Turk J Public Health
Available online at: http://dergipark.org.tr/tjph/
Doi: 10.20518/tjph.1093570

TURKISH JOURNAL OF PUBLIC HEALTH

ORIGINAL ARTICLE

Knowledge, attitude, and practice of medical students about medical research in Mansoura University, Egypt

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Received: 25.03.2022, **Accepted:** 05.12.2023

Abstract

Objectives: Medical students are the bright future researchers and giving priority to their early research experiences will have its remarkable effect on research evolution. Recent advances in medical fields are challenging and increase the importance of attracting new researchers. This study describes knowledge, attitude, practice, and barriers to participation in research among undergraduate medical students.

Methods: This is a cross-section study on 260 medical students. Data collected included: knowledge about research (nine multiple questions); attitude towards medical research (eight questions); practice of research (five questions) and barriers against participation in research (nine questions).

Results: Some aspects of research knowledge were affected by students' sex, previous year grade, academic phase, and premedical school type. About 44.6% gave right answers about parts of scientific papers. Academic phase medical students had better research knowledge than clinical phase students. More than 80% of study participants agree on the importance of being oriented about clinical research methodology. Lack of time was the most addressed barrier against participation in research projects by the students (50.5% of clinical phase students).

Conclusions: Students' research knowledge needs improvement. Creating customized curricula will lead to increased involvement and significant contributions from medical students in the field of research. Barriers addressed can be targeted to uplift students' contributions to research process.

Keywords: Attitude, Barriers, Knowledge, Medical students, Practice

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Cite This Article: Marhoon S, Elmetwaly M, Samy A, Elsayyad A, El-Gilany AH. Knowledge, Attitude, and Practice of Medical Students About Medical Research in Mansoura University, Egypt. Turk J Public Health 2023;21(3): 383-393.

INTRODUCTION

Notably, medical students do not always have the privilege to participate in research projects during their undergraduate medical education. This generated a need to investigate knowledge and attitude of medical students to the concepts of medical research and their reflection on practice [1].

Conducting research by a student can affect the published output not only of the institution but also of the country. In medical education, undergraduate training on basic research skills is crucial to improve the physician's research skills including literature search, critical appraisal, independent learning, and writing research papers [2]. Previous reports showed limited students' participation in medical research activities, which is attributed to many barriers such as lack of mentorship, lack of research training, and lack of extracurricular time. These barriers are more common in developing countries [3]. A good starting point in getting the students involved in research is to introduce students to research and publishing. Mabvuure (2012) mentioned 12 tips for this including highlighting the importance of research to students, motivation to create research opportunities, encouraging students to participate in extra-curricular research and interact with other research teams, attend scientific events and apply for research projects, and viewing research as an educational process not only focusing on the output [4]. Choosing a research interest, choosing own research mentor, defining a personal statement, following and contacting relevant research teams, formulating a realistic approach, and developing academic and writing skills were among the important tips mentioned in another research that was conducted by two medical students [5].

To the best of authors' knowledge, data about the knowledge, attitude, practice, and barriers against undergraduate medical research in Mansoura Faculty of medicine, Egypt are limited. This study aims to describe the research knowledge, attitude, and practice, also barriers against participation in research activities among undergraduate medical students and its social demographic features. The findings of this study can potentially be used for creating an evidence-based approach to promote research practice among medical students.

MATERIALS AND METHODS

Study Design

The current study is an institution-based observational descriptive cross-sectional study.

Place and duration of the study:

Data collection process took about 3 months during 2020. Subjects were students enrolled in Mansoura University Faculty of Medicine in the academic year 2019-2020.

Sampling

Sample size was calculated using Open Epi, Version 3 (https://www.openepi.com/) where population size (N) was 6900 according to the official report of the Student Affair Department. The hypothesized percent of good attitude towards undergraduate student's research was at least (p) 21.8% [8], $\alpha = 0.05$ (d): 0.05 precision and confidence level to be 95%. The estimated sample size was at least 253.

