

Original Article

PRACTICE ON BIOMEDICAL RESEARCH AND BARRIERS EXPERIENCED BY THE POST-GRADUATE MEDICAL STUDENTS IN BANGLADESH

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ABSTRACT

Background: Research experience in medical education is strongly related to post graduate course curriculum and is also highly associated with future career achievements but conducting research is a difficult task at student level. Many hurdles are faced by post-graduate medical students during conducting biomedical research in Bangladesh. Previously doctors were either clinicians or researchers but now it is realized that a good clinician is a good researcher and able to be a competent physician & scientist. This study was conducted to find out practice on biomedical research and barriers experienced by the post-graduate medical students during conducting it in Bangladesh.

Methods: This cross-sectional type of descriptive study was carried out in the different medical colleges and Universities all over the Bangladesh over a period of 12 months from January to December 2020 among the post-graduate students of different medical colleges. Approval from the Ethical Review Committee (ERC) of Rajshahi Medical College was obtained prior to the commencement of the study and convenient sampling technique was used. Pre-designed, validated, structured questionnaire was used to collect data from 325 respondents on practice of biomedical research and 5-point Likert scale was used for assessment of barriers to its practice.

Results: Regarding practice on research, 35.10% respondents had satisfactory practice on biomedical research and only 13.20% had published their research report in journals. Lack of research training & necessary skills (73.80%), lack of fund (68.80%), lack of interest & motivation (66.20%) and lack of appropriate knowledge (65.50%) were commonly faced barrier by the post-graduate medical students. Students who were in Ph. D (100%) and MPH course (68.20%) had more practice on biomedical research than those who were in MD/MS (35.80%), M. Phil (32.40%), FCPS (39.20%) and Diploma (4.90%) courses ($p < 0.05$). Thesis part (39.50%) and dissertation part (39.20%) post-graduate students had also more practice on biomedical research than those who were in Diploma (4.90%) courses ($p < 0.05$). But relationship of practice on biomedical research of the respondents was not statistically significant with age, gender, religion, type of medical college of MBBS passing, marital status, parental and spouse educational status ($p > 0.05$).

Conclusion: The study revealed that the post-graduate medical students faced various types of difficulties during conducting research. So, respective higher authorities must be careful to solve their problems during conducting biomedical research.

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INTRODUCTION

Research is a systematic method to attain new knowledge, science or invention and it plays vital

role in our existence. Research is a prerequisite in any field of scientific and social development. So it is

applicable for Medical Science. With the help of biomedical research, inventions and effective cure have been made possible in many diseases by employing new technologies and solutions [1]. Biomedical research supports and strengthens the health systems and also in the delivery of better and more rational health care to people [2]. It does so by identifying felt-need of the people and providing best solutions to them and monitoring how health systems perform and how it should perform. It produces new knowledge, technologies and improved approaches to public health [3]. The World Health Organization (WHO) has affirmed that all national and international health policies should be based on valid scientific evidence that derives from scientific reasoning and logical propositions. The application of such knowledge, information and technology that emanates from health research has enormous potential in promoting health, preventing disease, disability and death. Biomedical research is essential because there are shifting of epidemiological trend in disease patterns, rapid increase in populations, arisen of emerging and reemerging health problems, increasing commercial interests of private health sectors, shrinking of public health resources and as a whole global inequity in health care [4,5]. It is, therefore, extremely important to identify the priorities in health sector so that national and international development partners can focus on the most important health issues and determinants of health. For this reason, our health systems should have to be capable enough to provide convincing data resulting from research activities to justify allocation of the scarce resources [6]. Health research is necessary, not luxury. The unprecedented health gains in the last century are undoubtedly the fruits of research. The joint endeavor in science is becoming one of the unifying forces among the diverse people of the globe. In recent years, the United Nations are trying consistently to make the world a better place for people to live including the destitute and the rich [7]. So, all health professionals especially post-graduate medical students must be knowing how to do research or should have at least a level of research knowledge that will help them understand the published researches. Even if they wish to spend their professional lives dealing with patients or health administration, a scientific approach of research is essential. As the practice of medicine is advancing rapidly day by day, so the need for critical evaluation of new developments is a must [8,9]. Research helps to develop a scientific critical attitude in the evaluation of what is right and what is wrong. Health policy-makers particularly in developing countries may not appreciate the contribution which research can make [10,11]. There is still a division between

