

Homeopathic undergraduates' perspectives on research: a survey

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ABSTRACT

Historical Context: Undergraduate research is given top priority in order to foster analytical thinking, autonomous writing, future clinical practice, increased employability, and better research productivity. Research perception of homeopathy undergraduates has been surprisingly understudied so far, despite the far-reaching repercussions. One MEDLINE indexed paper with appropriate student contributions in the recent decade reflects the poor engagement of homeopathic undergraduates in research. Our goals were to gauge their familiarity with research, their outlook on it, and any obstacles to its effective execution. **Methods:** In August and September 2013, 902 students from four different government undergraduate homeopathic institutions in West Bengal, India participated in an institutional cross-sectional survey. Based on previous research with pre-med students, a semi-structured questionnaire was created for this specific aim. At last, 364 replies were considered. **Findings:** The majority of the participants were between the ages of 18 and 25, and almost all of them were from urban homes. There were no significant variations in gender distribution (roughly 1:1) and 73.1% of the families did not have a doctor. Calcutta Homeopathic Medical College and Hospital students (51.2%) and third-year students (61.5%) had the highest percentage of full replies. Despite a desire to take part and a generally optimistic outlook on research, present levels of engagement, education, and understanding are severely lacking. The main obstacle to research was the lack of infrastructure. In conclusion, undergraduates were generally supportive of homeopathic research, but they need a more practical knowledge of how studies are conducted. There aren't many places to hone your research abilities.

Keywords: Undergraduate homeopathic students, India, research perception

Introduction

In recent years, a paradigm shift has been noticed from experience-based to evidence-based practice in medicine and education. Research is the cornerstone of evidence-based medical practice, which translates new knowledge and technological capability into powerful tools for prevention and treatment of disease [1]. The last few decades have witnessed a tremendous upsurge in clinical and biomedical research [2] which is vital to ensure continuing advances in health care and develop new initiatives. Research evidence is a prerequisite to ensuring the best possible care is provided to patients in the most effective and

efficient manner [3]. Students and practitioners need continually updating them to keep abreast of relevant exponentially expanding knowledge of research. Research experience has been recognized to help foster scientific thoughts and nurture evidence-based practice in clinical settings [4]. Exposing students at an earlier stage in their careers to the basics of research not only improves their knowledge and attitude towards research, but also provides lessons in teamwork, helps to develop critical analytical skills, thinking and also enhance their skills in searching and evaluating literature, independent writing, future

clinical practice, enhanced employability, and improved research productivity [5-8]. Engaging in research projects can also influence students' choice of clinical specialty or interest in research [9,10]. Clinician-scientists have already been identified as an 'endangered species' [11-13], a 'vulnerable population' [12]. Non-prioritization of medical research in undergraduate curriculum [7,8,14-19] has caused a further serious decline in medical graduates choosing clinician-scientist careers in the last two decades [17,20-23]. Many medical practitioners have either limited or no formal education in research and are inadequately prepared to critically analyze the quality of research they are reading [24-26].

South Asia has a quarter of the world's population, but a weak public sector health care, and a staggering disease burden, and thus research is particularly important. In all disciplines of science and technology, India and Pakistan combined had 208 researchers per million citizens, as compared to 4,526 researchers per million citizens in the United States [27]. The published research output from South Asia was small – South Asian health researchers accounted for only 1.2% of all papers within the Institute for Scientific Information database from 1992-2001 [28]. Although investment has increased in infrastructure for health research over the past decade, gaps remain in evidence to guide reduction of important health burdens/challenges. Furthermore, even when technical knowledge is available, political commitment, managerial competencies, and incentives for changing behavior within health systems are often lacking [28]. Senior administrators have to decide whether and how much to invest their limited resources in research or in support of the educational goals of the institutions [29]. However, emphasis has been made to integrate research within the medical community [30,31] Research is gradually being inducted into the curriculum, but unfortunately only to be manipulated by untrained mentors with no formal research training or even informal experience [32].

