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IMPACT OF EARLY EXPOSURE TO RESEARCH IN UNDERGRADUATE MEDICAL CURRICULUM-A PILOT TRIAL

Physiology

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ABSTRACT

Objectives: the aim of the study was to provide a scope for research oriented learning and to inculcate a research culture from early undergraduate days in order to produce a well competent researcher and scholar at the end of the curriculum.
Method: In the three years of pilot study,150 undergraduate students in the first year were exposed to research methodology and participated in 'mini projects' in topics relevant to the curriculum.
Result: Interest and involvement in research activities demonstrated an increase in the following years regarding scholarly and research activities. There was considerable learning enhancement of additional soft skills acquired during the exposure to 'mini research projects'.
Conclusion: Early exposure to research methodology and participation in less time consuming, relevant projects generate a sustained interest in research and research skills, thereby strengthening the specific competency.

KEYWORDS:

Research, Undergraduate Curriculum, Mini Projects, Scholarly activity

Introduction

A medical educational institution owes to the society to produce 'competent' doctors who are responsible and qualified to tackle any emerging health problem and Research is one such skill. Only by producing medical graduates who are well qualified and trained to analyze and provide solutions to the emerging trends of diseases can the educational institutions make a positive impact on people's health. It is important to advocate reforms and improve the standards of medical education to meet the changing needs of health care in the society (Oliveira et al., 2014). It is important for the society that enough and adequate number of physician -scientist be produced to take care of their emerging health issues

The need of the hour is to prepare medical students of today to cope with newer emerging technologies and the ability to solve problems. Knowledge of research and the ability to take scientific decision is the essence of Evidence based practice. Early exposure to research is recommended and the faculty should actively encourage such activities.(Murdoch-Eaton et al., 2010).

Thus, for the benefit of the community that the medical education needs to inculcate a research oriented mindset in the aspiring physicians.

Besides academic knowledge ,skills as critical thinking, problem solving, self-directed learning skills are also necessary in a physician scientist(Oliveira et al., 2014).

Research in the Undergraduate Medical Curriculum has been incorporated in various forms in the western world CanMEDS framework ("The Royal College of Physicians and Surgeons of Canada:: CanMEDS Framework," n.d.-a)and also Medical Council of India has recognized that a medical graduate needs to be a scholar and be contributing to research ,solving the visible gaps and problems related to healthcare.("Medical Council of India," n.d., "MEDICAL COUNCIL OF INDIA REGULATIONS ON GRADUATE MEDICAL EDUCATION," 1997, "The Royal College of Physicians and Surgeons of Canada:: CanMEDS Framework," n.d.-b) One of the reasons of decline of physician-scientist include inadequate exposure to research skills and lack of opportunity to research in the South east Asia .(Abu-Zaid & Alkattan, n.d.; Burgoyne, O'Flynn, & Boylan, 2010; Das & Ismail, 2011; Garg, Goyal, & Singh, 2017a; Jeelani, Aslam, & Elahi, n.d.; Khan, Khawaja, Waheed, Rauf, & Fatmi, 2006). But efforts are being implanted to form research friendly bodies as future of biomedical science and medicine solely depends on undergraduates who would take on the onus for innovations and discoveries in the field(Davidson, Dube, & Vancouver, n.d.; Moore & Teter, 2014; Rathore Farooq Azam, 2014)

Undergraduates recognize the role of research but mostly remain unware of the know-how. There is lack of training in research methodology and analysis besides critical assessment(Auchincloss et al., 2014a) Therefore, they need to be motivated by early exposure to research and research methodology.

With these observations in mind, the study was conceived to expose the first year MBBS Students to Research and Research Methodology through 'Mini projects 'in physiology in the lines of' Peer Instruction and Lab Occupation training'(Borgon, Verity, & Teter, 2013) and 'Group Effort Applied Research'(Davidson et al., n.d.; Moore & Teter, 2014; Rickards, Borkan, & Gruppuso, 2007; Riley, Morton, Ray, Swann, & Davidson, 2013; Schravendijk, Rz, & Garcia-Seoane, 2013) No Skill can be mastered in a day. Since a medical graduate needs to be competent in research skills, it's imperative that the student be primed and gradually exposed to research skills throughout the undergraduate curriculum by doing research in an incremental manner. It is only by repeated practice that a skill is perfected Research skills would be learnt in a more complete manner if the students are exposed to research in a gradually increasing stepwise manner throughout the curriculum and is also assessed in some form. Unavailability of individual mentor for the research student and lack of available time for research was noted by many investigators(Auchincloss et al., 2014b; Moore & Teter, 2014). It entails lot of involvement, funds and effort but there could be no second opinion that training the undergraduates in research methods is the only way for scientific advancement in the field of medicine (Linn, Palmer, Baranger, Gerard, & Stone, 2015).

