Article published online: 2021-08-12

ORIGINAL ARTICLE

Attitudes, barriers, and practices toward research and publication among medical students at the University of Damascus, Syria

Tarek Turk[1], Tareq Al Saadi[1], Mahmoud Alkhatib[1], Ibrahem Hanafi[1], Fares Alahdab[2], Belal Firwana[3], Maysoun Koudsi[4], Ahmad Al-Moujahed[5,6]

[1]Faculty of Medicine, University of Damascus, Damascus, Syria, [2]Assistant Professor of Medicine, Mayo Clinic Evidence-Based Practice Center, Mayo Clinic, Rochester, MN, USA, [3]Division of Hematologyand Oncology, University of Arkansas for Medical Sciences, Little Rock, AR, USA, [4]Department of Internal Medicine and Vice Dean, Faculty of Medicine, Damascus University, Damascus, Syria, [5]Department of Ophthalmology, Massachusetts Eye an Ear Infirmary, Harvard Medical School, [6]Department of Pathology, Boston University School of Medicine, Boston, MA, USA

Access this article online

Website: www.avicennajmed.com

DOI: 10.4103/ajm.AJM_116_17

Quick Response Code:

ABSTRACT

Introduction: Research is crucial for health-care delivery. However, medical students may not participate in research during their training, which might negatively affect their understanding of the importance of research and their future ability to conduct research projects. This is more prominent in developing countries. We aim to assess the attitudes of a sample of Syrian medical students toward research and suggest plausible solutions to reduce their self-reported barriers. **Methods:** A cross-sectional study was conducted using a self-administered, pretested questionnaire. **Results:** Three hundred and twenty-three responses were included. Most students demonstrated positive attitudes toward research. However, most of the responses indicated that they did not receive any training in academic writing or research and therefore did not have the opportunity to participate in formal research projects or scholarly writing. Students reported various types of barriers that challenged their progress in the field of research. Students who reported being encouraged by their professors to participate in research and writing/publishing scientific papers or reported receiving training about these activities were more likely to participate in research projects or writing scientific articles. **Conclusion:** Students have positive attitudes toward research and publication while they reported poor education, limited participation, and presence of many barriers that impede their participation in such activities.

Key words: Developing country, medical education, medical students, publications, research, Syria

INTRODUCTION

Research is the only known tool for the advancement of our knowledge of biology and medical sciences. It is the only method, with proven record, which allows us to elevate the human condition, both in sickness and health. Biomedical research activity and production are directly associated with countries' and societies' prosperity in medical practice and health-care delivery.[1] Earlier exposure to the basics of research can result in more research-intensive careers by medical doctors.[2] Various studies have reported that medical students who are exposed to research during their college years show higher research productivity during their future careers.[3] Unfortunately, medical students do not always have the opportunity to participate in a research project during medical school. This missed opportunity might affect their understanding of the importance of

Address for correspondence: Dr. Tarek Turk, Fayez Mansour Street, Al-Mezzeh, Damascus, Syria. E-mail: tu.tarek@gmail.com

Cite this article as: Turk T, Al Saadi T, Alkhatib M, Hanafi I, Alahdab F, Firwana B, *et al*. Attitudes, barriers, and practices toward research and publication among medical students at the University of Damascus, Syria. Avicenna J Med 2018;8:24-33.

research and future ability to conduct research projects on their own.

Many obstacles have been reported to hinder a student's ability to conduct research. Some of these obstacles include lack of mentorship,[4] lack of time to devote to extracurricular activities, and lack of adequate research training.[5,6] These obstacles seem to be more prominent in developing countries.[5] This might be attributed to the fact that countries with limited resources remain consumers of knowledge instead of taking a lead in producing it.[7,8] As a result, important health care-related data are not properly investigated in these low-resource countries, and therefore, medical clinics and hospital suffer from a lack of evidence-based care that can improve the lives of patients.

Similar to other developing countries, Syria contributes minimally to the global wealth of biomedical research production and knowledge. In 2011, a report indicated that between 1980 and 2011, only 593 papers in the medical literature were published from Syrian medical institutions.[9] Another report stated that since 1980, only 61 medical case reports were published from Syria, which is considered low compared to other countries.[10,11] Given the crisis in Syria, there is a critical need for the application of evidence-based medical practices in emergency clinics throughout the affected area.

We believe that medical students are a vital force that can effectively participate in establishing an extended increase in research production and activity in Syria. We also believe that building a generation of well-educated and scientifically-oriented physicians will help tackle the long-term health consequences of the current war. However, boosting students' participation in research requires a further investigation of their perspectives on the importance of research and the barriers that are inhibiting their participation. In this study, we aim to assess the attitudes of medical students at the University of Damascus, Faculty of Medicine, toward research. We also suggest solutions to reduce these barriers. The findings from this study can potentially be used to create an evidence-based approach to promote research among medical students in Syria.

METHODS

Study design and participants

A cross-sectional study was conducted at the Faculty of Medicine, Damascus University, to investigate medical students' experiences, attitudes, and opinions about biomedical research and scientific papers. All participants were active medical students at the University of Damascus, Faculty of Medicine. Participants were recruited from 2nd to 6th year of medical school using convenience sampling method. First-year students were excluded from the study because this year is considered to be a premedical preparatory year.