Homeopathic research in India like most developing countries is clearly still in its infancy. This country faces obstacles in research which are similar to other developing countries. With a

few exceptions, there is little quality research in India and a large majority of work is compromised due to flawed methodology and poor research training and background of researchers. In the last decade, from 2004 to September, 2013, a total of 312 peer-reviewed homeopathic research papers have been published from India, out of which 46 (14.7%) were indexed with MEDLINE (PubMed). 65 (20.8%) were published in journals with impact factor, a number almost double than the previous decade [33]. Still, the number of peer-reviewed papers with sufficient contribution from undergraduate (UG) students is limited to only three (0.9%) [34-36], out of which only a single was indexed with MEDLINE and published with journal having impact factor [36]. Some efforts are being made to improve training in research at post graduate level only, yet research output still remains almost non-existent. Most of the research being produced is through required papers generated by postgraduate trainees; which is a mandatory requirement for completion of their training. Inclusion of epidemiology and biostatistics even in the UG curriculum is getting minimal attention. It is therefore important to understand and highlight the attitudes and problems in conducting quality research. This may

help identify barriers and further encourage research by young professionals so that future research is more in number, better in quality and greater in impact.

An autonomous body, namely Central Council for Research in Homeopathy (CCRH) has been functioning since March, 1978 in India, currently under the Department of Ayurveda, Yoga, Unani, Siddha and Homeopathy (AYUSH), Ministry of Health & Family Welfare, Government of India. As on September 2013, it has 93 Research Officers (Scientists) conducting research all over India and through Drug Proving Extension Units in different institutions [37]. CCRH conducts Continued Medical Education (CME) programs from time to time involving internees, house-staffs and post graduate trainees of different academic institutions. CCRH has also been trying to promote research among junior homeopathic professionals by running

Senior/Junior Research Fellows scheme since 1987-88. Still, motivation to participate in homeopathic research remains seriously low among the UGs in India. Despite far reaching consequences, research perception of homeopathic undergraduate students has barely been investigated to date. Our evaluation aimed to gauge students' awareness of research activities and perception of their research-specific skills and competencies, to determine their motivation for research, and to identify personal views about obstacles towards conduct of research. Another purpose of our study was to collect reliable data that would be helpful for drafting recommendations concerning development and improvement of their research perception.

Methods

Setting and design: An institutional survey was carried out during August-September, 2013 in the four Government homeopathic medical colleges of West Bengal, India, namely Calcutta Homeopathic Medical College and Hospital (CHMC&H), Midnapore Homeopathic Medical College and Hospital (MHMC&H), D N De Homeopathic Medical College and Hospital (DNDHMC&H) and Mahesh Bhattacharyya Homeopathic Medical College and Hospital (MBHMC&H). Permission was taken from the institutional ethics committees of the respective institutions prior conduct of the study.

Participants: Out of total 902 students enrolled in the (4¹/₂+1) years Bachelor in Homeopathic Medicine and Surgery (BHMS) courses running in the four colleges under approval of West Bengal University of Health Sciences (WBUHS), Government of West Bengal and under affiliation to Central Council of Homeopathy, Government of India, 511 (56.7%) participated and answered the questionnaire. For analytical purposes, students were divided into five academic years and internees.

Sample size: Considering margin of error as 5%, confidence level 95%, response distribution unknown, taken as 50%, and population size of 902 (enrolled number of students in the undergraduate courses in the four Government homeopathic schools in West Bengal), target

sample size became 270. However, as we obtained 364 complete and analyzable responses, the confidence level was increased to almost 99%.

Questionnaire and data analysis plan: No universally accepted standardized questionnaire was available to evaluate homeopathic undergraduate students' perception towards research. We developed a questionnaire extracting items from earlier studies by Ahmed F, et al. 2009 [38] and Ejaz K, et al. 2011 [32] on medical undergraduate students. The directions to fill up the questionnaire were explained verbally to all the students in detail by the research assistants. The questionnaire consisted of three sections. The first open section sought information regarding students' institutions, academic standings, age, gender, residence and presence of physicians in family. Section two comprised of eighteen close-ended questions focusing on students' knowledge and attitude towards homeopathic research. The last section was also close-ended and aimed to identify barriers towards research as perceived by the students.

