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Perceptions of medical undergraduate students toward biomedical research – A sequential, explanatory, mixed-method study from Puducherry, South India

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Abstract:

BACKGROUND: Biomedical research is not given adequate attention during undergraduation due to the failure of the medical curriculum to motivate the students to take up research, teach the research methodology, and emphasize the scope of research in the future. Our objective was to study the perceptions of medical undergraduate students toward biomedical research and to explore the facilitators and barriers to biomedical research.

MATERIALS AND METHODS: This was an explanatory, sequential, mixed-method study. Consenting medical undergraduate students, irrespective of their previous contribution to research, were interviewed by a pretested questionnaire concerning biomedical research, its barriers, and facilitators. For the qualitative component, two focused group discussions (FGDs) were conducted among students in the nonclinical and clinical phases. Data were analyzed and expressed as percentages. Thematic manual content analysis of the transcribed manuscripts was performed.

RESULTS: This study included 553 participants. Only 5.52% had previous experience undertaking research. Self-interest and acquiring deeper knowledge were identified as drivers. Lack of motivation, proper guidance, and training in research methodology was found to be the barrier among 90% of the subjects. The FGD reflected the perceptions of students and variations in their ideologies toward taking up research.

CONCLUSION: It becomes important to analyze the factors that promote or avert a student from taking up research. A thorough investigation in this regard will be helpful for future cohorts of medical students and will impact their decisions on taking up research and in seeking a career in research-based fields.

Keywords:

Barriers, biomedical research, curriculum, facilitators, perceptions, undergraduate (UG)

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Introduction

In the present era, research is not given adequate attention in developing countries such as India. Researchers have analyzed the number of publications contributed by different countries between 1995 and 2018, and it was sad to note that India could not make it to the top 10.^[1]

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Undergraduate students are in a dilemma with regard to the importance of research in the undergraduate curriculum and its contribution to academics.^[2] Taking up research during undergraduate days is rightly associated with a better orientation toward community issues and a more practical approach.^[3] Laying an early foundation during the undergraduate period seems to be meaningful, as it can

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be complemented and strengthened in the right way during the postgraduate residency period through dissertations.^[4] Although there are studies concerned with biomedical research among undergraduate medical students, there is an existing gap regarding their facilitators and barriers, more so on a qualitative background. Addressing this lacuna, we have undertaken this research intending to study the perceptions and explore the facilitators and barriers of medical undergraduate students toward biomedical research.

Materials and Methods

Study design and setting

This was an explanatory, sequential, mixed-method study with two phases. Phase I included the quantitative component, which was a facility-based descriptive cross-sectional study, and Phase II included the qualitative component, which involved a focused group discussion (FGD).

The study was conducted in a public tertiary care teaching hospital situated in the union territory of Puducherry, India. The medical college has a sanctioned intake of 150–180 students for the undergraduate program in medicine (Bachelor of Medicine and Bachelor of Surgery [MBBS]).

Study participants and sampling

A convenience sample of all consenting medical undergraduate students irrespective of their previous contributions to research were included in the study. These students from the first year to final year MBBS were divided into two groups. Students of the first- and second-year MBBS comprised the pre/para-clinical phase, while the third- and final-year MBBS students comprised the clinical phase. For Phase II of the study that involved the qualitative exercise, purposive sampling was adopted to select the subsample for the FGD. The maximum variation technique was chosen for purposive sampling to ensure inclusion of diverse group of participants who contribute to the richness of the data. The subset of participants was enrolled based on their individual responses in the questionnaire under the following categories – exposure to research, experience in research, the facilitators experienced, and the barriers experienced.

Study tools

The study tools comprised a pretested and semi-structured questionnaire for collecting quantitative data and an FGD guide to collect qualitative data. Data regarding the profile of the participants, their previous contribution to research, their perceptions about biomedical research, and various facilitators and barriers toward conducting research were collected using the self-administered questionnaire.

The study tool used for the qualitative component of the study was an FGD guide comprising a total of 13 questions divided under the following sections – six global questions pertaining to the general ideas and perceptions of biomedical research, four specific questions inquiring the factors that form the barriers and the ones that facilitate research, and three questions requesting information on the future implications of biomedical research and research as a career option. The study tools were developed after considering previously published literature on this topic and incorporating inputs from the subject experts. Face and content validity were ensured (Content validity ratio - CVR > 0.65).

Technique of data collection

All the undergraduate students were contacted for Phase I of the study. All the participants who were present on the day of data collection were enrolled in the study after obtaining their written informed consent. Each candidate was given a unique computer-generated code/reference number to maintain anonymity and to establish future references. These numbers were assigned in parallel to their college roll numbers, whose correspondence lied only with the principal investigator, and the participants were assured complete confidentiality. These numbers were later used to refer to the qualitative component of the study.