Data Collection Tool

Data were collected using an anonymous

English questionnaire that was created as a Google form and posted on medical students' groups only to ensure that only them will contribute. The questionnaire was constructed after an extensive literature review to collect relevant data about undergraduate medical research [6-9], it included: 1) Personal data: sex, previous year grade, academic phase, and premedical school type. 2) Nine multiple choice questions about research to measure students' knowledge. 3) Eight questions that measure attitude towards medical research. 4) Five questions about students' practice of research. 5) Nine questions about personal and institutional barriers against participation in research from the students' perspective.

Data Analysis

Data were analysed using Statistical Package for Social Science Program (SPSS 23 for windows). Categorical variables were presented as number and percent. Chi-square and Fischer exact tests were used for comparison between groups, as appropriate. P ≤ 0.05 was considered statistically significant.

Ethical Approval

Study proposal was approved by the Institutional Research Board (IRB), Faculty of Medicine, Mansoura University. Proposal code is R.20.08.973.R1. Date: 31/8/2020.

Informed Consent

An informed consent was obtained from each participant in the study through a statement in the beginning of the questionnaire; this statement emphasised that if the student is willing to participate, they are asked to answer all the questions. They were allowed to respond anonymously to the questionnaire in their own time and privacy after ensuring their freedom to accept or refuse to participate. Google form settings were adjusted so that each participant will fill the questionnaire only once.

RESULTS

Out of 260 students, 38.5 % were males. 66.5 % had a "Very good" or "Excellent" grade in the previous year (this did not apply to first year students), and 20.0 % had a "Good" grade. More than half (53.5%) of participants were in preclinical phase. 85.4 % were in public schools before joining faculty of medicine (data not shown in tables).

Table 1 shows that students are more knowledgeable about parts of scientific paper (44.6% gave right answers) and rules of writing (43.8% gave right answers). The vast majority (97.7%) agree that managing clinical problems can be easier if the scientific approach is properly followed. More than 80% agree on the importance of being oriented about clinical research methodology, undergraduates' participation in research, and the importance of clinical research skills in improving clinical practice of physicians. The table shows relatively low research practice scores, with presentation in scientific conferences being the most achieved activity by the students (38.8%). The table shows that the most addressed research barrier is time limitations followed by difficulty in getting permissions from review boards ad difficulty in choosing research topics. Table 2 is showing the right answers of the 9 research knowledge questions used in the study. Knowledge about scientific theory showed significant difference between males and females in the favour of females (28.2% vs. 71.8%). Knowledge about the scientific truth showed significant difference between

students with different previous year grade, in the favour of those with a "very good" or "excellent" grade. Public schools' student showed significantly higher knowledge about how to know citations of a published research article. Preclinical students and public schools' students showed significantly higher knowledge about rules of writing of a scientific introduction. Table 3 shows medical students' attitudes towards scientific research with a statistically significant difference between preclinical and clinical students as regards agreement that all medical advances are based on the proper application of the scientific methodology (60.7% vs. 39.3%). Table 4 is about medical students' research practice and shows a significant difference between public schools' students and private schools'

Table 1: Number and percent of overall answers to knowledge, attitude, practice, and barriers.