To evaluate the feasibility of application of the questionnaire in a large population, a pilot testing was done on twenty students involving five from each institution before conducting the study. It took only five minutes time to complete and all the data were collected from them by the research assistants. Instructions on the

questionnaire promised anonymity. No participant identifiable information was required to ensure protection of privacy. Also the filled in questionnaires were concealed by putting those inside opaque envelopes which were sealed at the survey site by the students themselves. All these were collected by the research assistants and were sent for data analysis. All the responses were individually extracted in a specially designed excel sheets and subjected to statistical analysis using online statistical calculators.

Statistical analysis plan: Descriptive statistics has been represented in the form of absolute values and percentages.

Results

Variables: Though poor, maximum (51.2%) numbers of complete responses were obtained from CHMC&H and the lowest (26.9%) from MHMC&H. The third year students contributed the highest (61.5%) responses and the first year the lowest (29%). Respondents spanned two

groups of ages – 18-25 years (94%) and 26-30 years (6%). Gender distribution was almost the same among the sample analyzed. Students chiefly (44.8%) belonged to urban families and 26.9% had physician in family (Table 1).

Table 1: Variables of the responses obtained

Variables	N	%
Institutional complete responses		
▪ CHMC&H	103	51.2
▪ MHMC&H	101	26.9
▪ DNDHMC&H	93	40.6
▪ MBHMC&H	67	28.2
Complete responses as per academic standings		
▪ 1 st year	58	29
▪ 2 nd year	63	31.0
▪ 3 rd year	88	61.5
▪ 4 th year	55	36.9
▪ 5 th year	66	57.9
▪ Internee	34	36.6
Age (years)		
▪ 18 – 25	342	94
▪ 26 – 30	22	6
Gender		
▪ Male	191	52.5
▪ Female	173	47.5
Residence		
▪ Urban	163	44.8
▪ Semi-urban	109	29.9
▪ Rural	92	25.3
Physician in family		
▪ Yes	98	26.9
▪ No	266	73.1

Knowledge and attitude towards research: 55.2% students had already conducted first literature search at undergraduate level. Medical research journal reading habit was found to be modest (41.8%). 65.7% students read first medical research journal already, but reading frequency remained poor. Interestingly, majority (70.6%) felt the need for reading journals as part of curriculum only. Overall information regarding Medline indexed homeopathic research journals was very poor – 70.3% did not know any. Still, encouraging was the fact that 81.3% students were willing to contribute to any research project. Obviously, a large section (51.6%) did not know the role specifications of research workers. Only 7.7% students were currently part of any ongoing research project and only 2.5% had any manuscript published or anticipated under name at the time of conduct of the survey. 73.9% students felt that they had inadequate exposure to homeopathic research.

68.7% students desired research as part of basic homeopathic education, probably because 96.7% students had not received any kind of research training previously. The scenario remained almost similar among institutions and different academic years. Majority felt the usefulness of descriptive epidemiology (87.4%), analytical epidemiology (86.5%), basic biostatistics (88.5%), inferential biostatistics (86.3%) and knowledge of survey methodology (92.9%) in medical education. (Table 2)

Table 2: Frequency and percentage of responses from study participants

Variables	N	%
Academic standing at conducting first literature search		
▪ At undergraduate level	201	55.2
▪ Not as yet	163	44.8
Medical research journal reading habit		
▪ Yes	152	41.8
▪ No	212	58.2
Academic standing at reading first medical research journal		
▪ At undergraduate level	239	65.7
▪ Not as yet	125	34.3
Frequency of reading medical research journals		
▪ Once a month	64	17.6
▪ Once every 3 months	46	12.6
▪ Even less frequently	100	27.5
▪ Never	154	42.3
Need for reading medical research journals		
▪ Out of interest	69	19
▪ Part of curriculum	257	70.6
▪ No need	38	10.4
Information regarding Medline indexed homeopathic research journals		
▪ More than five	11	3
▪ Four	5	1.4
▪ Three	21	5.8
▪ Two	27	7.4
▪ One	44	12.1
▪ Do not know any	256	70.3
Would like to contribute to any research project		
▪ Yes	296	81.3
▪ No	68	18.7
Willingness to contribute to research projects as		