Research is mandatory in the postgraduate course, but almost absent in the undergraduate curriculum which makes it difficult for the student in later years. The skills of research and writing skills get more and more refined and well comprehended if research exposure occurs from early years. (Garg, Goyal, & Singh, 2017b)

It was felt by many that early exposure to research would be successful in reducing the gap between technical information overload and comprehension (Ávila & Rodríguez-Restrepo, 2014).

There have been many schools of view how research should be conducted in undergraduate level to facilitate and encourage research aptitude through various TL methods. Many institutions run compulsory/elective, curriculum driven research methodology programs (Abu-Zaid & Alkattan, n.d.; Atul, n.d.). However role of mentoring could not be denied along with the implementation of most effective teaching –learning method which needs to be worked out in a customized manner ,keeping in mind the availability of resources and dedicated faculty(Moraes et al., n.d.)

The present study was designed keeping the need to cultivate a research culture, especially in basic and translational fields through an early exposure to research methodology, limited resources, lack of

adequate faculty mentors in view, It was envisioned that by the end the curriculum, they would be competent researcher and scholar. Objectives were to develop active interest in scholarly activities and research skill , develop necessary soft skills of learning through research and to incite appreciation to clinical relevance of Basic Sciences

Methodology:
The study was conducted with the batch of fifty students in North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences as a pilot study for the past three years since 2013-14 to 2015-16. Total one hundred and fifty students participated in the trial.

Each year, the batch of fifty students are exposed to twenty-four hours of interactive lectures on research methodology and thereafter they have to appear in an objective test so as to standardize the baseline acquisition of knowledge of research methodology which was a new subject to them.

The students were divided into ten groups of five students with an elected group leader. Each group took up a research project, relevant to the syllabus and which was doable within three to six months.

Research Methodology classes are held during the first semester with some hands-on exercise. Few project topics were also suggested. The topic of the 'mini project 'was decided by the group leader in consultation with other group members.

Enough care was taken while designing the topics that they do not have to compromise on their study time. The projects topics were relevant to the subject and syllabus and the subjects required for the study also readily available and that the study could be completed within three to four months and well within the academic year.

Prior to commencement of the study a need assessment was done and informed consent taken from the student participants.

Research methodology classes were divided into sections e.g. 1) What is research, hypothesis, research question, Designs and types of research, Critical appraisal of scientific literature and literature search.2) Methods and tools of data collection, data entry and analysis 3) Writing a research proposal and ethical considerations, selection of participants, informed consent4) Writing for publication, choosing a journal and publication ethics.

At the end of each year, student perception on the research experience was recorded. Each project was assessed on how much of the research skill it covered. Emphasis was given on research method, study design and literature review with information gathering. The program was evaluated after three years.

Workshop on Research topic like PubMed Search, Reference management, Study Designs are also held periodically for Undergr aduate students.

Ethical approval was not considered necessary as the exercise was tried as a pilot project and all students were equally exposed to the beneficial effects mentioned in the study. However, informed consent was obtained before proceeding with the schedule.

Result:
During past three years, all fifty students in each batch have consented to be the part of the study and attend the requisite classes on research methodology and do the projects. Some of them had prior exposure in school and they understood the benefit from such an exercise.

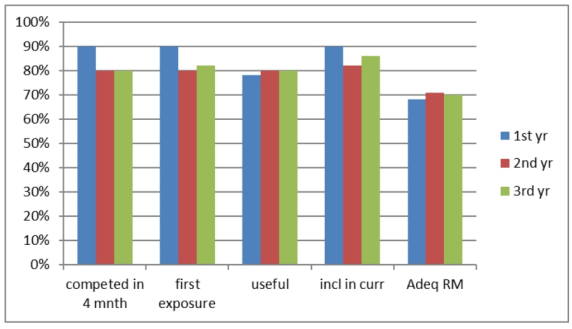
The previous research experience at school level was limited to information gathering.