the domain of research and domain of policy-making. So, in the developing countries like Bangladesh research is a less priority area. For that reason, research cannot play an important role in the development of our country. Accordingly, our Tertiary Medical Institutes should have been equipped with research instrument and expert research personnel. But unfortunately, there are dearth shortages of either of the two. A very few Government Postgraduate Medical Institutes have Research Cells or Departments in Bangladesh but they are inactive. A number of postgraduate institutes in the Private Sector are currently offering Masters in Public Health but only few of them making quality researchers to contribute to the health sector. A large number of postgraduate students are enrolled every year in different postgraduate medical institutes of the country for higher education and as a part of the course curriculum they have to undertake a research. They conducted research for only passing exam, not for acquiring research knowledge. Given the above situation prevailing in the Tertiary Medical Institutes, it is quite unusual to expect that they will conduct research independently. They need training on different aspects of research methodology like protocol writing, data analysis, statistical interpretation of data, report writing and so on. But there are limited scopes of learning on these topics in their respective institutes.

Besides these, many beginners and young researchers seek formal training on 'Research Methodology' so that they can conduct study of their own. Lack of exposure during the undergraduate program forms a major obstacle towards postgraduate research. Other factors including inadequate knowledge of newer on research methodology, shortage of research staff and lack of funds also form barriers in carrying out medical research. As thesis forms the first stepping stone for them in medical research, assessment of these factors may be of great help in developing a good attitude and interest towards research in the field of medical science. Research training should be integrated in undergraduate and post-graduate curricula by the respective higher authorities [12] so that post-graduate medical students can able to perform their roles as clinicians, educators as well as clinical researchers [13]. In the existing medical curriculum, designing a thesis is usually the first step for physician to the entry of research field in our country. So it is very important to identify level of practice and barriers of practice of biomedical research among post-graduate medical students in our country.

METHODS

Study population, place and period: All post-graduate medical students in the courses of PhD, MD, MS, FCPS, M.Phil, MPH & Diploma of different Medical Colleges under different Universities in Bangladesh were included in the study. This cross sectional type of descriptive study was conducted in the different medical colleges and Universities all over the Bangladesh from January 2020 to December 2020 to find out the practice on biomedical research and barriers to its practice of the post-graduate medical students in Bangladesh.

Sample size and sampling technique: A convenient sampling technique was used and the total sample size was 325. Consulting with the guide and reviewing the previous published literature, researcher developed the research instrument for the study.

Data collection instruments and procedure: To evaluate the effectiveness of the questionnaire a pretest was carried out on 15 post-graduate medical students. After pretest, some corrections were done and the questionnaire was finalized for data collection. Prior to data collection, respondents were briefed about the purpose of the study and their consent was taken. Data were collected from the respondents by google form through a self-administered semi-structured questionnaire and Likert scale scoring. Baseline information of some selected socio-demographic characteristics of the respondents and information regarding practice on biomedical research and barriers to its practice were collected. All efforts were done to collect data accurately.

Statistical analysis: After collecting data, the google forms were converted into x-cell sheet. Then the completeness and internal consistency of the questionnaire were checked. Participants who did not fill out all the questions in the google form were removed from the sample. Then data were cleaned by editing, coding, recoding and categorizing. Data were

rechecked to detect errors and to maintain validity. Then x-cell sheet was converted into SPSS file. All data were analyzed by using the 'Statistical Package for Social Sciences (SPSS)' software, version-24. The test statistics used to analyze the data were descriptive statistics and inferential statistics. Categorical variables were summarized by using numbers and percentages while continuous variables were summarized by means \pm standard deviation (SD). Relationship of practice on biomedical research with socio-demographic characteristics were determined by chi-square test. A p-value < 0.05 was considered statistically significant for all test.

Operational definitions: For assessment of practice there were 13 questions with binary responses for each question no = 0 to yes = 1; 0 for negative answer and 1 for right answer. So minimum practice score was 0 and maximum practice score was 13 for each respondent. Higher performance related to higher score obtained from practice portion of the questionnaire. Then this practice score was divided into 3 categories (No practice=0, poor practice-1 to 7 and satisfactory practice-8 to 13) which divination was used in different previous studies [20]. For better statistical analysis 3 practice categories were converted into 2 categories -no to poor practice and satisfactory practice. For assessment of barriers during conducting biomedical research there were 15 statements in 3-point Likert scale.