For Phase II, two FGDs were conducted, one each in pre/para-clinical (group 2) and clinical (group 1) phases, with six to eight participants in each. This classification into two groups was performed to ensure homogeneity among participants and given differences in perceptions of the two groups owing to differences in their exposure to clinical teaching. Gender equality was ascertained. The FGD was conducted by the principal investigator, who had prior sensitization to qualitative research, at a time and venue convenient to the participants. The discussion was supplemented by note-taking and audio recording. Refreshments were arranged for all the participants, and the discussion was formally ended with a vote of thanks.

Data entry and statistical analysis

All the responses were entered and analyzed using MS Excel software version 2019. Categorical variables were expressed as percentages. For the FGD, the process of content analysis was iterative. Transcripts were prepared from the field notes supplemented by audio recordings. After familiarization of the text by multiple readings, data were coded (inductive and deductive) using a manual codebook. Initially, 23 codes were generated. After merging similar codes and deleting the duplications, we had a total of 18 codes. These 18 codes were organized and grouped into seven themes.

Manual content analysis was performed, and themes were generated and interpreted.

Ethical consideration

Institutional Ethics Committee approval (No.: 8/229/IEC/26/PP/2019) was obtained before the start of the study. Written informed consent was obtained from all the participants.

Results

Quantitative component

Table 1 gives the sociodemographic profile of the study participants. Of the 553 students surveyed, 56 (10.1%) had approached a mentor for taking up research, 30 (5.5%) had undertaken research, and two (0.3%) had published. Approximately 436 (78.8%) participants, ranging between 49.7% and 66.4% from the first to final year, felt that research bore importance in the medical field [Figure 1].

More than half of the participants cited prospects such as usefulness during the postgraduate period as a reason for research to bear importance, while only 38.8% believed that it has to be evidence-based medicine. One-third (36.5%) of the students observed faculty as a resource to help them become sensitized in research [Table 2].

Only 21.5% of the participants felt motivated to take up research. Of the students, 83.9% felt Indian Council of Medical Research – Short Term Studentship (ICMR-STs) awards to be the main reason for their motivation. Only 23.8% of the participants were aware of forums that would offer short-term research internships for undergraduate students. Approximately 37.1% of the participants were aware that they had to perform a dissertation during their postgraduate education. While 17.3% of the study population had been exposed to scientific writing, only 7.8% were aware of the components of a scientific paper.

The thirst for acquiring more knowledge, personal interest, and future competencies were the common

facilitators identified for biomedical research [Table 3]. While personal barriers comprised a lack of guidance and incentives, nonpersonal barriers included a lack of training and exposure [Table 4].

Qualitative component

The transcripts from the audio recorded FGD and interviews with the participants were divided into seven

Table 1: Baseline characteristics of the study participants (n=553)

| Parameter | Frequency | Percentage |
|----------------------|-----------|------------|
| Year of study | | |
| 1 st year | 156 | 28.2 |
| 2 nd year | 121 | 21.9 |
| 3 rd year | 130 | 23.5 |
| Final year | 146 | 26.4 |
| Gender | | |
| Male | 210 | 38.0 |
| Female | 343 | 62.0 |
| Domicile | | |
| Urban | 447 | 80.9 |
| Rural | 106 | 19.1 |

Table 2: Biomedical research in undergraduate curriculum - Why? Where? When? - From the students' perspectives

| Parameter | Perspective | Frequency (n) | Percentage |
|---|-----------------------------------|---------------|------------|
| Reasons for research to bear importance | Future perspectives | 239 | 54.8 |
| | Self-interest in research | 184 | 42.2 |
| | Belief in evidence-based medicine | 169 | 38.8 |
| | Better knowledge | 43 | 9.9 |
| Platforms to sensitize about research | Proving individuality | 5 | 1.1 |
| | Workshops/conferences | 333 | 60.2 |
| | Faculty | 202 | 36.5 |
| Platforms where prior sensitization to research can be useful | Undergraduate curriculum | 156 | 28.2 |
| | Others | 45 | 8.1 |
| | Useful for postgraduation | 341 | 61.7 |
| | As a career option | 236 | 42.7 |
| For a better curriculum vitae | For a better curriculum vitae | 82 | 14.8 |
| | For promotions | 60 | 10.8 |
| | Others | 24 | 4.3 |