Data collection

Data collectors approached medical students during their practical learning sessions on campus. The collection process took place over a single week period, which precludes the chance of filling the form twice by the same person. Participants were informed about the objectives of the study, and that participation was voluntary and anonymous. They were asked to provide written consent to participate in the study before completing the questionnaire.

The questionnaire

We constructed a questionnaire that addresses all areas that we aim to investigate after reviewing a handful similar studies and consulting several experts in the field.[6,12-14] All questions were administered to students in the Arabic language. The first part of the questionnaire contained questions about the demographic characteristics of the participants (gender and year of study). Other factors that were assessed included English fluency and the availability of a reliable internet connection since these variables may have an influence on attitudes toward research. To determine the English fluency, participants were asked to fill out a 5-point Likert scale, ranging from "very poor" to "very good."

Participants were also asked about the reasons why they think research is important, their willingness to participate in research, and whether they are encouraged by their professors to do so. Their personal beliefs about the importance of and barriers to research were investigated using a 5-point Likert scale (ranging from "strongly disagree" to "strongly agree").

In addition, we were keen to investigate two distinct research activities: participating in research and writing scientific papers for publication. For each topic, participants were asked about the sources of their knowledge (if any), number and types of projects they participated in, and reasons for their participation or nonparticipation. On the topic of scientific papers, participants were also asked about the reasons for submitting or not submitting their work for publication, types of submitted publications, and results of those submissions.

Overall, the questionnaire contained 37 multiple-choice questions. Eight questions were not required since they were

not applicable to all participants. Responses were considered invalid if they were not legible, or if they contained false or contradictory information, such as stating to have published a systematic review while choosing zero as their number of publications. All questionnaires with invalid responses were discarded. In the case of missing variables, participants had to complete at least 75% of the questionnaire to be included in the analysis. Because some of the variables were missing, we added the total number of participants who completed each question (total *n*) to the tables.

The questionnaire was piloted on a sample of 26 participants to test the comprehension and relevance of the questions. The participants in the pilot study were not included in the analysis.

Ethical issues

All procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Declaration of Helsinki 1975, as revised in 2008.

Statistical analysis

Data were entered into Microsoft Excel Ver. 3. 2013. Jones, Chicago. using a Google online survey form created by two authors, with a verification of data integrity by a third author. Data were then imported into the Statistical Package for the Social Sciences version 22.0 (SPSS Inc., Chicago, IL, United States) for further analysis.

Participants' characteristics were reported as frequencies and percentages. The percentages reported were out of the total number of participants who answered each corresponding question. For questions with the option of choosing multiple responses, we reported the percentages of cases (participants who answered each corresponding question). For ease of reporting in Table 3, responses of "agree" and "strongly agree" in the 5-point Likert scale were grouped together into one "agreement" group.

Mann–Whitney test was used to compare the responses of the 5-point Likert scale between participants in their 2nd year of study and participants in their 4th–6th year of study. A $P < 0.05$ was used to determine the level of statistical significance. Chi-square and Fisher's exact tests were used to determine the associations between participation in research projects/writing scientific papers and each of the participants' characteristics (gender, year of study, internet connection status, English fluency, professors' level of encouragement, and previous education/training). The level of statistical significance was calculated using the Bonferroni correction (dividing 0.05 by the number of statistical tests performed for each endpoint variable; which in our study was 13; yielding a $P < 0.004$ to be the level of statistical significance). The measure of association was reported as odds ratios (ORs) with 95% confidence intervals (CIs).

RESULTS

A total of 376 participants agreed to participate in the study and completed the questionnaire. Fifty participants provided unclear or contradictory information, and their questionnaires

Table 1: General characteristics

Characteristics	*n* (%)
Gender (total *n*=323)	
Male	149 (46.1)
Female	174 (53.9)
Year of study (total *n*=322)	
2nd	72 (22.4)
3rd	68 (21.1)
4th	48 (14.9)
5th	68 (21.1)
6th	66 (20.5)
Internet connection status (total *n*=322)	
Do not have an internet connection	7 (2.2)
Have a low-quality internet connection	161 (50.0)
Have a high-quality internet connection	154 (47.8)
English language skills – writing (total *n*=323)	
Very poor	2 (0.6)
Poor	11 (3.4)
Intermediate	91 (28.2)
Good	149 (46.1)
Very good	70 (21.7)
English language skills – speaking (total *n*=322)	
Very poor	5 (1.6)
Poor	31 (9.6)
Intermediate	118 (36.6)
Good	114 (35.4)
Very good	54 (16.8)
English language skills – reading and comprehension (total *n*=323)	
Very poor	4 (1.2)
Poor	6 (1.9)
Intermediate	62 (19.2)
Good	125 (38.7)
Very good	126 (39.0)
Participation in clinical research (total *n*=323)	
Not looking for opportunity to participate	35 (10.8)
Do not know how to get an opportunity	187 (57.9)
Actively looking for an opportunity	101 (31.3)
Participation in laboratory research (total *n*=323)	
Not looking for opportunity to participate	101 (31.3)
Do not know how to get an opportunity	141 (43.7)
Actively looking for an opportunity	81 (25.1)
Encouraged by professors to participate in research? (total *n*=323)	
No	264 (81.7)
Yes	59 (18.3)
Encouraged by professors to write and publish scientific papers? (total *n*=316)	
No	271 (85.8)
Yes	45 (14.2)

Total *n*: Total number of participants who answered the corresponding question, *n*: Number of participants who chose the corresponding answer, %: Percentage of participants who chose the corresponding answer

were considered invalid. Three participants completed less than the 20 required questions. Those invalid and incomplete questionnaires were excluded from the study, and the analysis was carried out on the remaining 323 participants.