Ethical Considerations: Ethical clearance was taken from ethical committee of Rajshahi Medical College before the onset of the study. The respondents were briefed about the study and informed written consent was taken from them. Complete assurance was given that confidentiality of all information provided by the respondents would be maintained properly and they had freedom to withdraw themselves from the study at any moment. Their name or anything which could be identified them, would not be published. Their participation and contribution was acknowledged with due respect.

the respondents completed their MBBS degree from Government medical college and at the time of data collection 45.50% of the respondents were in MD/MS course. Study respondents involved in research work for their academic purpose. Majority (64.60%) of the respondents were involved in thesis, 22.80% in dissertation and rest 12.60% diploma students were not involved in thesis or dissertation because no type of research work was included in diploma course in Bangladesh (Table 1).

RESULTS

Out of the 325 study respondents, more than half (53.50%) of the respondents were male and rest 46.50% were female. Most (88.30%) of the respondents were within the age group of 31-40 years and the mean age of the respondents was 33.56 ± 3.10 years. Majority (89.20%) of the respondents were married and 82.80% were Muslim. Most (86.80%) of

Table 1. Background information of the respondents (n=325).

Variables	Categories	Frequency	Percentage
Age in years	21-30 years	24	7.40
	31-40 years	287	88.30
	41-50 years	14	4.30
Gender	Male	174	53.50
	Female	151	46.50
Religion	Muslim	269	82.80
	Hindu	53	16.30
	Christian	3	0.90
Marital status	Single	35	10.80
	Married	290	89.20
Running post-graduation course	Ph.D	3	0.90
	MD/MS	148	45.50
	FCPS	74	22.80
	M.Phil	37	11.40
	MPH	22	6.80
Involvement of research	Diploma	41	12.60
	Thesis	210	64.60
	Dissertation	74	22.80
Medical college of MBBS passing	No thesis no dissertation	41	12.60
	Govt. medical college	282	86.80
	Private medical college	43	13.23

Majority (62.80%) of the respondents had poor practice, 35.10% had satisfactory practice and only

2.20% had no practice on biomedical research (Figure 1).

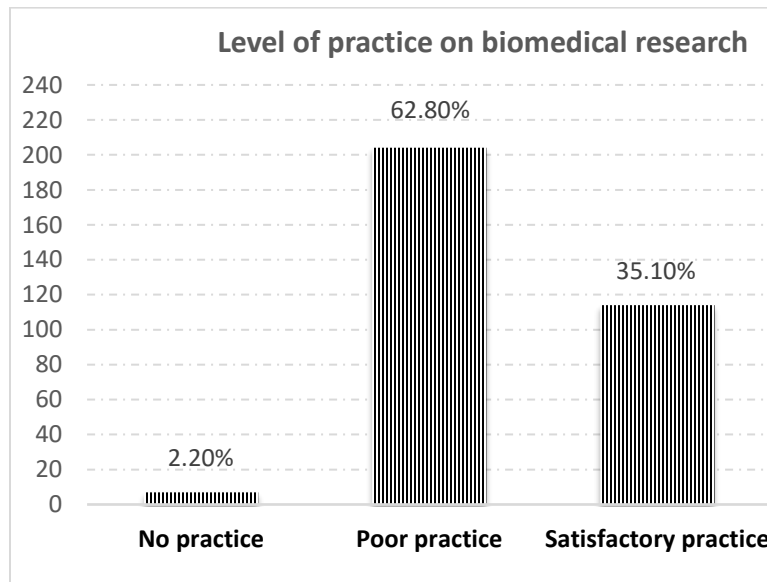


Figure 1. Distribution of the respondents on the basis of level of practice on biomedical research (n=325)

At the time of data collection majority (87.40%) of the respondents were involved in research and only