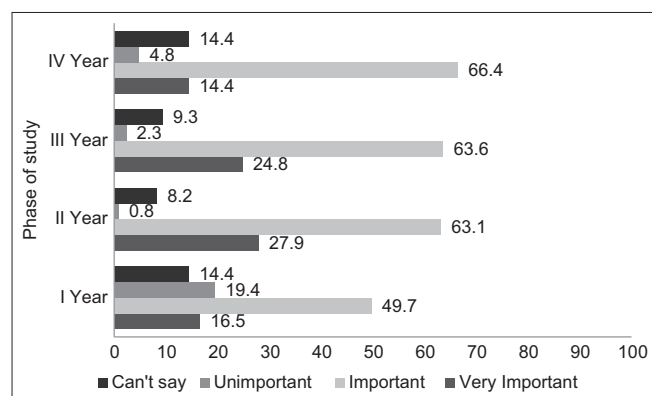


Figure 1: Level of importance research bears in the medical field (N = 553)

Table 3: Various facilitators for undertaking biomedical research (n=553)

| Facilitators | Frequency (n) | Percentage |
|---|---------------|------------|
| Acquiring more knowledge | 349 | 63.1 |
| Personal interest | 317 | 57.3 |
| Future competencies-USMLE/PLAB/ECFMG | 170 | 30.7 |
| Maintaining social relationships with faculty/friends | 101 | 18.3 |
| Do research as its funded | 81 | 14.6 |
| Better awareness | 5 | 0.9 |
| Exposure to research methodology | 1 | 0.2 |

Table 4: Barriers averting students from taking up research (n=553)

| Type of barrier* | Factors | Frequency (n) | Percentage |
|--|---------------------|--|------------|
| Personal barrier | Lack of guidance | 280 | 50.6 |
| | Lack of incentive | 248 | 44.8 |
| | Lack of motivation | 238 | 43.0 |
| | No topic in mind | 201 | 36.3 |
| | Lack of time | 191 | 34.5 |
| | Lack of interest | 175 | 31.6 |
| | Family constraints | 50 | 9.0 |
| | Bad past experience | 28 | 5.1 |
| | Others | 21 | 3.8 |
| | Nonpersonal barrier | Lack of training in research methodology | 265 |
| Lack of early exposure | | 245 | 44.3 |
| MBBS curriculum is stressful | | 210 | 38.1 |
| Clinical practice is given more importance | | 133 | 24.1 |
| Lack of infrastructure | | 101 | 18.3 |
| Internet inexperience | | 20 | 3.6 |

MBBS=Bachelor of Medicine and Bachelor of Surgery. Others-Demotivation from peers, health issues, economic crunches, inability to approach faculty. *Multiple responses obtained

themes generated from the manual content analysis of the FGDs. These included the following:

1. Perceptions about the term “biomedical research”
2. Perceptions about physicians becoming scientists – bedside research
3. Facilitators for an undergraduate to take up biomedical research
4. Barriers faced by an undergraduate to taking up biomedical research
5. Prospects of taking up research in undergraduate days
6. Bringing research into the spotlight – emphasis on the undergraduate curriculum
7. Coercing biomedical research – intimidating or reassuring?

Perceptions about the term “biomedical research”

Research, according to the participants, is working out a new ideology. Novelty, relevance to society, and staying updated are all key drivers of any research. They felt that research is not limited to labs, but influences treatment modalities and outcomes.

One of the participants P2.2 added,

“We choose a topic of interest. The topic needs to be relevant and novel. Topics are also influenced by our teachers and their interests.”

Perceptions about physicians becoming scientists – Bedside research

The majority of the participants agreed to the fact that bedside research should be promoted. They believed it would form a strong base for evidence-based treatments and would help identify newer disease presentations.

One of the participants P1.5 from the final year cited,

“The mental status of a patient is better known only to the treating physician. A better understanding of patient psychology becomes relevant. It does take care of humanities and ethical conflicts in research.”

Facilitators for an undergraduate to take up biomedical research

Throughout this excerpt of the discussion, self-interest and motivation were identified as the most important facilitators of biomedical research. Other important facilitators included opportunities in the form of ICMR-STs, family support, and accolade that research could fetch in the form of social connections.

One participant from the clinical FGD group P1.4 added,

“Communication and a strong senior–junior relationship is the key facilitator for any undergraduate student to take up research. It’s mostly your seniors who form the influencer cohort, who can kindle the spark in you. For this, good communication is a must.”

Participants felt that motivation could be in two ways – internal and external. While internal motivation is the start to the process, the fuel that keeps it running is external – from peers, faculty, friends, family, and seniors.