General characteristics

The sample contained a similar percentage of males and females (46.1% and 53.9%, respectively) and a similar percentage of participants from each year of study [Table 1]. Only 2.2% of the participants stated that they do not have an internet connection. The remaining participants reported either having a low-quality (50%) or a high-quality (47.8%) internet connection. The participants' assessments of their English fluency are summarized in Table 1.

Included students varied significantly in their willingness to participate in research [Table 1]. The majority of respondents favored participating in clinical research over laboratory-based research; while 31.3% of respondents stated that they are not looking for an opportunity to participate in laboratory-based research, only 10.8% of them stated that they are not looking for a clinical research opportunity. Over 80% of participants indicated that they are not encouraged by their professors to participate in research or write and publish scientific papers [Table 1].

Importance and barriers of research

Results of the 5-point Likert scale questions regarding the importance of research are shown in Table 2. The majority of participants agreed or strongly agreed that the role of research is important (96.3%). Most of them thought that it was important to participate in research during medical school (71.2%) and that teaching research methodology should be part of the curriculum (79.8%).

Participants' responses regarding why they think research is important are shown in Figure 1. Improving the state of research in the country and relaying information were the most frequently reported reasons (reported by 35.8% and 32.1%, respectively), while keeping up with peers was the least frequently reported reason (reported by 3.7% of participants).

The participants' beliefs about the barriers of research are also shown in Table 2. With over 75% of participants disagreeing or strongly disagreeing with the statement about the presence of adequate training for research and evaluating scientific literature, lack of such training was the most commonly reported barrier of research.

Attitudes toward the importance and barriers of research are compared between students of basic sciences (second and third) years of study and students of clinical (fourth through sixth) years of study [Table 3]. The importance of participating in research during medical school was more appreciated among students of clinical years of study than among students of basic sciences. For those in their clinical years of study, the availability of adequate time in medical school to pursue research was not considered to be

Table 2: Participant's personal beliefs about importance and barriers of research

	Total *n*	Strongly disagree, *n* (%)	Disagree, *n* (%)	Neutral, *n* (%)	Agree, *n* (%)	Strongly agree, *n* (%)
Importance of research						
The role of research in the medical field is important	323	1 (0.3)	1 (0.3)	10 (3.1)	116 (35.9)	195 (60.4)
Participating in research or publishing scientific papers during medical school is important	323	1 (0.3)	13 (4.0)	79 (24.5)	147 (45.5)	83 (25.7)
Teaching research methodology should be part of the curriculum	322	2 (0.6)	10 (3.1)	53 (16.5)	127 (39.4)	130 (40.4)
Research will be a part of my long-term career goals	323	6 (1.9)	45 (13.9)	109 (33.7)	94 (29.1)	69 (21.4)
Conducting research always needs a lot of money	323	4 (1.2)	48 (14.9)	85 (26.3)	108 (33.4)	78 (24.1)
Barriers of research						
There is adequate time in medical school to pursue research	323	45 (13.9)	122 (37.8)	110 (34.1)	33 (10.2)	13 (4.0)
There is adequate training in research methodology in medical school	323	83 (25.7)	175 (54.2)	48 (14.9)	13 (4.0)	4 (1.2)
There is adequate training in reading and evaluating scientific literature in medical school	323	56 (17.3)	193 (59.8)	50 (15.5)	20 (6.2)	4 (1.2)
Research mentors are easily available	323	59 (18.3)	161 (49.8)	82 (25.4)	15 (4.6)	6 (1.9)
There are many opportunities to participate in research in medical school	320	46 (14.4)	154 (48.1)	93 (29.1)	25 (7.8)	2 (0.6)
There is adequate facility for research	320	67 (20.9)	169 (52.8)	67 (20.9)	13 (4.1)	4 (1.3)
It is easy to access medical journals and get all wanted papers through the medical school library	321	33 (10.3)	95 (29.6)	101 (31.5)	69 (21.5)	23 (7.2)
It is easy to obtain approval for conducting research	320	49 (15.3)	105 (32.8)	143 (44.7)	22 (6.9)	1 (0.3)
There are enough rewards/motivations to participate in research	321	73 (22.7)	110 (34.3)	117 (36.4)	17 (5.3)	4 (1.2)

Total *n*: Total number of participants who answered the corresponding question, *n*: Number of participants who chose the corresponding answer, %: Percentage of participants who chose the corresponding answer

Table 3: Comparison of attitudes regarding research importance, interest, and barriers for participants in basic sciences (2nd and 3rd) years of study and clinical (4th to 6th) years of study