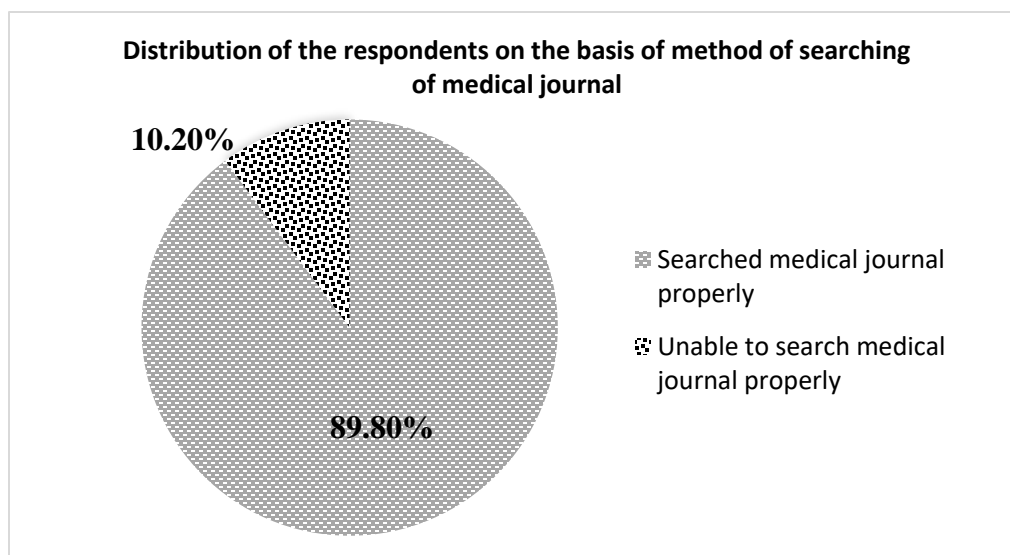
13.20% had publication in journal (Table 2).

Table 2. Distribution of the respondents on the basis of practice on biomedical research (n=325)

Practice on biomedical research	Yes	No
	Frequency (%)	
>2 months' work experience in research project	178 (54.80%)	147 (45.20%)
Involvement in research	282 (87.40%)	43 (12.60%)
Research training	153 (47.10%)	172 (52.90%)
Generating research idea	227 (69.80%)	98 (30.20%)
Protocol writing	225 (69.20%)	100 (30.80%)
Search medical journal	255 (78.50%)	70 (21.50%)
Data entry on SPSS	119 (36.60%)	206 (63.40%)
Data analysis	90 (27.70%)	235 (72.30%)
Participation in a research methodology workshop	158 (48.60%)	167 (51.40%)
Presentation an abstract	62 (19.10%)	263 (80.90%)
Extracurricular research activity	67 (20.60%)	258 (79.40%)
Scientific presentation in a conference	100 (30.80%)	225 (69.20%)
Publication in journal	43 (13.20%)	282 (86.80%)

Majority (89.80%) of the respondents searched medical journal appropriately through online using

Hinary, Pubmed, Google scholar etc and remaining 10.20% did not search medical journal properly.

Figure 2. Distribution of the respondents on the basis of method of searching of medical journal (n=325).

Distribution of the respondents on the basis of training on biomedical research revealed that 53.20%

had no training and 46.70% completed training on biomedical research (Figure 3).

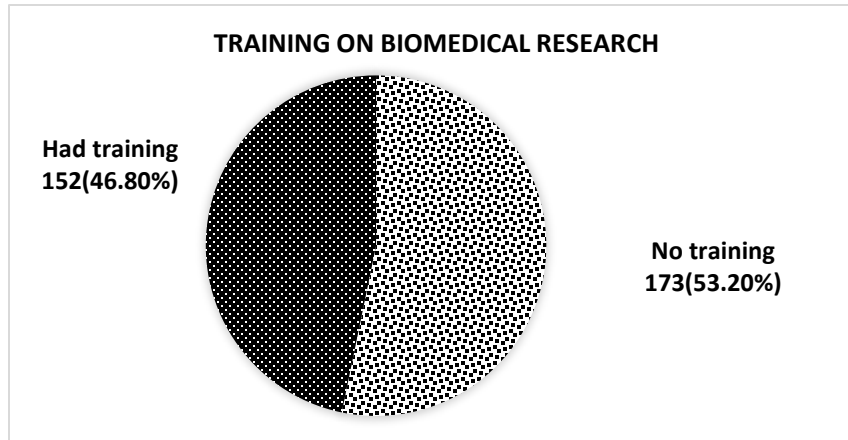


Figure 3. Distribution of the respondents on the basis of training on biomedical research (n=325).