Question stem		Total	
		n	%
Knowledge (correct answer)	How would you define the scientific hypothesis?	84	32.3
	How would you define scientific theory?	103	39.6
	How would you define the scientific truth?	16	6.2
	The essential characteristic of science is:	62	23.8
	Representativeness is a key characteristic of a:	93	35.8
	MEDLINE is:	99	38.1
	If you have published a paper in a prestigious Journal of Immunology, and want to check the number of citations your paper has received, you should search the:	99	38.1
	The following is a part of a scientific paper is:	116	44.6
	All listed rules apply to the process of writing an Introduction section of a scientific paper EXCEPT:	114	43.8
Attitude (agree)	Managing clinical problems can be easier if the scientific approach is properly followed.	254	97.7
	Clinical research skills can significantly improve the physician's clinical practice.	225	86.5
	All medical advances are based on the proper application of the scientific methodology.	183	70.4
	Clinical research methodology should be a mandatory knowledge requirement for all physicians.	189	72.
	Being oriented with the clinical research methodology is necessary to obtain accurate clinical data.	229	88.1
	Limiting medical practice to scientific findings only makes the practicing physicians narrow-minded.	169	65.0
	Following the scientific research methodology adds difficulty to clinical research practice.	101	38.8
	Undergraduate students should participate in clinical research projects.	229	88.1
Practice	Participation in research methodology workshops	79	30.4
	Writing a research protocol	61	23.5
	Conducting medical research	86	33.1
	Scientific presentation in a conference	101	38.8
	Publication of research study in a journal	32	12.3
Barriers	Difficulty in choosing topic	170	65.4
	Getting permission from review boards	171	65.8
	Difficulty in writing proposal	161	61.9
	Difficulty in collecting data	133	51.2
	Difficulty in analysis	139	53.5
	Difficulty in writing report	126	48.5
	Time barriers	184	70.8
	Budget-related barriers	157	60.4
	Other barriers	152	58.5

students as regards presentation in scientific conferences in the favour of the former (91.1% vs. 8.9%). Table 5 presents research barriers addressed by the study participants. Difficulty in collecting data and in analysis showed a statistically significant difference as regards students' sex. Difficulty in collecting data was significantly more addressed by public schools' students (81.2%) than private schools' students (18.8%). Previous year's grade significantly affected considering difficulty of writing a scientific report as a research barrier. It was more addressed by the students with higher grades. Academic phase of the students significantly affected viewing time and budget as research barriers.

Test of significance used: Chi-square test.

Table 2: Student's knowledge of research (right answers).

Question stem [a)]	Sex				Previous year grade						Academic Phase				Premedical school type			
	Males		Females		F./P.		G.		V.G./E.		Pre.		Clin.		Pub.		I./Priv.	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
How would you define the scientific hypothesis?	26	31.0	58	69.0	10	11.9	15	17.9	59	70.2	45	53.6	39	46.4	75	89.3	9	10.7
How would you define scientific theory?	**29**	**28.2**	**74**	**71.8**	12	11.7	23	22.3	68	66.0	60	58.3	43	41.7	85	82.5	18	17.5
How would you define the scientific truth?	7	43.8	9	56.3	**2**	**12.5**	**3**	**18.8**	**11**	**68.8**	10	62.5	6	37.5	12	75.0	4	25.0
The essential characteristic of science is:	28	45.2	34	54.8	8	12.9	17	27.4	37	59.7	31	50.0	31	50.0	50	80.6	12	19.4
Representativeness is a key characteristic of a:	39	41.9	54	58.1	13	14.0	19	20.4	61	65.6	49	52.7	44	47.3	73	78.5	20	21.5
MEDLINE is:	38	38.4	61	61.6	11	11.1	20	20.2	68	68.7	59	59.6	40	40.4	81	81.8	18	18.2
If you have published a paper in a prestigious Journal of Immunology, and want to check the number of citations your paper has received, you should search the:	38	38.4	61	61.6	15	15.1	19	19.2	65	65.7	51	51.5	48	48.5	**78**	**78.8**	**21**	**21.2**
The following is a part of a scientific paper is:	48	41.4	68	58.6	13	11.2	25	21.6	78	67.2	60	51.7	56	48.3	98	84.5	18	15.5
All listed rules apply to the process of writing an Introduction section of a scientific paper EXCEPT:	49	43.0	65	57.0	19	16.7	18	15.8	77	67.5	**69**	**60.5**	**45**	**39.5**	**86**	**75.4**	**28**	**24.6**

Tests of significance used: Chi-square and Fischer exact (in cell values less than 5).
Bold indicates significant differences between categories of the same variable.
F./P., Fail or pass. G., Good. V.G./E., Very good or excellent.
Pre., Preclinical phase. Clin., Clinical phase.
Pub., Public schools. I./P., International or private schools.
[a)], Students were given choices

Table 3: Students attitude towards research (agree answers).