<ul style="list-style-type: none"> ▪ Investigator or co-investigator ▪ Both investigator and data collector ▪ Data collector ▪ Do not know 	25	7
	101	27.7
	50	13.7
	188	51.6
Is currently part of a research project		
<ul style="list-style-type: none"> ▪ Yes ▪ No 	28	7.7
	336	92.3
Have had a manuscript published (or anticipated) under name		
<ul style="list-style-type: none"> ▪ Yes ▪ No 	9	2.5
	355	97.5
Opinion on current exposure to homeopathic research		
<ul style="list-style-type: none"> ▪ Adequate ▪ Inadequate ▪ Do not care / makes no difference 	62	17
	269	73.9
	33	9.1
Would like to have research as part of basic homeopathic education		
<ul style="list-style-type: none"> ▪ Yes ▪ No 	250	68.7
	114	31.3
Received research training previously		
<ul style="list-style-type: none"> ▪ Yes ▪ No 	12	3.3
	352	96.7
Descriptive epidemiology useful in medical education		
<ul style="list-style-type: none"> ▪ Yes ▪ No 	318	87.4
	46	12.6
Analytical epidemiology useful in medical education		
<ul style="list-style-type: none"> ▪ Yes ▪ No 	315	86.5
	49	13.5
Basic biostatistics useful in medical education		
<ul style="list-style-type: none"> ▪ Yes ▪ No 	322	88.5
	42	11.5
Inferential biostatistics useful in medical education		
<ul style="list-style-type: none"> ▪ Yes ▪ No 	314	86.3
	50	13.7
Knowledge of survey methodology useful in medical education		
<ul style="list-style-type: none"> ▪ Yes ▪ No 	338	92.9
	26	7.1

Barriers towards homeopathic research: Students identified lack of infrastructure as the principal (22.1%) hindrance towards homeopathic research, followed by lack of research training (19.6%), statistical support (12.4%), financial incentives (12.2%), and mentorship (10.2%). The students found it difficult to devote sufficient time for research and also perceived the inadequacy of research training, statistical support, mentorship, financial incentives, infrastructure, funding, uncertainty of future benefit, and others. (Table 3)

Table 3: Perceived barriers towards homeopathic research

Barriers	N	%
Overall		
▪ Lack of research allotted time	73	6.7
▪ Lack of research training	214	19.6
▪ Lack of statistical support	135	12.4
▪ Lack of mentorship	111	10.2
▪ Lack of financial incentives	133	12.2
▪ Lack of infrastructure	240	22.1
▪ Lack of funding	104	9.5
▪ Uncertainty about future benefit	56	5.1
▪ Others	24	2.2

Discussion

The validity and reliability of the developed questionnaire has not been addressed. Instead, most enticing is the fact that homeopathic undergraduate students from four homeopathic schools in West Bengal, India have positive attitudes towards homeopathic research despite poor knowledge and awareness of research methods and scientific communication. They recognized the benefits of acquiring research skills, but identified practical difficulties of participating. The most important covariates of skill levels were lack of infrastructure, current time commitment to research, and lack of formal training and mentors, as were identified by Perneger TV, et al. in 2004 [39]. Increase in knowledge of scientific methods and critical thinking may reinforce attitudes towards science and help to embrace evidence based medicine (EBM) [39]. But overall, in contrast with the global [40-47] and even Indian mainstream population-based medical research scenario [48], undergraduate homeopathic research in India is almost non-existent. Majority of students expressed unawareness about research, even in their host institution, a figure similar to that provided by Burgoyne LN et al in 2010 [49], but much poorer than Harsha KH, et al. in 2009 [50] as 70% and by Chaturvedi S, et al. in 2001 [48] as 91%. Students are not necessarily clear about what research actually constitutes. Only a minority of students are submitting articles for publication which agrees with other studies that quote 8- 17.6% of medical students either had

anticipated or published articles [51]. Working in research projects require in-depth understanding of research methodology, epidemiology, and biostatistics [52,53], which are usually not acquired during undergraduate medical training [54]. Other potential deterrents identified were constraints in research funding and devoted time, work overload, poor pay, lack of motivation, rewards, recognition and guidance, minimal awareness, lack of facilities, inadequate faculty-student interaction, conflicts between the role of clinicians and scientists, and sometimes a scientifically uninteresting research question; findings similar to a recently concluded study [55].

