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Assessment of research methodology concepts through critical appraisal among undergraduate medical students and their perception: A single center study.

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A B S T R A C T

Introduction: Evidence based medicine is an interplay of individual clinical acumen and best available evidence through scientific systematic research. With the advent of modern medicine in the last two centuries, medical education has seen and continues to experience its revolutionary effects. An important aspect in this regard is the integration of biomedical research.

Objectives: To assess the research skills among undergraduate medical students exposed to the teaching of research longitudinally through all the five academic years.

Methodology: A mixed method study was conducted in which third year MBBS students were assessed in a group through power point presentation regarding different concepts of research while critically appraising a research article. Quantitative and qualitative data were collected. Descriptive statistics were calculated, as well as thematic analysis was done.

Results: From a total of 102 participants, 58 were male and 42 were female. Majority of the participants (81.4%) achieved an average or a good score and only 18.6% achieved a poor score. Six themes were generated. General enthusiasm about the activity was noted among participants who considered it beneficial. However, only a few were in the favor of incorporating this activity as a mandatory component in undergraduate studies.

Conclusion: Incorporating research in a mandatory longitudinal theme component as part of undergraduate medical studies seems a potential method of laying the foundation for future physician scientists.

Keywords: *Research, critical appraisal, undergraduate medical curriculum*

Introduction

Evidence based medicine is an interplay of individual clinical acumen and best available evidence through scientific systematic research.[1] While there has been a lot of focus on developing this clinical acumen throughout the history of medical education, interest in nurturing research skills has only surfaced in the last few decades. The issue of 'endangerment' of physicians pursuing clinical research was highlighted as early as the 1980s. However, 40 years down the line, the problem continues to persist. Multiple reasons have been attributed to this, with the core lying at the level of colleges and universities.[1]

In an attempt to curtail this extinction, medical schools throughout the world are incorporating research in undergraduate curriculum.[2-3]

These incorporations have been in the form of research driven curricula,[4] research electives,[5] compulsory research projects for graduation,[6]

programmme for volunteers, and facilitation of research training by charitable non-governmental organizations.[7] These have amalgamated in the form of student-led national collaborative research training initiative and student selected components of learning among others.[8-10]

In developing countries, however, the situation is much grimmer. The lack of four 'Is' have been implicated in the lagging behind of these countries; impulse, initiative, incentive and idols.[11] The 'brain drain' of qualified personnel, idols, produces a lack of research environment which fails to generate an impulse to initiate the potential learner; the 'lacking' environment offering little to no incentive whatsoever to curb the situation.

In Pakistan, where only seven medical journals are listed by the journal of citation reports with the highest impact factor still less than one,[12] priority of quality research among medical students remain low. As of a few years back, only two medical schools in the country dominated student publications in Journal of the Pakistan Medical Association, a PubMed indexed journal; a staggering 87.5% of the 96 articles were published by students of these two schools over 90 issues of that particular journal.[13]

A recent study done in a leading medical school in the country demonstrated that while most of the participating medical students considered research to be useful, only a third of them considered it a good career choice. However, a disturbing finding was that senior students not only considered it more difficult and stressful when compared with junior students, they were also less likely to be in favor of incorporation of research in professional education.[14]

In this study, based on the training of students in medical research in a longitudinal theme spread over five years of medical school education, assessment of the critical appraisal skills was carried out followed by documenting their perceptions.

Methodology

A mixed method study was conducted in July 2018; a quantitative cross-sectional study and a qualitative study in the form of focused group discussion. This study was conducted after taking ethical committee approval. Participants were ensured regarding confidentiality of data collected. The study included students from a private medical school with integrated modular curriculum in Islamabad. Students are taught four different components of longitudinal theme over a period of 5 years; ethics, evidence-based medicine, research methodology and behavioral sciences. The first three years focus on developing the understanding while the last two years focus on instigating the students to practically implement the understanding of these concepts. All 3rd year MBBS students were included. Students who were in different years of MBBS at the time of study were excluded. Programme leaning objective of research for year 3 MBBS students are given in box 1. Course topics, methods of teaching and learning, assessment for year 3 MBBS students are presented in box 2.

Box1: Programme Learning Objective: Year 3 MBBS

1. Develop a research question and write synopsis under supervision of assigned preceptor.
2. Submission of research proposal to ethical committee (IRB), Shifa Tamer-e-Millat University (STMU) and subsequent approval.
3. Critically appraised a given research article
4. Prepare and present an e-poster based on review of literature.

Box 2: Course Topics, Methods of Teaching and Learning, Assessment.

