P*=0.243, and C±Q=1±3 for both male and female instructors and research fellows, *P*=0.904; Mann-Whitney U test).

Basic science teachers had more positive attitude towards science than clinical teachers, but not than public health teachers (mean±standard deviation=4.30±0.43 for basic science teachers vs. 4.07±0.47 for clinical science teachers vs. 4.20±0.47 for public health teachers; p<0.001, ANOVA with Scheffe post-hoc test; Cohen's d=0.36). There were no differences among the teachers in different research fields in motivational orientation (p=0.472 for enjoyment, p=0.271 for challenge, p=0.100 for outward and p=0.411 for compensation; One way ANOVA) or in the number of published papers (p=0.549, Kruskal-Wallis test).

In bivariate analysis of association, the number of publications was significantly and positively correlated with both intrinsic motivation subscales (Enjoyment and Challenge), as well as with the score on Attitude Towards Science scale, but negatively correlated with Compensation subscale of extrinsic motivation (Table 4). Next, we performed a linear regression analysis with the number of publication as the independent variable and other five variables (attitude towards science and enjoyment, challenge, outward and compensation motivation subscales) as dependent variables. The model was statistically significant, explaining 16% of the dependent variable variance (R^2=0.158, Table 4). The scores on Science Attitude Survey and Challenge subscale of intrinsic motivation were significantly positively associated with the number of publications, whereas the scores of Compensation subscale of extrinsic motivation showed significantly negative association (Table 4).

Discussion

Medical teachers in our study were motivated for scientific work primarily by the enjoyment they derive from this activity, which corresponds with the findings of Barnett and colleagues that intrinsic motivation of medical faculty to produce academic publications is higher than extrinsic motivation [11]. A similar finding was reported by Wright and Beasley, who surveyed a sample of US medical faculty at the assistant professor level and found that clinician-investigators, when compared with clinician-educators, were significantly more often motivated by the ability to express themselves, which can be considered an intrinsic motivation [10]. The similarity of the findings in developed countries [11,12] and small scientific communities, such as Croatia, indicates that predominantly intrinsic motivation for doing research among medical faculty is a universal phenomenon, independent of social and economical circumstances, culture and scientific policy. Our study was limited by a cross-sectional design which did not allow drawing conclusions on the possible causative relationships between the orientation of research motivation and attitudes toward science. Nevertheless, we used validated instruments for measuring both variables, so the results are credible enough to indicate possible associations. Another possible limitation of the study is a relatively low response rate of 66% for the total study sample, which was especially low for professors (54.9%). However, gender and professional structure of the respondents was similar to the target samples of both professors [16] and instructors/research fellows [17], so that they could be considered representative samples. Finally, the instrument we used for assessing attitudes towards science was developed and validated on a student population [8,13] and not on their teachers. However, its psychometric characteristics proved satisfactory for the assessment of the teachers' population as well.

Publishing scientific articles is a requirement for academic advancement, and it is perhaps not surprising that in our study junior faculty, who are under great pressure to satisfy the requirements for academic advancement, scored higher on the Compensation subscale of extrinsic motivation for doing research. This may be further explained by a considerable increase in salary and job security after promotion from the position of an instructor/research fellow to the position of assistant professor. Such explanation is supported by the results of multivariate analysis, which showed that there was significant association between the number of publications required for promotion and the motivation for and attitudes towards scientific research.

More positive attitudes towards science that senior faculty expressed in our study may result from their research experience and deeper knowledge of the scientific method. Although the results of some research in student populations support a common notion that positive attitude is correlated with knowledge [8,18] or work experience [19], our study was not designed to test this relationship, so we can only assume that junior faculty gradually improve their attitudes towards science by learning and doing scientific research. Alternative explanation would be that only those teachers with positive attitude towards science stay in academia.

Similar to the findings of Barnett and colleagues [11], we found no significant sex differences in types of motivation for doing research. Although there was an overall difference in the number of published articles between male and female teaching staff, this difference did not persist after controlling for the faculty, as the number of women among the senior faculty is disproportionally smaller than among instructors/research fellows [20]. Other studies on the same faculty of the Zagreb School of Medicine also did not demonstrate differences between the sexes in the number of published articles [17,21].

High clinical workload and a lack of protected time for research [22,23] may be the reasons why clinical teachers in our study had less positive attitudes towards science than

basic science teachers. This difference in attitude, however, did not result in a smaller publication output, as there were no significant differences in the number of published articles between the basic science, clinical and public health group of teachers. An earlier study also failed to demonstrate significant differences in the overall publication output among basic science, clinical and public health departments at the Zagreb School of Medicine [24].

Regression analysis in our study confirmed the finding of Barnett and colleagues [11] that the motivational orientations are associated with the number of publications. In our study, the number of publications was positively associated with scores on attitude towards science scale and Challenge subscale of intrinsic motivation and negatively associated with the scores of Compensation subscale of extrinsic motivation. The set of predictors used in the regression analysis explained 16% of the variance. Such small effect sizes are expected in research fields which involve subtle and difficult-to-control issues [15]. Faculty publication record involves not only motivational orientations but a number of other variables related to scientists' publication record, such as department climate, collaboration practices or the number of research projects taken simultaneously [25].