Question	Sex				Previous year grade						Academic Phase				Premedical school type			
	Males		Females		F./P.		G.		V.G./E.		Pre.		Clin.		Pub.		I./Priv.	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Managing clinical problems can be easier if the scientific approach is properly followed.	99	39.0	155	61.0	33	13.0	51	20.1	170	66.9	137	53.9	117	46.1	217	85.4	37	14.6
Clinical research skills can significantly improve the physician's clinical practice.	85	37.8	140	62.2	30	13.3	45	20.0	150	66.7	122	54.2	103	45.8	193	85.8	32	14.2
All medical advances are based on the proper application of the scientific methodology.	66	36.1	117	63.9	20	10.9	37	20.2	126	68.9	**111**	**60.7**	**72**	**39.3**	158	86.3	25	13.7
Clinical research methodology should be a mandatory knowledge requirement for all physicians.	71	37.6	118	62.4	21	11.1	35	18.5	133	70.4	105	55.6	84	44.4	165	87.3	24	12.7
Being oriented with the clinical research methodology is necessary to obtain accurate clinical data.	84	36.7	145	63.3	31	13.5	43	18.8	155	67.7	127	55.5	102	44.5	195	85.2	34	14.8
Limiting medical practice to scientific findings only makes the practicing physicians narrow-minded.	60	35.5	109	64.5	18	10.7	35	20.7	116	68.6	91	53.8	78	46.2	143	84.6	26	15.4
Following the scientific research methodology adds difficulty to clinical research practice.	38	37.6	63	62.4	10	9.9	25	24.8	66	65.3	48	47.5	53	52.5	87	86.1	14	13.9
Undergraduate students should participate in clinical research projects.	90	39.3	139	60.7	32	14.0	45	19.7	152	66.4	127	55.5	102	44.5	194	84.7	35	15.3

Bold indicates significant differences between categories of the same variable.
M., Males. F., Females.
F./P., Fail or pass. G., Good. V.G./E., Very good or excellent.
Pre., Preclinical phase. Clin., Clinical phase.
Pub., Public schools. I./P., International or private schools.

Table 4: Students practice of research.

Practice	Sex				Previous year grade						Academic Phase				Premedical school type			
	Males		Females		F./P.		G.		V.G./E.		Pre.		Clin.		Pub.		I./Priv.	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Participation in research methodology workshops	32	40.5	47	59.5	15	19.0	17	21.5	47	59.5	45	57.0	34	43.0	71	89.9	8	10.1
Writing a research protocol	25	41.0	36	59.0	11	18.0	12	19.7	38	62.3	36	59.0	25	41.0	49	80.3	12	19.7
Conducting medical research	27	31.4	59	68.6	9	10.5	21	24.4	56	65.1	51	59.3	35	40.7	75	87.2	11	12.8
Scientific presentation in a conference	38	37.6	63	62.4	14	13.9	22	21.8	65	64.4	54	53.5	47	46.5	**92**	**91.1**	**9**	**8.9**
Publication of research study in a journal	11	34.4	21	65.6	5	15.6	9	28.1	18	56.3	21	65.6	11	34.4	30	93.8	2	6.3

Tests of significance used: Chi-square and Fischer exact (in cell values less than 5).
Bold indicates significant differences between categories of the same variable.
M., Males. F., Females.
F./P., Fail or pass. G., Good. V.G./E., Very good or excellent.
Pre., Preclinical phase. Clin., Clinical phase.
Pub., Public schools. I./P., International or private schools.