	Agreement† from basic sciences (2nd and 3rd) years of study (*n*=140) (%)	Agreement† from clinical (4th through 6th) years of study (*n*=182) (%)	*P*‡
Importance of research			
The role of research in the medical field is important	95.7	96.7	0.369
Participating in research or publishing scientific papers during medical school is important	67.9	74.2	0.038*
Teaching research methodology should be part of the curriculum	81.3	79.1	0.494
Research will be a part of my long-term career goals	44.3	55.5	0.057
Conducting research always needs a lot of money	56.4	58.8	0.462
Barriers of research			
There is adequate time in medical school to pursue research	7.1	19.8	<0.001*
There is adequate training in research methodology in medical school	7.1	3.8	0.005*
There is adequate training in reading and evaluating scientific literature in medical school	10.7	4.9	<0.001*
Research mentors are easily available	7.9	5.5	0.011*
There are many opportunities to participate in research in medical school	12.2	5.6	0.064
There is adequate facility for research	8.6	2.8	0.018*
It is easy to access medical journals and get all wanted papers through medical school library	28.6	28.9	0.071
It is easy to obtain approval for conducting research	9.3	5.6	0.151
There are enough rewards/motivations to participate in research	5.7	7.2	0.289

†Responses "agree" and "strongly agree" in 5-point Likert scale were grouped as "agreement" for reporting purposes, ‡Mann–Whitney test between responses of 5-point Likert scale, *Significant at the level of 0.05

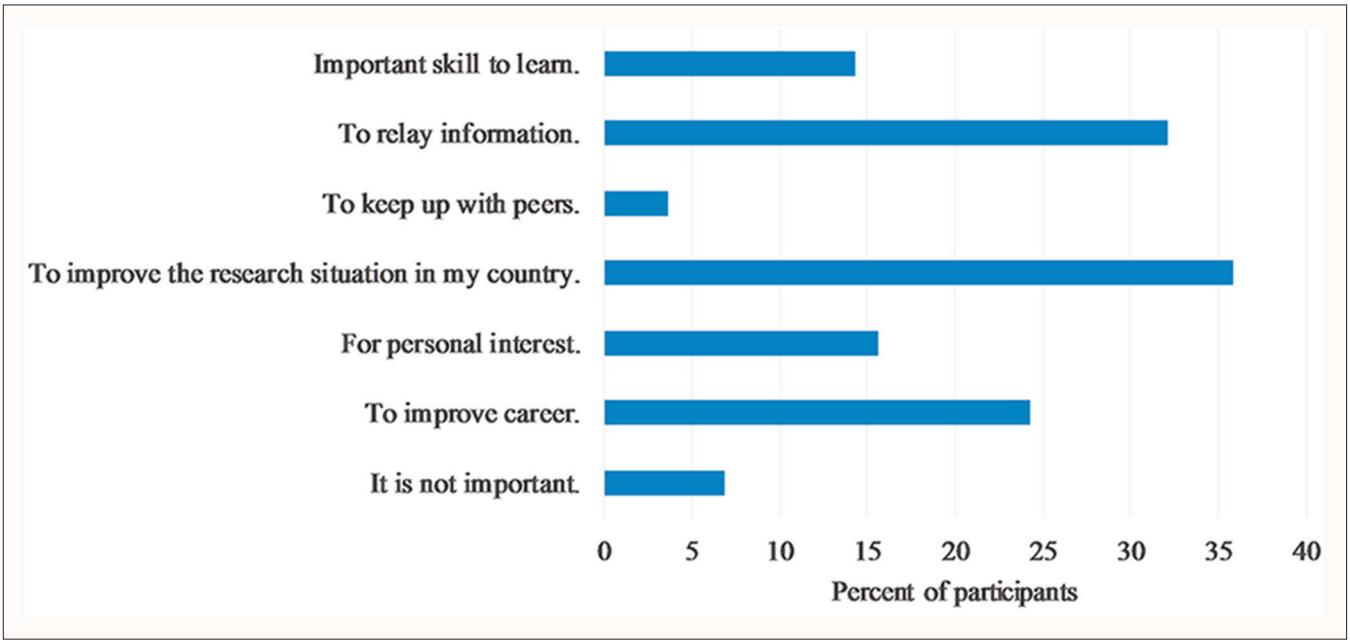

Figure 1: Reasons why it is important to participate in research and publish scientific papers (Total *n* = 321)*. Total *n*: total number of participants who answered the corresponding question. *: choosing >1 option was allowed

as significant a barrier compared to students in their basic sciences years of study. However, a lack of adequate training, shortage of research facilities, and unavailability of research mentors were perceived more as barriers.

Research experience

Participants' characteristics with regard to research education and experience are summarized in Table 4. The majority of participants stated that they did not receive any education or training in research (65.0%) and that they did not participate in any research projects (86.4%). Medical school was the most common source for receiving such training (16.3% of the participants). Questionnaire-based and case–control studies were the most common types of research among those who participated (both types were chosen by 47.7% of those who participated). For those

who did not participate in research projects, the lack of opportunities to participate and shortage of time were the most common barriers (reported by 54% and 39.5%, respectively) [Table 4].