90% of the students completed their projects in the first year i.e. one group did not complete the project in time. Though they submitted the findings, due to lack of time, they could not produce a publishable format.

In the following years too, only 80% i.e. eight groups could complete in time. Still they were not able to complete the witting part due to impending summative examinations For 68-71% of the students, the number of Research Methodology classes were adequate .82-90% of them wanted research methodology and 'mini projects' to be included in the curriculum. Majority of them understood the importance of research in their academics and professional advancement in the coming years.

(Refer fig. 1)

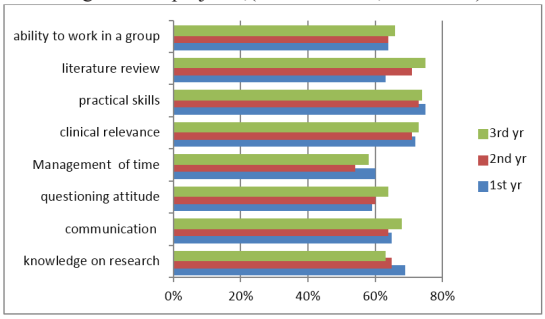
Fig 1: Result of 'mini project' (NEIGRIHMS,2013-2016)



Managing time for research was difficult for most of them in all the three years.

Skills including critical analysis, communications, ability to form and ask questions, lab skills, ability to work in a group were all enhanced. They also could appreciate the clinical relevance of Physiology and Basic Sciences in a much better manner. (Refer fig.2)

Fig 2 : Students'(one hundred and fifty) perception on additional skills gained during the 'mini projects',(NEIGRIHMS,2013-2016)



Motivated students, thereafter had applied for research grants. some of them had initiated independent projects with faculty mentor. (refer table 1

Table 1	Year End Summative	examination
Year	Passed in first attempt	marks>50%
2013-14:	49	3
2014-15:	50	4
2015-16:	50	4

During the three years, the yearend summative reports demonstrated and overall improved learning of the subject (refer table 2)

Table 2: Research output: Following Early Exposure to Research Methodology and 'mini projects'

Batch 2013-14	two projects applied (ICMR STS) in 2016. One selected.
Batch 14-15	none reported
Batch 2015-16	one project (intramural) in 2017

Research Oriented activities among the students demonstrate a steep increase in the following years with participation in scientific workshops and conferences, earning laurels for the institute.

Discussion: Introducing medical students to research and relevant support mechanisms early in their education is a time tested and novel way getting the budding clinician interested in research (Zier & Stagnaro-green, 2001) as evident by the successful OSRO, (Office of Student Research Opportunities) program established in 1995 to engage students in research. This went to show that students can be

motivated to carry out research with appropriate encouragement from the administration and faculty.

Medical schools should create an environment that attracts, fosters and rewards students committed to research. There are many programs offering simultaneous research opportunities parallel to the chosen course with or without grants(Nathan, 2002; Varki & Rosenberg, 2002).

NIH sponsored Medical Student Research Fellowship programs& Doris Duke Clinical Research Fellowship Programs are such Programs.(Gallin & Le Blancq, 2005; Varki & Rosenberg, 2002)

Norwegian Medical student Research Program and Alpert Medical School of Brown University also prepare the clinician to contribute to the healthcare system by solving unresolved health related issues(Hunskaar et al., 2009).

Disease focused translational research is the need of the hour today. there is a serious decline in medical graduates wanting to opt for research as careers. Our study was conducted in topics related to applied physiology so that the students acquire the basic foundation concepts which they need to carry forward.

Fostering analytical skills is of utmost importance in basic science, as are transferable skills like communication, teamwork, time management and critical thinking .Such programs are shown to be effective in choosing the specific clinical specialty of interest in later years(Khan et al., 2006).

Fostering such research specific skills have been recommended by Tomorrows Doctors, The Scottish Deans' Curriculum, Good Medical Practice USA (General Medical Council, 2009; Green et al., 2010; Scottish Deans' Medical Education Group, 2008; Varki & Rosenberg, 2002; Vujaklija et al., 2010).

Often, many students are unaware of research activities in the host institution. Not all opt for such a course unless the benefits are explained or demonstrated to them.(Hunskaar et al., 2009).At the commencement of each year, the benefits, objectives and the methodology of the pilot trial is explained to the students. Each student received equal opportunity to contribute to the student project in our study.