Few participants pointed out the significance of being self-efficient. Managing studies, research, personal and other commitments would help one be efficient, and efficiency is an important facilitator to research. To this end, one participant P2.2 contradicted stating that multitasking could also be a double-edged sword, with micromanagement being detrimental to ideologies.

Barriers faced by an undergraduate to taking up research

While discussing this particular topic, diversity and disparity between the individual participants with varied levels of understanding between the clinical and the pre/para-clinical cohorts was noted.

Lack of time, curiosity and ideas, peer demotivation, laziness, inability to handle stress, financial barriers, transportation issues to the field, and previous negative experiences were a few of the important personal barriers shared by the participants. As stated by a few members, one of the barriers that could be easily addressed was "lack of early awareness," which was noted to have decreased the spirit of taking up research.

One of the third-year medical undergraduates P1.1 cited,

"With increasing curriculum, stress keeps increasing. An early exposure would have kindled my self-interest. By the time I came to know about research, I was in my third year."

Another striking point made by one participant P2.5 was that the troubles in research are generally exaggerated. This overexaggeration, according to the participant, decreases and hampers the morale of anybody who wishes to take up research.

One participant P2.3 stated that research should be made compulsory as in engineering colleges, which would serve the basic purpose of introducing research to students. One participant P1.6 brought out institutional-specific barriers such as lack of funds, number of cases/patient load, and lack of logistics and resources.

One of the second-year students P2.4 felt,

"Institutional barriers along with sociocultural barriers form the stumbling blocks to taking up research. Being a girl, my parents never allow me to leave my house after 8 pm. If I had to travel a long distance for data collection, I wouldn't be permitted. According to my parents, research is still extracurricular."

Future prospects of taking up research in undergraduate days

Most of the participants felt that taking up research during their undergraduate days would help them understand the intricacies and nuances of research which, in turn, would assist them in finding a career in research-based fields. The other important atmospheres where undergraduate research takes up a connotation include USMLE (United States Medical Licensing Exam), PLAB (The Professional and Linguistic Assessment Board test for eligibility to practice modern medicine in the United Kingdom),

ECFMG (Educational Commission for Foreign Medical Graduates) exams, and a better curriculum vitae (CV)/resume.

One of the final-year undergraduates P1.6 felt,

"Taking up research now will at least give me an idea of how research works. It will prevent embarrassment during the postgraduation."

Research into the spotlight – Emphasis on the undergraduate curriculum

Few participants, while discussing possible solutions to the barriers, added that creating early awareness is the mantra to address the lack of involvement of young students in research.

One student P1.4 added,

"It was strange for me to see one of the first-year students ask me about ICMR-STs. I was aware of what research is only during my Community Medicine postings. When I asked him, he told me he had a session on research in the foundation course. The new CBME curriculum is stressing research. Therefore, the early introduction does seem to create an impact."

Coercing biomedical research – Intimidating or reassuring?

There is a mixed opinion among participants with regard to coercing biomedical research in the undergraduate medical curriculum. While the pre/para-clinical cohort felt that research should be made compulsory in the undergraduate curriculum to create a niche for students to explore research, the majority of participants from the clinical cohort felt that making research compulsory would dilute the standard and impair the quality of biomedical research.

Discussion

This study focuses on the key perceptions of medical undergraduates toward biomedical research. With regard to the importance of research in the present day, it was found that with consecutive progress in the curriculum, the response to research being important increased, probably due to an increase in the awareness, exposure, and better interaction with seniors turning postgraduates. The percentage of students belonging to the first and final years of MBBS who felt research was unimportant was more than that of students in the second and third years. This could be because of little or no awareness about research in the first year and tight schedules and increasing clinical pressure in the final year. Additionally, the percentage of students in the second and third year believing research to be unimportant was meager. This could probably be because of extra

time available during these, apparently, honeymoon years. In terms of reasons to give importance to research, prospects such as usefulness during postgraduation, examinations such as ECFMG, PLAB, and USMLE, and better CV were quoted as the main reasons by the study group, rather than belief in evidence-based medicine learning and practice. This finding is not in line with the lexicon definition of biomedical research, which is primarily done to increase the knowledge on a particular subject. This fact also indirectly reflects that the quality of research is falling down the slope.

Respondents felt workshops or conferences to be the platform for sensitizing research. This means emphasis should be given to hosting such platforms and institutions need to instill active learning methodologies and prefer them to didactic lectures. Such a platform could also help in creating awareness about research methodology. On looking at this particular finding from the other side of the table, workshops or conferences need separate teams to put in effort in the creation of such a platform. In contrast, faculty and curriculum are the available resources that do not require special efforts. This observation would help channelize the student to make maximum utility of the faculty members as a key resource, and, at the same time, it is a pointer to the faculty to impart medical education with a research-oriented angle than what it is currently delivered.