Course contents

Introduction to Evidence Based Medicine
Introduction to research
Steps of research
Literature search
Literature review
Selection of research topic
Developing research question
Epidemiological study designs
How to critique an article?
Writing a research proposal

Method of teaching and learning

Large group interactive session
Small group discussion
Team based learning

Method of assessment

Multiple choice questions
Short answer questions
Integrated practical exam

All participants were randomly assigned to 7 groups of 14 to 16 individuals. Randomization was done in Microsoft Excel using RAND function. Each of the 7 groups was given one published article related to Endocrinology and Reproduction as shown in Table 1.

Table 1: Topics assigned to each of the 7 groups

Groups	Topic Assigned
Group 1	Sexually transmitted infections
Group 2	Contraceptives
Group 3	Breast Cancer
Group 4	Goiter
Group 5	Rickets
Group 6	Complications of Diabetes Mellitus
Group 7	Diabetes Mellitus

We conducted an interactive lecture, which included all the participants, to refresh the knowledge of research protocol and critical appraisal. Participants were then given a week to prepare a presentation on the assigned article. The proposed criteria for assessment were shared with the participants. Each group was allotted a total of 20 minutes for their presentation. This was followed by 10 minutes of questions by assessors. A panel of five Professors assessed the presentations. Participants were marked with 0 being the lowest score and 10 being the highest. Those who did not play an active role in the presentation were cross questioned by the panel and assigned a score. The power point presentation included: abstract, introduction, materials and methods, results, discussion and conclusion. A good score refers to a score of 7 or more, an average score 4 to 6 and any score below 4 was considered poor. These were recorded on student logbook. Descriptive statistics were used to detail the gender and score of the participants.

Volunteers were invited from each of the 7 groups to reflect on the entire activity, a total of 3 groups were made. We conducted a focus group to gather the perceptions of students regarding this activity which was audio recorded that was later transcribed for generating different themes. Thematic analysis was done for the qualitative data by reviewing the audios recorded to streamline themes discussed.

Results

A total of 102 participants were included in the study; there were 58 (56.9%) male and 44 (43.1%) female. Figure 1 describes the distribution of scores while table 2 compares score with regards to gender.

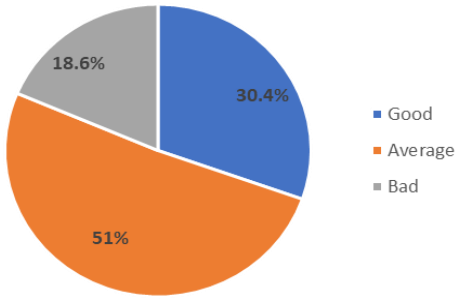

Figure 1: Frequency distribution of scores of participants.

Table 2: Comparison of scores on the basis of gender.

Score	Gender		p value
	Male	Female	
Good	16	15	p > 0.05
Average	33	19	
Poor	9	10	

Thematic Analysis

A total of 31 participants volunteered for this part of the study. Table 3 relates the volunteers with their scores. Six themes emerged from the discussions; usefulness and relevance, inspiration for research, longitudinal mode of content delivery, individual learning, peer assessment, and continuing the activity in future years.

Table 3: Distribution of volunteers for focus group according to score.

Detail of volunteers	Good	Average	Poor	Total
Number of volunteers	13	15	3	31
Percentage of volunteers from the specific category	41.9	28.8	15.8	30.4

Usefulness and relevance: All three groups of participants held the view that it improved their understanding of research and research methodology in practically implementing what they had been previously taught. Furthermore, it helped them realize the way an article is actually structured, what to look for in the articles and note flaws and weaknesses in articles; '… from all this activity, we found out how to go through an article, how to get out of it what we need out of it …'Some participants, however, did consider this activity to be more than their capacity and attributed it to the difficulty level of articles as one put it '… you can't expect us to comprehend that fully …'.

Inspiration for research: One group of participants was unequivocal in that they were inspired by this activity realizing that it doesn't have to be a completely flawless article or study in every aspect for it to be considered a reasonable study, '… you don't have to write a perfect article for it to be published ...'.Moreover, it helped them appreciate the importance of local research related to prevalence, risk factors and demographic details further encouraging them, in the words of a participant '… to understand Pakistan's pathologic demography, we'll need to promote local research more, since internationally they already know everything …'.

Longitudinal mode of content delivery: Regarding the way the content had been delivered in interactive lectures in the longitudinal theme, one group did agree that it made sure that they weren't completely new to the subject. However, most believed that delivery of the content needed considerable improvements citing logistic factors; such as dissemination of information among small group discussions in contrast to large groups, or clearer instructions or a suggested procedure for critical appraisal given, or sample critiqued articles provided as references; '… if the instructions were a little clear on the exact procedure as to how stepwise we should proceed …'.