Table 5: Barriers against students' research.

Barrier	Sex				Previous year grade						Academic Phase				Premedical school type			
	Males		Females		F./P.		G.		V.G./E.		Pre.		Clin.		Pub.		I./Priv.	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Difficulty in choosing topic	65	38.2	105	61.8	25	14.7	35	20.6	110	64.7	91	53.5	79	46.5	144	84.7	26	15.3
Getting permission from review boards	66	38.6	105	61.4	24	14.0	36	21.1	111	64.9	96	56.1	75	43.9	145	84.8	26	15.2
Difficulty in writing proposal	56	34.8	105	65.2	24	14.9	28	17.4	109	67.7	86	53.4	75	46.6	138	85.7	23	14.3
Difficulty in collecting data	**43**	**32.3**	**90**	**67.7**	18	13.5	21	15.8	94	70.7	72	54.1	61	45.9	**108**	**81.2**	**25**	**18.8**
Difficulty in analysis	**44**	**31.7**	**95**	**68.3**	16	11.5	28	20.1	95	68.3	67	48.2	72	51.8	121	87.1	18	12.9
Difficulty in writing report	43	34.1	83	65.9	**14**	**11.1**	**18**	**14.3**	**94**	**74.6**	62	49.2	64	50.8	109	86.5	17	13.5
Time barriers	71	38.6	113	61.4	23	12.5	41	22.3	120	65.2	**91**	**49.5**	**93**	**50.5**	160	87.0	24	13.0
Budget-related barriers	65	41.4	92	58.6	20	12.7	34	21.7	103	65.6	**70**	**44.6**	**87**	**55.4**	137	87.3	20	12.7
Other barriers	54	35.5	98	64.5	20	13.2	34	22.4	98	64.5	76	50.0	76	50.0	132	86.8	20	13.2

Test of significance used: Chi-square test.
Bold indicates significant differences between categories of the same variable.
M., Males. F., Females.
F./P., Fail or pass. G., Good. V.G./E., Very good or excellent.
Pre., Preclinical phase. Clin., Clinical phase.
Pub., Public schools. I./P., International or private schools.

DISCUSSION

This study included students from Mansoura University Faculty of Medicine. Research related curricula taught to them include Research Methodology / Biostatistics, and Evidence-Based Medicine courses. Basic medical sciences in Mansoura University Faculty of Medicine include Human Anatomy and Embryology, Medical Physiology, Medical Biochemistry, Histology, Pathology, Clinical Pharmacology, Medical Microbiology, and Medical Parasitology. Clinical sciences include Public Health, Occupational Medicine, Forensic Medicine, Toxicology, Ophthalmology, Ear / Nose / Throat, Paediatrics, Obstetrics / Gynaecology, Internal Medicine, and Surgery. The mentioned disciplines are integrated together, and the study is module-based. Additional elective courses are required to be fulfilled by students through their study years.

The current study suggests that some aspects of medical student's knowledge about scientific research are significantly related to their general characteristics such as sex, previous year grade, academic phase, and premedical school type. Knowledge about the concept of scientific theory was significantly in the favour of female rather than male students. The answers to a multiple-choice question about definition of scientific truth showed significant difference between students who achieved a "Very Good" or an "Excellent" grade and those who achieved less in the previous year of medical study. Knowledge about rules of scientific writing showed significant difference as regards academic phase, where preclinical students were better than clinical phase students. That might be attributed to the scope of courses studied in academic phase which they focus more on basics rather than applied knowledge. The current study reports significant difference between medical students who attended public premedical schools and those who attended private or international schools regarding some aspects of knowledge domain. The difference is in the favour of public schools. The meant knowledge aspects are representativeness of a sample, how to know citations of an authored scientific paper, and basics of scientific writing.

Some Egyptian studies reported generally low knowledge among medical students about scientific research [6]. Another study was based on three Arab universities and concluded also that medical students had lower than expected research knowledge without any significant difference between the three universities [7]. A Pakistani study affirmed that research knowledge and attitude improve with advancement in study years of medical school [8].