Table 4: Experience of participants regarding research

	n (%)
Sources of education/training about research (total *n*=320*)	
None	208 (65.0)
Medical school	52 (16.3)
Online resources	26 (8.1)
Peers	32 (10.0)
Books and journal	27 (8.4)
Number of research projects participated in (total *n*=323)	
None	279 (86.4)
One project	35 (10.8)
Two projects	5 (1.5)
Three projects	4 (1.2)
More than three projects	0
Types of research projects participated in (total *n*=44*)	
Laboratory based	2 (4.5)
Questionnaire based	21 (47.7)
Case–control	21 (47.7)
Cohort	2 (4.5)
Randomized control trials	1 (2.3)
Reasons for not participating in research (total *n*=276*)	
Not interested in doing research	31 (11.2)
Did not have the opportunity to take part in research	149 (54.0)
Lack of time	109 (39.5)
Lack of guidance and supervision	73 (26.4)
Lack of funding	15 (5.4)
Poor internet connection	15 (5.4)

*Choosing more than one option is allowed. Total *n*: Total number of participants who answered the corresponding question, *n*: Number of participants who chose the corresponding answer, %: Percentage of participants who chose the corresponding answer

The odds of participating in research were 5.128 (95% CI 2.590–10.154) times greater for those who were encouraged by their professors to participate in research compared to those who were not and 4.891 (95% CI 2.469–9.689) times greater for those who received education/training about research compared to those who did not. Other factors, including gender, internet access, and English language skills, did not significantly affect the likelihood of participating in a research project [Table 5].

Writing and publishing experience

Participants' characteristics regarding writing and publishing scientific papers are summarized in Table 6. Similar to research education and experience, the majority of participants stated that they did not receive any education or training about writing and publishing scientific papers (72.3%) and that they did not participate in the process of writing scientific papers (85.8%). Similarly, medical school was the most common source for such training (16.2% of participants). Most of the students who wrote scientific papers participated in case reports/case series or original research papers (35.0% and 47.5% of the participants, respectively). Those two types of papers were also the most likely to be submitted

Table 5: Associations between participation in research projects/writing scientific papers and the participant's characteristics

Comparison	Portability (*P*)	OR (95% CI)
Participation in research projects (yes/no)		
By gender (male/female)	0.673†	0.871 (0.459-1.654)
By year of study	<0.001†,*	-
2nd year versus non-2nd year	0.002†,*	0.141 (0.033-0.6)
3rd year versus non-3rd year	0.001†,*	3.157 (1.608-6.197)
4th year versus non-4th year	0.478†	0.701 (0.261-1.878)
5th year versus non-5th year	0.001†,*	0.073 (0.010-0.542)
6th year versus non-6th year	<0.001†,*	3.317 (1.686-6.526)
By internet connection status	0.514‡	-
By English language skills (writing)	0.182‡	-
By English language skills (speaking)	0.921‡	-
By English language skills (reading and comprehension)	0.544‡	-
By professors encouragement to participate in research (yes/no)	<0.001†,*	5.128 (2.590-10.154)
By education/training about research (yes/no)	<0.001†,*	4.891 (2.469-9.689)
Participation is writing scientific papers (yes/no)		
By gender (male/female)	0.145†	0.6 (0.301-1.198)
By year of study	0.023†	-
2nd year versus non-2nd year	0.394†	0.689 (0.291-1.630)
3rd year versus non-3rd year	0.566†	1.253 (0.579-2.711)
4th year versus non-4th year	0.617†	1.252 (0.518-3.023)
5th year versus non-5th year	0.009†	0.178 (0.042-0.758)
6th year versus non-6th year	0.013†	2.434 (1.167-4.992)
By internet connection status	1.0‡	-
By English language skills (writing)	0.612‡	-
By English language skills (speaking)	0.457‡	-
By English language skills (reading and comprehension)	0.051‡	-
By professors' encouragement to participate in writing scientific papers (yes/no)	<0.001†,*	6.520 (3.115-13.649)
By education/training about writing scientific papers (yes/no)	<0.001†,*	4.158 (2.098-8.241)

†Chi-square test, ‡Fisher's exact test, *Significant at the level of 0.05/13=0.004 (via Bonferroni correction). OR: Odds ratio, CI: Confidence interval

Table 6: Experience of participants regarding writing and publishing scientific papers

	n (%)
Sources of education/training about writing/publishing scientific papers (total *n*=314*)	
None	227 (72.3)
Medical school	51 (16.2)
Online resources	19 (6.1)
Peers	17 (5.4)
Books and journals	15 (4.8)
Number of scientific papers participated in (total *n*=317)	
None	277 (85.8)
One project	32 (9.9)
Two projects	4 (1.2)
Three projects	3 (0.9)
More than three projects	1 (0.3)
Types of scientific papers participated in (total *n*=40*)	
Case report/case series	14 (35.0)
Original research laboratory-based, questionnaire-based, case–control, cohort, or randomized control trial	19 (47.5)
Systematic review with or without meta-analysis	0
Narrative review	4 (10.0)
Letter to the editor	1 (2.5)
Commentary	4 (10.0)
Reasons for not participating in writing scientific papers (total *n*=236*)	
Not interested in writing a scientific paper	36 (15.3)
Did not have the opportunity to take part in research, therefore, have no paper	123 (52.1)
Lack of time	79 (33.5)
Lack of guidance and supervision	62 (26.3)
Poor internet connection	14 (5.9)
Types of scientific papers submitted for publication (total *n*=28*)	
Case report/case series	10 (35.7)
Original research (laboratory-based, questionnaire-based, case–control, cohort, or randomized control trial)	12 (42.9)
Systematic review with or without meta-analysis	0
Narrative review	3 (10.7)
Letter to the editor	0
Commentary	4 (14.3)
Main motivation to consider publication (total *n*=27*)	
Career progression	7 (25.9)
Peer pressure	3 (11.1)
Relay information	8 (29.6)
Personal interest	9 (33.3)
Supervisor encouragement	1 (3.7)
Outcome of paper submissions (total *n*=31)	
None was accepted for publication	22 (71.0)
Only few were accepted for publication	4 (12.9)
Most were accepted for publication	2 (6.5)
All were accepted for publication	3 (9.7)
Reasons for not submitting scientific papers for publication after writing (total *n*=20*)	
Not interested in publishing	9 (45.0)
Lack of time	5 (25.0)
Was not encouraged to submit as a scientific paper	4 (20.0)
Lack of guidance and supervision	8 (40.0)
Poor internet connection	3 (15.0)