Out of 325 respondents, only 43 had publications in Journal. Among these 43 respondents 0.30% had

maximum > 10 publications and 9.80% had 1-5 publications (Table 3).

Table 3. Distribution of the respondents on the basis of publications in Journal (n=325)

Number of publications	Respondents	
	Frequency	%
No publication	282	86.80
Have publication		
1-5 publications	32	9.80%
6-10 publications	10	3.10%
>10 publications	01	0.30%
Total	325	100.00

Lack of research training & necessary skills (73.80%), lack of fund (68.80%), lack of interest & motivation (66.20%) and lack of appropriate

knowledge (65.50%) were considered as a commonly faced maximum barrier by the post-graduate medical students.

Table 4. Barriers faced by the respondents during conduction biomedical research in 3-point Likert scale (n=325)

Barriers during conducting biomedical research	No barrier	Minimum barrier	Maximum barrier
	Frequency (%)		
Lack of appropriate knowledge	35 (10.80%)	77 (23.70%)	213 (65.50%)
Choosing topics	48 (14.80%)	153 (47.10%)	124 (38.20%)
Permission from Ethical Review Committee	45 (13.80%)	154 (47.40%)	126 (38.80%)
Writing proposal	70 (21.50%)	135 (41.50%)	120 (36.90%)
Collecting data	57 (17.50%)	136 (41.80%)	132 (40.60%)
Insufficient time	32 (9.80%)	120 (36.90%)	173 (53.20%)
Lack of research training & necessary skills	21 (6.50%)	64 (19.70%)	240 (73.80%)
Statistical support	21 (6.50%)	113 (34.80%)	191 (58.80%)

Lack of teamwork	24 (7.40%)	101 (31.10%)	200 (61.50%)
Writing report	39 (12.00%)	54 (47.40%)	132 (40.60%)
Technical support	90 (27.70%)	113 (34.80%)	122 (37.50%)
Lack of laboratory	35 (10.80%)	115 (35.40%)	175 (53.80%)
Communication gap	24 (7.40%)	125 (38.50%)	176 (54.20%)
Lack of fund	20 (6.20%)	82 (25.20%)	223 (68.60%)
Lack of interest and motivation	31 (9.50%)	79 (24.30%)	215 (66.20%)

Relationship of practice on biomedical research was statistically significant with running post-graduation course and type of research involvement ($p < 0.05$).

Table 5. Relationship between background information and level of practice on biomedical research of the respondents (325)

Personal information	Group		p-value
	No to poor practice Frequency (%)	Satisfactory practice Frequency (%)	
Age			
≤ 35 years	177 (65.60)	93 (34.40)	> 0.05
> 35 years	34 (61.80)	21 (38.20)	
Sex			
Female	106 (70.20)	45 (29.80)	> 0.05
Male	105 (60.30)	69 (39.70)	
Religion			
Muslim	173 (64.30)	96 (35.70)	> 0.05
Hindu	36 (67.90)	17 (32.10)	
Christian	2 (66.70)	1 (33.30)	
Marital status			
Single	20 (57.10)	15 (42.90)	> 0.05
Married	191 (65.90)	99 (34.10)	
Running post-graduation course			
Ph.D	0 (0.00)	3 (100.00)	
MD/MS	95 (64.20)	53 (35.80)	
FCPS	45 (60.80)	29 (39.20)	< 0.05
M.phil	25 (67.60)	12 (32.40)	
MPH	7 (31.80)	15 (68.20)	
Diploma	39 (95.10)	2 (4.90)	
Type of research involvement			
Thesis	127 (60.50)	83 (39.50)	
Dissertation	45 (60.80)	29 (39.20)	< 0.05
No thesis no dissertation	39 (95.10)	2 (4.90)	
Medical college in MBBS level			
Govt. medical college	187 (66.30)	95 (33.70)	> 0.05
Private medical college	24 (55.80)	19 (44.20)	
Educational status of father			
Undergraduate	59 (64.10)	33 (35.90)	> 0.05
Graduate	152 (65.20)	81 (34.80)	
Educational status of mother			
Undergraduate	139 (67.10)	68 (32.90)	> 0.05
Graduate	72 (61.00)	46 (39.00)	
Educational status of spouse			
Undergraduate	4 (66.70)	2 (33.30)	> 0.05
Graduate	187 (65.80)	97 (34.20)	