In the study, while prospects were found to be the key driver for a person to take up research, the most important facilitator was found to be acquiring more knowledge. This indicates the difference between approach and attitude toward research. Lack of proper guidance and lack of training in research methodology were identified as the most important personal and nonpersonal barriers that avert a student from taking up research. The irony is both of these are addressable.

In the study conducted by Jimmy *et al.*,^[5] 20.9% of the students had credited publications and 81.7% of the students admitted to research being important. In contrast, in the present study, only 5.2% of the students had credited publications and 78.8% of the students admitted to research being important. The probable reason for these variations could be attributed to the study setting. The present study was conducted in a teaching hospital in comparison to the reference study, which was done in a conference forum where a higher concentration of research-inclined minds could be found. The present study also proves the second fact that workshops and conferences form the best platforms to sensitize students about research and its methodologies.

The results of the present study conducted in India are second to the results of the study conducted by

Turk *et al.*^[2] in Syria, Kyaw Soe *et al.*^[6] in Malaysia, and Stockfelt *et al.*^[7] in Sweden in terms of similarity. This finding is consistent with the findings and suggestions mentioned in the article by Densen.^[8] The institutional and sociocultural barriers are akin in both studies.

The present study also proves the dire need for a platform in the form of a formal training program in research to create awareness among undergraduate students, such as the MSP (Mentored Student Project) program in the study conducted by Devi *et al.*,^[9] which fostered a positive attitude among students toward scientific research.

The present study findings are not in agreement with those of Harsha Kumar *et al.*,^[3] who reported that three-fourths of the participants were involved in research because of the medical curriculum, while thirst to acquire more knowledge and self-motivation were the reasons why the majority of our participants were involved in research. Additionally, the present study points out failure to create an early awareness in the medical curriculum to be one of the principal barriers to taking up research. From qualitative research, it was revealed that the present CBME (Competency Based Medical Education) curriculum introduced only in 2019 did take sterner steps to introduce research in the earlier fronts.

Unlike other studies available on the same topic, this study has a qualitative component that explored the facilitators, barriers, and ideologies of undergraduate students toward biomedical research and revealed myriad facets.

It was interesting to note that the participants from the pre/para-clinical group found breaking the ice and difficulty in communication to be barriers to research. It was realized down the conversations that students have a preconceived notion and prejudice that it is difficult to break the ice and approach a mentor for taking up research. They need to realize that communication is an essence for a medico, and that there is no harm in trying to make an effort. At the same time, it is significant for the school education systems to work on, so that the orientation of a medical student and accepting the paradigm shift from school to college would be easy. The same finding also stresses the fact that medical schools need to create a conducive environment to allow students to explore. One more finding that needs to be addressed is that clinical practice is given priority over research. Students felt that research was more lab related than patient related. This ideology is somewhere implanted within during teaching. All these issues need to be addressed to form promising future physician scientists.

Limitations and recommendations

Though our study sequentially explored through qualitative analysis the various facilitators and barriers faced by the medical undergraduate students toward taking up biomedical research, our study has a few limitations. In the present study, we did not include the medical interns due to logistic concerns. Understanding the perceptions of medical interns, who are soon-to-be postgraduates or residency match applicants, regarding biomedical research is extremely important. Considering the fact that their exposure to dissertations would be sooner and that they would also form the potential influencer cohort for their juniors, exploring their perceptions becomes crucial.

The findings of our present study have highlighted various barriers that are prevalent amidst the students. Early sensitization to biomedical research duly supplemented by appropriate guidance and delivery of resources can kindle the brains of young medical students into becoming great physician scientists. Further, our study involved students from a public teaching hospital. There is always a significant difference in the availability of resources between students of a public-run institution versus those in a private institution. Thus, in the future, we plan to appreciate the differences between these sections of undergraduate students.

Conclusion

The results of the present study are a small prototype of the ideologies that run in the minds of an undergraduate student about biomedical research. It also identifies barriers to biomedical research. The results of the present study bear the following implications. To the student, it would cultivate interest and promote active participation. To the teacher, it will help in devising pedagogies to impart knowledge of research methodology among undergraduates by overcoming barriers to research. To the administration, it requests to take measures that promote research by ensuring appropriate resources are in place, and to the system, it suggests making possible changes in the undergraduate medical curriculum from the research point of view.

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Ethical approval

Institute Ethics Committee (Human Studies), Indira Gandhi Medical College and Research Institute, Puducherry – Ref. No.: 8/229/IEC – 26/PP/2019.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the participant(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The participants understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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