*Choosing more than one option is allowed. Total *n*: Total number of participants who answered the corresponding question, *n*: Number of participants who chose the corresponding answer, %: Percentage of participants who chose the corresponding answer

for publication among participants (35.7% and 42.9% of the participants, respectively). The most common reasons for the lack of participation in writing scientific papers were the inability to participate in a research project to yield a paper and a lack of time (52.1% and 33.5% of the participants, respectively).

The main reasons reported by respondents for considering publication were personal interest (33.3% of participants), relay of information (29.6% of participants), and career progression (25.9% of participants). However, the main reasons for not considering publication after writing papers were lack of interest in publishing (45.0% of participants) and lack of guidance and supervision (40.0% of participants). Among students who submitted scientific papers for publication, there was a low acceptance rate with 71% of participants reporting that none of their submitted publications was accepted.

Respondents who were encouraged by their professors to participate in writing and publishing scientific papers were about 6.5 times more likely to participate in such activities (OR = 6.520; 95% CI 3.115–13.649) compared to those who were not. In addition, those who received education/training about writing scientific papers were 4 times more likely to participate in writing a scientific paper (OR = 4.158; 95% CI 2.098–8.241). Gender, year of study, internet connection status, and English language skills did not have a significant effect upon writing scientific papers [Table 5].

DISCUSSION

Although the importance of research is well recognized in medicine, only small numbers of medical students[5,6,12,15] and postgraduate physicians[13,16] conduct research, as evident in our study and others. To our knowledge, this is the first study to investigate the attitudes of medical students toward research in Syria and to address the barriers that are inhibiting students from learning about and conducting research.

In developing countries, research is not a high priority for health-care professionals. This can be due to poverty, lack of resources, poor access to the literature, and poor knowledge about the fundamentals of research practice.[17,18] Unfortunately, this creates a large disparity in research productivity between high- and low-income countries. For instance, medical students in Germany were listed as authors in 28% of all medical publications in a 2-year period, with students acting as leading authors in >7% of the cases.[19] In contrast, the vast majority of Indian postgraduates had no research experience in medical school.[16] Certain factors may be exacerbated in conflict zones such as Syria, where physicians face intolerable conditions that preclude them from applying current evidence, without the proper environment to produce new evidence that fits the needs of the current situation. Given all these facts, we believe

that it is necessary to pay more attention to build a new generation of young doctors who are capable of bridging the gap and elevate the current reality of biomedical research to a higher level.

The analytical process that characterizes research contributes to the development of a medical student's critical thinking skills, ability to evaluate the literature, and technical tools to communicate scientific data.[20-22] In addition, engaging in the research process also contributes to an increase in the research productivity at the institution where the medical students are enrolled[22] and encourages students to get involved in research after graduation.[21-25] Furthermore, education on writing scientific papers can increase publication productivity.[26] The results from our study are consistent with the literature; students who reported receiving education about research and writing scientific papers were more likely to participate in research projects or writing scientific articles. Furthermore, the high percentage of students who reported not participating in practicing research or writing scientific papers can be partially explained by the presence of a similarly high percentage of students who reported not receiving any training in these areas.

Education about research methodology is delivered at Syrian universities through two separate courses (Public Health and Medical Biostatistics) during the 3rd year of study. However, only a small percentage of students in our study (about 16%) reported that they received research and academic writing education from their medical school. Although a proportion of those participants may not have reached those two courses in medical school, this finding is still worrisome and may indicate inadequate training or a lack of perceived value among the students regarding these courses. A re-evaluation of the curriculum regarding biomedical research education may be necessary to enhance students' understanding of this important topic in the Faculty of Medicine.

In our study, most students showed positive attitudes and a good understanding of the importance of research and its role in medicine, and most of them indicated a willingness to participate in research. However, the majority did not know how to get involved in a research project. They reported many perceived barriers that are negatively affecting their progress in the field of research, such as a lack of training, adequate time, motivation, and mentorship. These barriers are common for medical students and residents as they were reported in previous studies around the world.[5,6,12,13,15,16] These findings point out the importance of allocating enough time for medical students to conduct research and providing them with guidance and motivation, research opportunities, and training sessions.

Medical education at Syrian Universities is taught through a 6-year program. The first 3 years are dedicated to the basic sciences and the clinical sciences are taught in the last 3 years of the program. We compared the reported attitudes and barriers between these two phases of study as they might affect students' perception of research. Students in their clinical years of study showed more appreciation for the importance of research during medical school and reported time to be less of a barrier to research compared to students in their basic sciences years of study. However, a lack of adequate training, adequate research facilities, and adequate mentorship was reported more as barriers to research among them. In addition to placing more value on research and a better understanding of its requirements, these students may have better time management skills and may be more likely to benefit from research programs and opportunities. Therefore, they should be given priority in any future efforts or initiatives in countries, such as Syria, that lack the proper infrastructure for research. Furthermore, more attention should be given to students in their basic sciences years of study to educate them about the importance of research and its impact.

