



Undergraduate Medical Students' Knowledge About Principles of Research Methodology and Impact of Extracurricular Principles of Research Workshops: A Cross-Sectional Study in Tehran University of Medical Sciences

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ABSTRACT

Background: It is widely acknowledged that research is crucial for development of countries. Despite various studies on the benefits of research, there is no fresh study about students' familiarity with principles of research methodology in developing countries.
Objectives: In this study, we aim to assess undergraduate medical students' knowledge in principles of research methodology and its contributing factors.

Materials and Methods: In this cross sectional study, we investigated 65 randomly selected students who were in their basic science stage of medical studies at Tehran University of Medical Sciences in 2010. To determine knowledge about principles of research, participants filled a validated and reliable questionnaire. The characteristic information of the students and their answers to ten questions on research principles were collected. Linear regression models were applied to predict the score of knowledge of the participants.

Results: Median age of participants was 19 ranging from 17-21. 15 (25%) of participants were male and 45 (75%) were female. 45 (75%) of participants had not attended Students' Scientific Research Center (SSRC) research methodology workshop. The mean of knowledge score was 6.99 ± 3.23 (out of 20). We observed no significant difference in knowledge of the students and also participation in SSRC research methodology workshop between two genders ($P = 0.75$ and 0.86 , respectively). Linear regression model showed participation in research methodology workshop independently predicts 59% of variance of students' knowledge about principles of research methodology and adding students' semester to the model increases the prediction to 70%.

Conclusions: Despite limitations of this study, our findings highlight low to moderate level of knowledge of undergraduate medical students in principles of research methodology and the important impact of research methodology workshops.

► Implication for health policy/practice/research/medical education:

Assessment of research knowledge of medical students in order to provide policy makers with evidence for educating more competent medical students in terms of research and facilitate planning about medical students' curriculum.

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1. Background

Currently it is widely acknowledged that research becomes critical for development of countries and innovations; and outcomes derived from basic and applied research tremendously benefit the community (1, 2). Many studies have addressed the benefits of financial investment in research; likewise, many benefits have been provided from researches for the welfare of community (3-8). These studies have encouraged policy makers to invest in research and innovation (9).

Furthermore, shifting research paradigm considers physicians as crucial creators of science through clinical and translational researches. In this regard, medical students who play key roles in helping the progress of science as potential physicians are encouraged to contribute in research projects to promote their independent trainings and skills. Universities not only perform necessary researches in various fields, but also they educate students about research principles, as the fundamental step in research. In other words, health research training is an important part of medical education. There is growing evidence on the importance of the involvement of students in research (10). However, findings upon the survey of knowledge and attitudes toward science at medical universities in the southeast Europe, suggests that each country and medical school needs an individual approach to promote scientific skills (11). This is more emphasized in developing countries where finance and human resources are limited and there is a critical need for research as a tool to make efficient decisions in order to prevent unnecessary waste. In this regard, it is important to remember that there is some evidence that students with extracurricular research programs and experiences are more likely to become future scientists or physician investigators (10, 12-14).

To the best of our knowledge, despite various studies on the benefits of research, currently there is no study on knowledge on principles of research methodology in developing countries. In this study, we aim to assess undergraduate medical students' knowledge in principles of research methodology and factors contributing to it in Tehran University of Medical Sciences (TUMS).

2. Objectives

The results of this study can provide useful evidences for policy makers in educating more competent medical students in terms of research.

3. Materials and Methods

3.1. Study Design

In this cross-sectional study, we investigated 65 undergraduate students who were in their basic science stage of medical studies at Tehran University of Medical Sciences (TUMS) in April 2010. The students were selected via simple randomization from total of about 400 students who are at the basic science stage of their medical studies at TUMS.

To determine knowledge of students about principles of research, participants were asked to fill in a questionnaire with two parts. The first part inquired the characteristics of the participants such as age, gender, number of semesters passed in medical studies, and history of participating in Students' Scientific Research Center (SSRC) research methodology workshop. The second part contained ten subparts (research subject, protocol writing, normal distribution, understanding impact factor, primary research, secondary research, basics of searching in medical databases, medical databases, understanding *P* value, and structure of an original article). Each part was consisted of some one to four questions. Scoring of questions ranged from 0 to 4. Total range of score of the questionnaire was 0 to 20. Content of the questionnaire was validated by four faculty members who were expert in research methodology and epidemiology (two faculty members of school of medicine and two public health faculty members). Reliability of the questionnaire was examined with use of test-retest on 30 volunteers with the interval of two weeks and acceptable interclass correlation coefficients were achieved (ranging from 0.78 to 0.98, *P* values < 0.001).