Individual learning: Two of the groups were unsatisfied with the number of participants in a group since that ends up in only a third of the group doing the actual work with the rest not showing any interest whatsoever. '… You don't need so many people, it's useless to have so many people …'. They extrapolated from it the suggestion that a single group should have a maximum of 3 to 5 participants with the participants deciding who they would be willing to collaborate with rather than a randomized group; some even suggested a completely individualized activity. However, one group said '… the group must have learnt something for which reason they were able to answer it'.

Peer assessment: On floating the idea of peer assessment, none of the participants favored the idea and thought they were not trained to do peer assessment. '… it won't be fair …'.

Continuing the activity in future years: While all three groups came up with suggestions on the frequency of the activity in a year from as less as annually to as much as nine times a year, when asked if they were given a choice to have the activity in future years, only one group was enthusiastic about it, as one participant confidently suggested '… I think it would be smart to implement it …'.

Discussion

We observed that a staggering majority, a little more than 80%, of participants grasped the content in a longitudinal theme sufficiently. Most of the students agreed that the activity was useful in developing an understanding of research basics but differed with regards to the specifics of the incorporation.

The importance of clinical research as a field opted by physicians and its existence is lagging behind.[1] This was followed up by a subsequent report in 2002, which applauded the efforts undertaken but at the same time, emphasized further required leaps to successfully curb the problem.[4]

Medical schools throughout the world have employed and continue to employ different methods of following these recommendations; in preclinical years or clinical years or both.[14]

In developed countries, the situation has largely started improving with respect to incorporating it in the curricula, while in developing countries it still requires tackling skillfully.

Some schools include making a research elective mandatory in their curricula. This may be in the clinical or preclinical years as is the case with the Queen's University Faculty of Health Sciences, Canada, where students are required to undertake a minimum eight weeks course in their second year.[15] Similar is the

University of KwaZulu-Natal, South Africa, where three 4 weeks courses are divided over three academic years; second, third and fourth years.[16] Results from both these programs show improvements in research skills and understanding, on the basis of self-reported outcomes.

Another approach used is making a research project or thesis mandatory for graduation. This has been reported in the Albert Einstein College of Medicine, United States, 8 University Kebangsaan Malaysia[17] and Aga Khan University Hospital, Pakistan.[19] Our medical school originally adopts a similar approach as well. These have again showed improvements in research skills and understanding.[17-18]

Yet, a third strategy implemented is to have students involved in underserved community projects as conducted by University of Texas Southwestern Medical Center, United States.[6] While this has also benefitted, the program itself was restricted to a selected number of students depending on applications and curriculum vitae making it difficult to generalize assessments for the entire student population, especially the academically weak students.

Two well established programs, having survived rigorous trials and challenges over several decades, are those of the Duke University and Stanford University. Duke University started with the introduction of an additional year in their curriculum which eventually evolved into multiple study tracks planned around electives.[19] Stanford University, on the other hand, set out an 'all-elective curriculum' which encouraged research among students right from the beginning of their studies with indirect support from National Institute of Health (NIH) funded programs.[20]

In contrast, Cleveland Clinic Lerner College of Medicine (CCLCM) combines multiple approaches by formal training of research foundations in the first two years followed by biweekly half day research seminars and a compulsory research project. Thus, by the end of the undergraduate program, the medical student graduates with special qualification in biomedical research.[21] Our study describes a longitudinal research theme similar to the programs described for Stanford University and CCLCM, even if on a smaller scale.

While participants did not seem very enthusiastic about having a similar program incorporated in the form of a mandatory component, evidence suggests that mandatory undergraduate research involvement is positively associated with postgraduate research.[18]

There is also concern that such incorporations of research into the curriculum mainly focus on and benefits the already academically better students.[4] Our approach managed to involve the majority of students with less than a fifth not benefiting at all. This lack of benefit also reflected among the focus group participants which revealed only 16% response from the bad score category.

Needless to say, a small sample size and lack of controls marred our study making it difficult to compare with other methods of incorporating research. Added to this was the fact that most available data report qualitative results rather than quantitative ones.

An important issue with previous studies remains the lack of well-defined objective criteria to assess research skills among medical students beyond submission or publications. Such was the case with our assessments as well in that we had a set of uniform yet untested criteria. Qualitative data from previous studies made the job no less difficult.

Conclusion

Incorporating research in a mandatory longitudinal theme component as part of undergraduate medical studies seems a potential method of laying the foundations for future physician scientists.

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