We investigated the relationship between participation in research or authoring publications and proposed factors that might have an impact on students' research habits such as gender, self-perceived English language proficiency, and internet access. Our findings suggest that these factors do not play a significant role in research/publications productivity among the population from which we recruited our study sample. However, poor internet connection was reported as one of the reasons for not participating in research (5.4%), not participating in writing scientific papers (5.9%), and not submitting scientific papers for publication after writing (15%). In addition, students in their 3rd and 6th years of study were significantly more likely to have participated in research compared to others. Differences in the curriculum and workload between among years of study and the presence of two courses on research principles in the 3rd year of study may have contributed to these findings.

For students who reported having participated in research, questionnaire-based and case–control studies were the most common types of research. This finding is not consistent with the studies from other developing countries where reviews and prospective research projects were more dominant; for instance, in Saudi Arabia and Pakistan, it was found that original articles represent the majority of the sample while case reports were markedly less reported.[5,27] One of the reasons for our finding may be due to the fact that some types of studies require less financial resources than other studies such as cohort and randomized controlled trials.

In addition, when it comes to literature reviews, letters, and commentaries, which constituted a relatively small percentage of the reported publication types in our sample, they require access to publications and databases as well as advanced mentorship and experience that Syrian medical students may lack.

Our results suggest that Syrian medical students face many difficulties regarding publishing their work. Most participants who submitted their papers for publication stated that none of their submissions was accepted. While further research is needed to investigate the reasons behind this phenomenon, a few potential causes come to mind. This includes the low acceptance rate that can be explained by the inability of students to produce high-quality papers, low interest by medical journals in research papers coming from Syria, lack of mentorship or guidance throughout the publication process, and possible publication bias against authors from less prestigious institutions.[28] In addition, lack of interest in publishing and lack of guidance and supervision appear to be the most common reasons for not considering publication after writing papers. These findings suggest that providing mentorship and additional education about academic writing and publishing are necessary.

Mentorship is crucial for research.[22] The lack of adequate mentorship has been reported as a main research barrier in many studies.[5,6,12,14,15] As expected, we found that Syrian medical students also struggle with the same issue. Most participants think that research mentors are unavailable, and a lack of guidance and supervision was reported by a substantial number of participants as a reason for not participating in research (26.4%), not writing scientific papers (26.3%), and not submitting scientific papers for publication after writing (40.0%). This confirms the role of inadequate mentorship as a cause of the limited involvement of medical students in conducting research and the poor research output from Syria. We believe that researchers and academics, especially Syrians, around the world could reduce this barrier by volunteering to share their knowledge and provide learning opportunities to students in Syria. This can be achieved by, for example, online education, distance-mentorship, and project collaboration. Encouragement has also been cited as an important contributor in motivating medical students to carry out research.[29] The importance of encouragement and support of professors, as part of good mentorship, is warranted as indicated by the respondents who were encouraged by their professors to participate in research and writing/publishing scientific papers.

Socioeconomic and political pressures can present a significant barrier to the health and impact of research institutions through reduced funding, reduced personnel, reduced morale, and – consequently – reduced learning opportunities and faculty engagement in a variety of scholarly activities. In today's chaotic political environment, pockets of threat to scholarship exist all over the world and may have lasting effects. Although our results confirm findings produced in other countries experiencing similar pressures,[5,27] we believe that Syrians already managed to partially tackle some of the barriers imposed by the poor research environment in the country; several recent reports from Syria indicated that peers effect, online courses, social media, and awareness campaigns can play a significant role in increasing students' exposure to research and can facilitate any mentorship program that seniors create to support juniors, even if those seniors were in another country.[30-32]

For developing countries with limited resources, students can be directed toward working on small research projects that do not need funding or highly-equipped facilities, such as survey-based cross-sectional studies, or "fundless" cohort and case–control studies. Students can also be taught and encouraged to participate in synthesizing medical evidence by conducting and publishing systematic reviews and meta-analyses. In addition, writing and publishing review articles or editorials could be a suitable and feasible option to encourage medical students in developing countries to become involved in academic publishing. Moreover, policymakers can adopt or learn from some initiatives that have shown to be successful for increasing research output in certain countries, such as creating opportunities for students to publish their research in local academic journals[27] or creating specialized entities for providing research opportunities, guidance, and encouragement.[29]

This study is an observational survey that gathered self-reported data. Therefore, these findings need to be taken into account in the light of several limitations. The results are derived from self-reported data that could not be verified. Some factors, such as English language proficiency and internet connection, where investigated subjectively, which may introduce bias. The same applies to many other data variables collected, such as number of publications.