Level of attitude to research			
Negative to neutral attitude	94 (69.60)	41 (30.40)	> 0.05
Positive attitude	117 (61.60)	73 (38.40)	

DISCUSSION

Research plays an essential part in academic advancement of medical students. At student level, research experience is highly associated with future career achievements but conducting research is a difficult task at student level. Many problems are described like lack of support from the senior faculty, lack of motivation, deficient time and scarcity of funds [14,15]. Participation of medical students in research is related with the gain of transferable skills in the areas of communication, group work and time.

It was a cross sectional study to find out practice on biomedical research and barriers to its practice of the post-graduate medical students in Bangladesh. Due to time limitation cross-sectional study was chosen. A time schedule was prepared at the beginning of the study. At first, topics of the study was selected. Literature related to the study were reviewed. Data collection instrument was prepared, pre-tested and finalized. Then protocol was developed and approved by the Ethical Review Board of Rajshahi Medical College. Then after necessary correction and modification of the instrument, data collection was done from August to September, 2020. The study was carried out on the post-graduate medical students all over the country.

In this study, data on biomedical practice were collected by 13 structured questions. Out of total 325 respondents, 62.80% had poor practice, 35.10% had satisfactory practice and only 2.20% had no practice on biomedical research. A study conducted in Madison, in USA showed that out of 143 postgraduate students, 850% felt that research experience was desirable but only 48.00% were interested in pursuing research during residency and only 8.00% were active in research [25]. However, these two studies that were carried out in Canada and Pakistan reflected a contrasting attitude of residents that a majority of time in residency should be spent learning the clinical aspects of their specialty and they were unwilling to sacrifice personal time for research [25,26].

In the present study, 30.80% did a scientific presentation in a conference and only 13.20% published article in journal. A study conducted by Pawar et al. [5] in India found that 50.00% had participated in research other than a dissertation project, 28.00% had made scientific presentations and only 4.00% had publications. This dissimilarity

with my study findings may be due to unequal sample size. Pawar et al. [5] enrolled 100 post-graduate medical students but in our study there were 325 post-graduate medical students. Discrepancy between attitude and practice was also highlighted in a study done in Faisalabad, in India. Although in this study a large majority of postgraduate trainees of the Allied Hospital in Faisalabad appreciated the importance of reading current literature, only a few actually read journals and were actively involved in presenting research papers and making scientific contributions to the literature [24].

In the current study 13.20% published article in journal, 19.10% presented an abstract in a conference, 20.60% involved in extracurricular research activities and 47.10% completed training on biomedical research. A study by Halabi et al. [27] on medical students in Kuwait University found that 17.30% published their required medical school research, 45.30% presented abstracts in conferences, 34.70% conducted extracurricular research and 11.30% completed a research course.

In this study, major barriers were lack of research training and necessary skills (73.80%), lack of financial incentives (68.60%), lack of interest and motivation (66.20%), lack of appropriate knowledge (65.50%), lack of mentorship and teamwork (61.50%), lack of statistical support to do analysis (58.80%), lack of communication and linkages with other institutions (54.20%) and insufficient research allotted time among routine academic activities (53.20%). A study conducted by Behera et al. [28] in a Medical College of Delhi among 247 MD/MS post-graduate students found that most of the barriers were difficulty to follow up patients (69.20%), lack of access to internet in the department (48.20%), stress (46.2%), lack of time (44.10%), difficulty in data collection (42.90%), lack of inter departmental coordination (37.20%), lack of funding (27.10%), difficulty in obtaining approval from various departments (26.70%), inadequate library facilities (25.90%) and lack of facilities for statistical analysis (18.60%). Results were different from my study may be due to unequal sample size and our study was on all post-graduate students and this study was conducted only MD/MS students. Deficiency of appropriate knowledge and necessary skills ranked third in a study done by Amin et al. [29] in three Arab Universities. But in our study deficiency of appropriate knowledge and necessary skills was first

ranked barrier. Another study by Narasimhaiah et al. [30] in India among medical students found that the biggest barrier was lack of previous research experience (91.67%). Professional development activities may be initiated to bring positive change among students. There must be promotion of research culture because it is not only valuable for students' professional pathway but also for the health of patients and the community where they will serve.