Health Research training is essential to Medical education for implementation of evidence based health care., especially important in filling up the void in physician-scientist in developing coun tries. (Detsky & Detsky, 2007)

Importance on hypothesis testing, advancement of knowledge, information gathering, data collection and maintaining lab reports in requisite format need to be stressed upon. Though most of the Undergraduates understand the role of research in their career and education, they require to be provided the adequate opportunities (Murdoch-Eaton et al., 2010) Mandatory or elective research assignments students' section in indexed journals, organizing student 'scientific conferences, molding medical curriculum to integrate capacity building for research and holding workshops on different aspects are crucial in inculcating a research aptitude in the medical graduates(Hren et al., 2004; Khan et al., 2006)

A scholar is expected to solve problems in heath related issues and hence incorporation of research activities should be within the curriculum.(Siemens, Punnen, Wong, & Kanji, 2010)

Most of the undergraduates wish to be involved in some kind of research activity and find such activity to be beneficial to their education, that research will play a role in the choice of their career. But time allotted is a restricting factor(Siemens et al., 2010) .One of the main motivating reason appears to be entry into their choice of residency program.(Boninger et al., 2010) Adequate training of critical appraisal is a prerequisite of research and the students need to be prepared in this skill from the initial years .This was very well achieved by an early exposure to research methodology course and in the present study (Vujaklija et al., 2010).

There is a strong correlation between academic career and students publishing their research reports(Zier & Stagnaro-green, 2001).This was ably demonstrated .

The students need to be acquainted with value of research to them, to society, helping them to think out of box, to be made aware of research opportunities and encouraging them to participate in projects, rewarding students and creating new, innovative program. Recognizing and rewarding student activity in projects was another motivating factor itself(Vujaklija et al., 2010).

Making a devoted supervisor available is a must for this type of research orientation program, which can run alongside the course. To overcome the problem of lack of faculty and mentor, group project work had been devised in this project.

Successful programs depend on active Student involvement, clinical relevance, integrated teaching and question development(Detsky & Detsky, 2007) .Students' self-assessment, literature searching skill and critical appraisal skill and problem solving of clinical problems are all tested in this research driven' mini project'.

Research experience leads to better critical thinking skills, improves the ability to interpret and read scientific data and confidence in doing further research.

In our longitudinal study, we clearly were able to demonstrate that a mandatory course in research methodology maybe responsible in changing the attitude towards science and research. Due to lack of adequate number of faculty, a group project was devised which would lead to equal sharing of research work and there would be peer mentoring.

Medical students had a positive attitude towards science and scientific method, with continual increase during the following years. This was amply provided in our study. They also recorded good academic results in the summative examination. Therefore, It is possible to increase attitude towards science and scientific research, in all (not only in highly motivated and interested students, if exposed early and gradually moving onto higher level of expertise.

Limitation and Recommendations:

Less duration of the preclinical posting was an issue resulting in projects not completed in time. If the classes in research methodology are made online, more time could be spared for interactions and hands on practice. This would enable the students to complete the projects in time and feel more accomplished. Lack of dedicated individual mentors could be compensated by creating student mentors from the previous batch of motivated students. An undergraduate research cell with faculty in-charge could be a solution to the problem.

Research workshops for Undergraduates and Conferences (preferably organized and conducted by the Undergraduates, earning them credit points) could also act as a motivating factor for involvement in research. Funding for such activities require to be looked into by the administration of the Institute.

Conclusion: Research and academics are complimentary to each other and they stimulate interest in each other, Introduction of 'mini research projects' based on physiology has been well accepted by the students and has been of help in their studies. Group research activity has also developed skills like communication skill, peer relationship, time and resource management and questioning attitude, sharing etc. in the face of a faculty shortage.

Interest and willingness to be involved in research and scholarly activities require to be cultivated from initial years of undergraduate Curriculum in order to produce graduates who are competent in doing research. Mandatory Mini projects in as many subjects as feasible should be incorporated in the regular curriculum with a structured research methodology course, more so in the basic sciences in order to drive home the clinical relevance and application of the basic sciences like physiology which is so important in deriving at differential diagnoses and translational research. Institutional support should be extended in the form of online services, funding etc. and capacity building of faculty in research and skills as well as faculty strength must be enhanced for better results.

Opportunities for collaboration with other institutes regarding students' workshop, conference etc., should be explored besides

conducting workshops on research methodology topics for the undergraduates.

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Conflict of Interest: No conflict of interest was noted

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