3.2. Statistical Analysis

All data were analyzed using the statistical software SPSS version 16. Descriptive statistics (mean, range, and standard deviation) were used to describe quantitative variables. Qualitative variables are expressed as the number and percentage in each level of the variables. The normal distribution of the continuous variables such as knowledge of research methodology score was assessed using Kolmogorov Smirnov test. Student T-test, One-Way ANOVA, and Chi-square were used to assess the relationship between quantitative and qualitative variables. Tukey Post-hoc test was used to evaluate knowledge score among students in different semesters of their studies wherever it seemed to be appropriate. Relationship between continuous variables was assessed by Pearson correlation coefficient. Probability value of less than 0.05 was considered significant. Linear regression models were applied to predict score in research methodology knowledge as the dependent variable. With the use of a stepwise method, correlated variables such as history of participating in SSRC research methodology workshop, age, gender, and number of semesters passed in medical studies were entered into regression model as independent variables (*P* value at the entry level was < 0.1).

3.3. Ethical considerations

There was no obligation for the student to take part in this study and no funding was sought for this study.

4. Results

60 students returned the questionnaire; therefore, response rate of 92.3% was achieved. Median age of participants was 19 ranging from 17-21. 15 (25%) of participants

Table 1. Principles of Research Knowledge Score in Participants

	Score	Participation in Principles of Research Workshop			Total
		Yes	No	P Value	
Research subject, correct No. (%)	1	11 (73.3)	30 (66.7)	0.63 ^a	41 (68.3)
Protocol writing, correct No. (%)	1	10 (66.7)	32 (71.1)	0.74 ^a	42 (70.0)
Normal distribution, Correct No. (%)	1	8 (53.3)	20 (44.4)	0.55 ^a	28 (46.7)
Impact factor correct, Correct No. (%)	1	8 (53.3)	2 (4.4)	< 0.001	10 (16.6)
Primary research, mean ± SD	4	2.06 ± 1.03	0.64 ± 0.77	< 0.001	1.00 ± 1.04
Secondary research, mean ± SD	2	0.46 ± 0.51	0.44 ± 0.50	0.88 ^a	0.45 ± 0.50
Basics of searching in medical databases, mean ± SD	2	1.33 ± 0.72	0.66 ± 0.76	0.005	0.83 ± 0.80
Medical databases, mean ± SD	2	1.68 ± 0.42	1.00 ± 0.56	< 0.001	1.1 ± 0.60
P value, mean ± SD	2	0.53 ± 0.91	0.44 ± 0.84	0.73 ^a	0.46 ± 0.85
Structure of an original article, mean ± SD	4	2.93 ± 1.16	0.51 ± 0.78	< 0.001	1.11 ± 1.37
Total, mean ± SD	20	11.28 ± 2.60	5.56 ± 1.87	< 0.001	6.99 ± 3.23

^a P value is not significant.

Table 2. LINEAR REGRESSION MODEL FOR PREDICTING PRINCIPLES OF RESEARCH KNOWLEDGE SCORE

	Regression Model	β (95% Confidence Interval)	P value	r ²
Model 1				0.59
Participation in principles of research workshop	Linear-Stepwise	0.77 (0.64-0.90)	< 0.001	
Model 2				0.70
Participation in principles of research workshop	Linear-Stepwise	0.60 (0.44-0.76)	< 0.001	
Semester		0.36 (0.20-0.52)	< 0.001	

were male and 45 (75%) were female. Distribution of the number of semesters passed of participants is summarized in Figure 1. 45 (75%) of participants had not attended SSRC research methodology workshop, while 15 (25%) had attended this workshop previously.

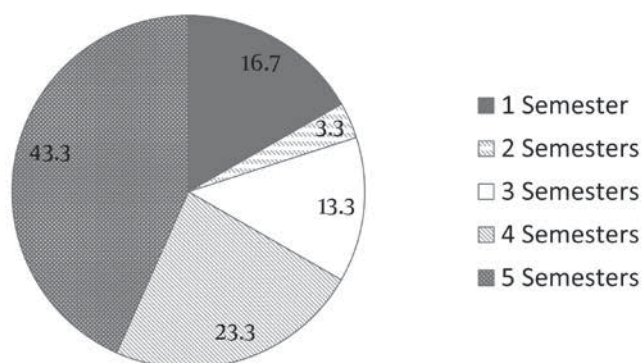
Table 1 summarizes knowledge of the students in different aspects of research methodology. We observed no significant difference in knowledge score of the students and also participation in SSRC research methodology workshop between two genders ($P = 0.75$ and 0.86 , re-

spectively). Number of semesters passed by the students affected students' knowledge in research methodology ($P < 0.001$). Total knowledge as well as understanding P-value scores were significantly higher in medical students in 4 or 5 semester comparing to students in first and second semester ($P < 0.001$). No significant difference was observed in score of other aspects of research methodology and number of semesters passed by students ($P > 0.05$) (Data not shown).