In this study, students who were in Ph. D and MPH courses had more practice on biomedical research than those who were in MD/MS, M.Phil, FCPS and Diploma courses ($p < 0.05$). Thesis part and dissertation part post-graduate medical students had also more practice on biomedical research than those who were in Diploma courses ($p < 0.05$).

The present study has a number of strengths. The study questionnaire was comprehensive and addressed a wide range of personal and institutional barrier factors. Also, the study questionnaire has been validated by an epidemiologist and medical research experts. To the best of our knowledge, this study is the first to study the barriers and practice of medical research among post-graduate medical students in Bangladesh.

This study also has a number of limitations. The study was conducted during limited period of time enrolling smaller number of respondents and convenient sampling technique was used. Due to COVID-19 situation Google form was used for data collection so direct reaction of the respondents on the study topics was not identified. This study involved only three division among eight division of our country that limiting the generalization of the results. I could not include the questions that reflected a broad range of topics in the research for evaluation of the practice and barrier aspect of research conduction by post-graduate medical students.

The study will be helpful for policy maker to take actions needed to put laws or policies to solve the barriers of post-graduate medical students during conducting biomedical research. And it will also encourage post-graduate medical students to practice biomedical research more efficiently.

CONCLUSION

In our country post-graduate medical students are introduced to the concept of designing and conducting research after entering post-graduation course. Although a light overview on research is given to the undergraduate students in the third year of MBBS course but it is not so effective. Although a

majority of the post-graduate medical residents wished to get involved in research but a very few had participated in research work other than the mandatory thesis and dissertation. Moreover, very few had presented research papers at conferences or had publications. In the study, respondents reported significant barriers impeding research during academic purpose such as lack of time, inadequate research training and necessary skills and financial support.

REFERENCES

1. Ejaz K, Shamim MS, Shamim MS. Involvement of medical students and fresh medical graduates of Karachi, Pakistan in research. *Journal of the Pakistan Medical Association*. 2011; 61(2):115-20.
2. Khan H, Khan S, Iqbal A. Knowledge, attitudes and practices around health research: the perspective of physicians-in-training in Pakistan. *BMC medical education*. 2009 Jul 17; 9:46.
3. Bovijn J, Kajee N, Esterhuizen TM, Van Schalkwyk SC. Research involvement among undergraduate health sciences students: a cross-sectional study. *BMC Med Educ*. 2017 Oct 16;17(1):186.
4. Osman T. Medical students' perceptions towards research at a Sudanese University. *BMC Med Educ*. 2016 Sep 29;16(1): 253.
5. Pawar DB, Gawde SR, Marathe PA. Awareness about medical research among resident doctors in a tertiary care hospital: A cross-sectional survey. *Perspect Clin Res*. 2012 Apr;3(2): 57-61.
6. Aslam F, Shakir M, Qayyum MA. Why medical students are crucial to the future of research in South Asia. *PLoS Med*. 2005 Nov 29;2(11): e322.
7. Temte JL, Hunter PH, Beasley JW. Factors associated with research interest and activity. *Fam Med*. 1994 Feb; 26(2): 93-7.
8. Imran SS, Nazir M, Dar W, Aziz U, Shoaib R. Attitude towards research among undergraduate and postgraduate medical students. 2019; 35(4): 240-243.
9. Al-Shalawy FA-N, Haleem A. Knowledge, Attitudes and Perceived Barriers towards Scientific Research among Undergraduate Health Sciences Students in the Central Province of Saudi Arabia. *EIMJ*. 2015 Mar 24;7(1) :266.