There is significant difference between preclinical and clinical phase students regarding their attitude towards medical research; more specifically, agreement that all medical advances are based on proper application of scientific methodology. A south African study showed that more than half of the medical students have good attitude towards scientific research and that was significantly reflected on their participation of different research activities [9]. Another Pakistani work showed low positive attitude of students towards research activities but within the context of self-learning rather than scientific articles production process [10].

In practice of scientific research domain, there is a significant difference between those who attended public premedical schools and

those who attended private or international schools regarding scientific participation in conferences and insignificant difference regarding sex in the favour of females. A Saudi research proved that research practice among medical students showed significant differences as regards sex (in the favour of males), previous year grade, and academic phase [11].

Some barriers against scientific research showed significant differences. Difficulty in data collection as a barrier showed significant differences regarding students' sex and premedical school type, being more reported by females and by those who attended premedical public-school type. Difficulty in data analysis was significantly associated with female sex. Difficulty in writing was significantly associated with previous year grade, more reported by those who got a "Very Good" or an "Excellent" grade. Time and budget related barriers were significantly associated with academic phase, and more reported by clinical phase students. The most reported barriers were time barriers, followed by administrative barriers such as getting permission from review boards. A Kuwaiti study reported that time barriers were the most commonly encountered among medical students followed by lack of interest among some research team members [12]. A Pakistani study concluded that lack of medical student's research knowledge was the most commonly reported barrier followed by unavailability of time to conduct research [13].

Preparing a competent medical student that is able to contribute significantly to research is viewed as an important target in the context of recent innovations in medical education. Student Selected Components (SSCs) is a recent approach that allows students develop their research skills, have more control over their learning and being able to study in-depth more topics of interest, and present their work results more flexibly. This approach was conceptualized and developed by Association for Medical Education in Europe (AMEE) [14]. Integrating the SSCs and similar approaches in the medical education process will build an encouraging research environment for students.

Study limitations include being a cross section, with no comparative groups, and being based only on one institute. Data collection was conducted online, and this has some limitations, such as non-random nature of selection of the sample, and technical issues that may hinder full participation of those who are willing to participate.

The current study is emphasizing on the importance in increasing research knowledge among medical students. This will have a remarkable effect on attitude and practice of research. Time barriers should be addressed and reframing of study curricula can be performed to enable the students to be more engaged in research activities. Administrative barriers issued by the students should be investigated for better understanding to its root reasons.

CONCLUSION

Research knowledge needs improvement. This research highlighted the points that needed improvement that can be targeted through tailored curricula. This will foster a more positive attitude towards research and encourage greater participation in various research activities that ends in uplifting students' meaningful participation in different

research activities. Working to overcome barriers against students' involvement in research will improve the outcomes.

Recommendations

Increasing research knowledge among undergraduates by increasing the share of research in study curricula (improving theoretical background).

Practical training on research via workshops and supervised participation in research.

Removal of barriers against research and provision of personalised student assistance.

ACKNOWLEDGEMENTS

Conflict of Interest

Authors declare there are no competing interests.

Financial Support

This research did not receive any specific grant from funding agencies in the public, commercial, or from non- profit sectors.

Ethical Declaration

Study proposal was approved by the Institutional Research Board (IRB), Faculty of Medicine, Mansoura University. Proposal code is R.20.08.973.R1. Date: 31/8/2020. An informed oral consent was obtained from each participant in the study. They were allowed to respond anonymously to the questionnaire in their own time and privacy after ensuring their freedom to accept or refuse to participate.

Authors Contributions

Concept: SM, AA, Design: SM, Supervising: AG, Data collection and entry: SM, AA, AE, ME, Analysis and interpretation: ME, AG, Literature search: AG, Writing: ME, Critical review: ME, AG. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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