Pearson correlation coefficient (r) between the number of semesters passed and research methodology knowledge score was 0.64 ($P < 0.001$). Table 2 summarizes results of linear regression models in predicting research methodology knowledge score. In both stepwise linear regression models age, gender, semester of education, and participation in SSRC principles of research workshop were applied as independent variables and knowledge score was the dependent variable.

5. Discussion

Our study shows medical students have low-to-moderate knowledge about principles of research methodology. In line with this finding, in a study by Windish *et al.* on understandings of medical residents of biostatistics and interpretation of results, mean correct answer was 41.4%, indicating low-to-moderate knowledge of the residents in these issues (15). Similar findings were observed among physicians practicing in an academic medical

**Figure 1.** Percentage of Number of Semesters Passed in Participants

center (16), medical students, first year Croatian medical students (17), Pakistani medical students (18), and medical students in South East Europe (11).

Linear regression model showed participation in extracurricular research methodology workshop independently predicts 59% of variance of students' knowledge about principles of research methodology and adding students' semester to the model increases the prediction to 70%. This shows the most important factor in students' knowledge on principles of research methodology is attendance in research methodology workshops of SSRC and other factors such as gender, age, and number of semesters passed does not play an important role in this regard. In concordance with this finding, Windish *et al.* found that prior biostatistics training as well as additional advanced degrees contributes to higher mark in understanding biostatistics and interpretation of results (15). Similarly, Polychronopoulou *et al.* have shown that prior relevant education in biostatistics is an important predictor of knowledge of biostatistics among European orthodontic postgraduate students (19).

Considering the fact that some units of medical curriculum are related to health and epidemiology basics, it was assumed that passing these courses would enormously improve students' knowledge on principles of research methodology. However, our findings indicate that medical curriculum is exclusively important in topics of understanding p-value and secondary studies. Nevertheless, confounding factors such as attendance in other research workshops (for example evidence-based medicine or advanced research methodology workshop) or personal interest of students in epidemiology may also contribute to the knowledge of students' in principles of research methodology.

Students' scientific research center which was officially established in 1992 played an important role in educating research methodology to medical sciences students in recent years. Holding research methodology workshops is one of the fundamental approaches applied by this center to facilitate progress of researches by medical sciences students. In SSRC, extracurricular workshops are held by the undergraduate students who are considered to be active researchers in the SSRC. These students have learned research principles through similar workshops, medical doctor-master of public health (MD-MPH) concurrent degree program, designed for talented students in TUMS, and their involvement in various research projects. Some faculty members specialized in epidemiology or biostatistics play a mentorship role through holding meetings to develop the curricula of the workshops or providing the students with consultations whenever necessary. SSRC provides the opportunity for junior students to discuss their research problems with senior students experiencing researches. Besides workshops, in SSRC, students get familiar with peers' research projects and learn the details of research experience through this process. These issues may contribute to the higher impact of SSRC principles of research workshop rather

than epidemiology courses as observed in this study. We observed no significant difference between male and female students score. However, it is in contrast to the findings of studies showing female students perform better in written examinations (20-23).

In interpreting the results one should consider limitations of our study: First, the study is conducted cross-sectionally, therefore one may not interpret the role of SSRC research methodology workshop accurately. Participation in SSRC workshops is voluntary and this may be a potential source for a selection bias; interested students who more probably attend the workshops may achieve higher scores. Investigating prospective studies is beneficial in overcoming this limitation. Second this study is performed in a single university on students in basic sciences stage of medical education. Furthermore, considering similar academic and research potentials of these students, one should be cautious in generalizing findings of this study. Third, we only assessed attendance in SSRC research methodology workshop and did not evaluate participation in other workshops of SSRC or other institutions which may improve students' knowledge on principles of research. Similarly, students' marks in epidemiology course were not appraised. Despite the limitations of this study, our findings highlight low-to-moderate level of knowledge of undergraduate medical students in principles of research methodology and the important role of principles of research workshop in improving students' knowledge. Conducting further multi-center researches on students studying in different universities and students at different stages of medical education can provide useful information for education and research policy makers.

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