10. Arif A, Siddiqui MA, Aziz K, Shahid G, Shiekh A. Perception towards research among undergraduate physical therapy students. *Biom Biostat Int Journal*. 2018 May; 7(3): 171–175.
11. Althubaiti A. Undergraduate Medical Research Programme: A Cross-Sectional Study of Students' Satisfaction, Perceived Challenges, and Attitudes. *Glob J Health Sci*. 2015 Feb 24;7(5): 117–123.
12. Pacifici LB, Thomson N. Undergraduate science research: a comparison of influences and experiences between premed and non-premed students. *CBE Life Sci Educ*. 2011;10(2): 199–208.
13. Dzau VJ, Ackerly DC, Sutton-Wallace P, Merson MH, Williams RS, Krishnan KR, et al. The role of academic health science systems in the transformation of medicine. *Lancet*. 2010 Mar 13;375(9718): 949–953.
14. Grant J, Hinrichs S. The nature, scale and beneficiaries of research impact: An initial analysis of the Research Excellence Framework (REF) 2014 impact case studies. 2015.
15. Davis JL, Bynum SA, Katz RV, Buchanan K, Green BL. Sociodemographic differences in fears and mistrust contributing to unwillingness to participate in cancer screenings. *J Health Care Poor Underserved*. 2012 Nov;23(4 Suppl): 67–76.
16. Flynn MA, DE Eggerth. When the Third World Comes to the First: Ethical Considerations When Working with Hispanic Immigrants. *Ethics and Behavior*. 2010 June; 20(3-4):229-242.
17. Ford ME, Siminoff LA, Pickelsimer E, Mainous AG, Smith DW, Diaz VA, et al. Unequal burden of disease, unequal participation in clinical trials: solutions from African American and Latino community members. *Health Soc Work*. 2013 Feb;38(1): 29–38.
18. Tamariz L, Palacio A, Robert M, Marcus EN. Improving the informed consent process for research subjects with low literacy: a systematic review. *J Gen Intern Med*. 2013 Jan;28(1): 121–126.
19. Ejaz K, Shamim MS, Shamim MS. Involvement of medical students and fresh medical graduates of Karachi, Pakistan in research. *Journal of the Pakistan Medical Association*. 2011 Feb; 61(2): 115-20.
20. Khan H, Khan S, Iqbal A. Knowledge, attitudes and practices around health research: the perspective of physicians-in-training in Pakistan. *BMC medical education*. 2009 Jul; 9:46.
21. Bovijn J, Kajee N, Esterhuizen TM, Van Schalkwyk SC. Research involvement among undergraduate health sciences students: a cross-sectional study. *BMC Med Educ*. 2017 Oct 16;17(1):186.
22. Osman T. Medical students' perceptions towards research at a Sudanese University. *BMC Med Educ*. 2016 Sep 29;16(1):253.
23. Pawar DB, Gawde SR, Marathe PA. Awareness about medical research among resident doctors in a tertiary care hospital: A cross-sectional survey. *Perspect Clin Res*. 2012 Apr;3(2): 57–61.
24. Aslam F, Shakir M, Qayyum MA. Why medical students are crucial to the future of research in South Asia. *PLoS Med*. 2005 Nov 29;2(11): e322.
25. Temte JL, Hunter PH, Beasley JW. Factors associated with research interest and activity. *Fam Med*. 1994 Feb; 28(2): 93-7.
26. McCrindle BW, Grimes RB. Will pediatric residents do research? A survey of residents' attitudes. *Ann R Coll Physicians Surg Can*. 1993.
27. Al-Halabi B, Marwan Y, Hasan M, Alkhadhari S. Extracurricular research activities among senior medical students in Kuwait: experiences, attitudes, and barriers. *Adv Med Educ Pract*. 2014 Apr 28; 5: 95–101.
28. Behera S, Cherian V. Perceptions and Attitudes of Postgraduate Students towards Thesis Work in A Medical College in Delhi. *Journal of Comprehensive Health*. 2019 July; 7(2): 53-128.
29. Amin TT, Kaliyadan F, Qattan EA, Majed MA. Knowledge, attitudes and barriers related to participation of medical students in research in three Arab Universities. *Educ Med J*. 2012 May; 4(1): e43-e46.
30. Narasimhaiah MG, Mallikarjuna SR, Kalaburgi RA. Attitudes and barriers of medical students towards conducting research in a medical college. *Int J Basic Clin Pharmacol*. 2020 May 21;9(6): 966.