The findings of our study may have important implications for developing strategies for recruiting new generations of academic physicians, as fostering positive attitudes toward science among medical students seems not only achievable [8] but also related to the intrinsic motivation, a key factor for a long-term engagement in research [24]. One of the methods to cultivate positive attitudes towards science is mentoring, which was proven to be effective among the young people [26], and was also reported to have an important influence on career choice and research productivity in the context of academic medicine [27]. Several studies showed that the completion of research and publication during medical school was associated with pursuing a career in academic medicine [7]. Therefore, integrating research activities in

medical curricula [28] may be a practical strategy to build up students' motivation for engaging with science and pursuing academic career. However, students should be closely guided in their research activities, since a failure to successfully complete a research project may undermine their motivation. Guiding and mentoring students and junior researchers may also stimulate senior faculty and present them with new challenges and enjoyments in doing research. Another way of maintaining senior faculty's intrinsic motivation is to encourage their involvement in interdisciplinary research projects [29].

The future of academic medicine rests on young people with genuine enthusiasm for science and research. Facing a general trend of declining interest in scientific careers [2,30], institutions of academic medicine will be well-advised to actively work on building positive attitudes towards science among their faculty and consider using different strategies to enhance faculty's motivation to perform research.

Notes on Contributors:

Mario Cvek works at the Administrative Department for PhD Studies, Scientific Work and Continuous Medical Education of Zagreb University School of Medicine. Darko Hren and Dario Sambunjak are research fellows in the *Croatian Medical Journal*. Mislav Planinc is a 5th year medical student, and Maja Mačković is a 6th year medical student at Zagreb University School of Medicine. Ana Marušić is a professor of anatomy, and Matko Marušić is a professor of physiology and immunology at University of Split School of Medicine.

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Table 1. Basic characteristics of the teaching staff surveyed in the study

	No (%)	
	Instructors/research fellows (n=177)	Professors (n=150)
Age (C±Q)*	32±9	56±11
Sex:		
Male	65 (37)	89 (59)
Female	112 (63)	61 (41)
Field of work:†		
basic sciences	43 (25)	31 (21)
clinical sciences	109 (64)	111 (74)
public health	18 (11)	7 (5)

* C – median, Q – interquartile range.

† Eight participants (7 instructors and 1 professor) did not answer this question.

Table 2. Average attitude towards science and motivational orientation scores for junior and senior teaching staff*

	Research fellows and instructors (n=177)	P† (Cohen's d)‡	Professors (n=150)
Science Attitude Survey	4.07±0.49	0.008 (0.25)	4.21±0.41
Intrinsic motivation:			
Enjoyment scale	4.11±0.42	0.001 (0.27)	4.27±0.42
Challenge scale	3.53±0.64	<0.001 (0.28)	3.77±0.55
Extrinsic motivation:			
Outward scale	3.54±0.48	0.566	3.51±0.51
Compensation scale	3.49±0.74	<0.001 (0.39)	3.08±0.71

*Attitude and motivational scores are presented as mean±standard deviation of the individual scores on a Likert-type scale from 1 to 5. for each of the scales (Attitude scale 24 items, Enjoyment and Outward scales 10 items each; Challenge and Compensation scales 5 items each).

†T-test for independent samples.

Table 3. Average attitude towards science and motivational orientation scores for female and male teaching staff*

	Women (n=173)	P†	Men (n=154)
Science Attitude Survey	4.10±0.48	0.138	4.17±0.44
Intrinsic motivation:			
Enjoyment scale	4.20±0.43	0.380	4.16±0.43
Challenge scale	3.64±0.60	0.927	3.63±0.63
Extrinsic motivation:			
Outward scale	3.53±0.51	0.784	3.52±0.48
Compensation scale	3.28±0.81	0.801	3.30±0.68

*Attitude and motivational scores are presented as mean±standard deviation of the individual scores on a Likert-type scale from 1 to 5 for each of the scales (Attitude scale 24 items, Enjoyment and Outward scales 10 items each; Challenge and Compensation scales 5 items each).

†T-test for independent samples.

Table 4. Bivariate and multivariate analysis of association between the number of publications and scores on motivation and arttitude scales*

Bivariate correlations:		
	Pearson's r	P
Attitude towards science	0.28	<0.001
Enjoyment (intrinsic)	0.28	<0.001
Challenge (intrinsic)	0.28	<0.001
Outward (extrinsic)	-0.010	0.869
Compensation (extrinsic)	-0.196	<0.001

Multivariate analysis with number of publications as dependent variable (R^2=0.158):		
	Standardized Beta	P
Attitude towards science	0.173	0.003
Enjoyment (intrinsic)	0.125	0.075
Challenge (intrinsic)	0.141	0.042
Outward (extrinsic)	0.027	0.666
Compensation (extrinsic)	-0.176	0.003

*Publications were defined as articles published in journals indexed in Current Contents® or Web of Science® databases of Thomson Reuters, required for academic promotion at university medical schools in Croatia.