Today's medical students are tomorrow's physicians and scientists who, if well-trained, will lead medical research and achieve health-care prosperity. Faculty, staff, and administrators should devote more attention to enhance students' understanding of research, hone their academic writing skills, and facilitate their early exposure to the fundamentals of conducting research. Efforts should be made to overcome the obstacles reported in this study. This can be achieved by refining curricula, building proper

infrastructure, providing adequate training, research opportunities, mentorship, and encouragement.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

REFERENCES

1. Portney LG, Watkins MP. Foundations of clinical research: Applications to practice. Philadelphia, PA: FA Davis; 2015.
2. Kassebaum DG, Szenas PL, Ruffin AL, Masters DR. The research career interests of graduating medical students. Acad Med 1995;70:848-52.
3. Solomon SS, Tom SC, Pichert J, Wasserman D, Powers AC. Impact of medical student research in the development of physician-scientists. J Investig Med 2003;51:149-56.
4. Reynolds HY. In choosing a research health career, mentoring is essential. Lung 2008;186:1-6.
5. Alghamdi KM, Moussa NA, Alessa DS, Alothimeen N, Al-Saud AS. Perceptions, attitudes and practices toward research among senior medical students. Saudi Pharm J 2014;22:113-7.
6. Siemens DR, Punnen S, Wong J, Kanji N. A survey on the attitudes towards research in medical school. BMC Med Educ 2010;10:4.
7. Benamer HT, Bakoush O. Arab nations lagging behind other Middle Eastern countries in biomedical research: A comparative study. BMC Med Res Methodol 2009;9:26.
8. Arab Development Self-Doomed to Failure: The Economist; 2002. Available from: http://www.economist.com/node/1213392. [Last updated on 2002 Jul 04].
9. Diab MM, Taftaf RM, Arabi M. Research productivity in Syria: Quantitative and qualitative analysis of current status. Avicenna J Med 2011;1:4-7.
10. Alhamid N, Almounayer N, Alsabbagh B, Atassi B. Case reports and research productivity among syrian medical students: Review, reality, and suggested solutions. Avicenna J Med 2015;5:101-5.
11. Atassi B. Comments on: "Case reports and research productivity among Syrian medical students: Review, reality, and suggested solutions". Avicenna J Med 2016;6:61-3.
12. Griffin MF, Hindocha S. Publication practices of medical students at British medical schools: Experience, attitudes and barriers to publish. Med Teach 2011;33:e1-8.
13. Mitwalli H, Al Ghamdi K, Moussa N. Perceptions, attitudes, and practices towards research among resident physicians in training in Saudi Arabia. East Mediterr Health J 2014;20:99.
14. Noorelahi MM, Soubhanneyaz AA, Kasim KA. Perceptions, barriers, and practices of medical research among students at Taibah college of Medicine, Madinah, Saudi Arabia. Adv Med Educ Pract 2015;6:479-85.
15. Chaturvedi S, Aggarwal OP. Training interns in population-based research: Learners' feedback from 13 consecutive batches from a medical school in India. Med Educ 2001;35:585-9.
16. Giri PA, Bangal VB, Phalke DB. Knowledge, attitude and practices towards medical research amongst the postgraduate students of Pravara Institute of Medical Sciences University of Central India. J Family Med Prim Care 2014;3:22-4.
17. Bennett NR, Cumberbatch C, Francis DK. There are challenges in conducting systematic reviews in developing countries: The Jamaican experience. J Clin Epidemiol 2015;68:1095-8.
18. Varmus H, Satcher D. Ethical complexities of conducting research in developing countries. N Engl J Med 1997;337:1003-5.
19. Cursiefen C, Altunbas A. Contribution of medical student research to the medline-indexed publications of a German medical faculty. Med Educ 1998;32:439-40.
20. Frishman WH. Student research projects and theses: Should they be a requirement for medical school graduation? Heart Dis 2001;3:140-4.
21. Houlden RL, Raja JB, Collier CP, Clark AF, Waugh JM. Medical students' perceptions of an undergraduate research elective. Med Teach 2004;26:659-61.
22. Aslam F, Shakir M, Qayyum MA. Why medical students are crucial to the future of research in South Asia. PLoS Med 2005;2:e322.
23. Segal S, Lloyd T, Houts PS, Stillman PL, Jungas RL, Greer RB 3rd, *et al.* The association between students' research involvement in medical school and their postgraduate medical activities. Acad Med 1990;65:530-3.
24. Brancati FL, Mead LA, Levine DM, Martin D, Margolis S, Klag MJ, *et al.* Early predictors of career achievement in academic medicine. JAMA 1992;267:1372-6.
25. Reinders JJ, Kropmans TJ, Cohen-Schotanus J. Extracurricular research experience of medical students and their scientific output after graduation. Med Educ 2005;39:237.
26. Jackson D. Mentored residential writing retreats: A leadership strategy to develop skills and generate outcomes in writing for publication. Nurse Educ Today 2009;29:9-15.
27. Aslam F, Waheed A. An audit of the students' corner of journal of the Pakistan Medical Association. J Pak Med Assoc 2005;55:517-9.
28. Peters DP, Ceci SJ. Peer-review practices of psychological journals: The fate of published articles, submitted again. Behav Brain Sci 1982;5:187-95.
29. Zier K, Stagnaro-Green A. A multifaceted program to encourage medical students' research. Acad Med 2001;76:743-7.
30. Sabouni A, Chaar A, Bdaiwi Y, Masrani A, Abolaban H, Alahdab F, *et al.* An online academic writing and publishing skills course: Help Syrians find their voice. Avicenna J Med 2017;7:103-9.
31. Turk T, Aboshady OA, Albittar A. Studying medicine in crisis: Students' perspectives from Syria. Med Teach 2016;38:861-2.
32. Sabouni A, Bdaiwi Y, Janoudi SL, Namous LO, Turk T, Alkhatib M, *et al.* Multiple strategy peer-taught evidence-based medicine course in a poor resource setting. BMC Med Educ 2017;17:82.