The main cause of our dismal performance in the field of research and innovation has been a medieval curriculum that focuses on didactic learning instead of a scientific and an experimental approach [35]. This lecture-based curriculum does not stimulate students' interests in research during medical school and therefore they are less likely to seek a research experience. Majority of the faculty lacks experience in research. Thus students are not exposed to dedicated role models and hence a vicious cycle of a non- experimental approach towards science is set up. Economic factors also need to be considered. Student's in developing countries make career decisions within a framework that includes income potential. Also counselling about research opportunities and research careers is non-existent at almost every homeopathic school in West Bengal. These factors



combined with the uncertainty of research funding make a career in research less attractive economically.

Thus, there is an urgent need to emphasize the importance of research and to undertake professional programs preparing students as well as supervisors for this task [49]. Courses in research methodology have already been proved a helpful tool toward successful conduct of research [20,56-59], that can substantially increase research knowledge, skill, competence and productivity [60-63]. Evolving medical science necessitates research training to be considered as an essential and fundamental component, 'an underlying principle', in an innovative undergraduate medical curriculum [49,55,64-70]. Undergraduate research is being seen as a fundamental element of general higher education in the UK, US and elsewhere [67,71]. A recent study showed that most medical students can generate scholarly work during medical school and sustain a high level of interest in research as a career option [72]. Despite the existence of courses in medical informatics, guides and thesis regulations, many students do not understand the process of scientific writing [73]. Some medical schools have developed student-oriented courses and program to overcome the perceived difficulties and improve the quality of theses and promote their publication [74-76]. It is important to teach undergraduate students the full scientific publishing process, including the peer review process, the format for scientific articles and the necessary skills in word processing. Requiring students to write their theses according to the guidelines of a few selected journals, improving the supervisor's engagement in the reporting and improving students' understanding of the peer review process would add a new dimension to the thesis process and provide additional opportunities for publication. The full digital text of the completed and reviewed thesis should be made visible and accessible in the institutions self-archive [77]. Appreciation of research work should be made a part of institutional mindset [2]. In health care sciences, understanding biostatistics have important implications in modulating clinical practice as it possesses a large effect on evidence-based diagnostic and treatment applications. Similarly, in academics, sufficient knowledge of epidemiological principles is required to successfully conduct a study and correctly analyze data derived from clinical investigations. Case

discussion teaching [78] and problem-based learning (PBL) [79] can be employed successfully rather than traditional lecture-based courses. Finally, encouraging research culture and fostering the development of inquiry and research-based learning among students is a high priority in order to develop more and better patient-oriented clinician-researchers [1,80-83] and strengthening integrity in the academic environment and society as a whole [38]. Medical students' research may help instill a culture of EBM in clinical medicine [84]. The 'teaching-research nexus' should be central to medical education [85]; however, the dilemma of education versus research-oriented publication seems to continue to exist [86]. The model proposed by Healey and Jerkins may be of use [87,88]. Also, the Continuous Research Education and Training Exercises (CREATE) program has been proposed as a peer- and group based, interactive, analytical, customized, and accrediting program with didactic, training, mentoring, administrative, and professional support to enhance clinical research knowledge and skills among healthcare professionals, promote the generation of original research projects, increase the chances of their successful completion, and optimize the potential for their meaningful impact [89].

One long-term and effective strategy for promoting health research is to target medical students early in their careers. Student research can contribute to the published output of an institution. Nothing can be more motivating for a student than to get published [42]. Currently there is very little literature that presents innovative ways of teaching public health research methods to undergraduate medical students. Above all, students need to be "sensitized" to research – that is, they should be made aware of why research is so crucial to health care. Then only it may be quite feasible to integrate medical student teaching with real-world research. This approach to integrated teaching and research should be considered further in health sciences training and continue to be evaluated and refined. Many medical graduates feel they have insufficient knowledge when it comes to basic research skills. This deficit could be due to the fact that students are often not taught these skills and do not value them in their under-graduate curriculum. A low



importance attached to public health, along with little understanding of research skills is not a promising combination, especially given the growing importance of evidence-based approaches to making health sector activities more effective and cost-effective [90]. Accessible resources, appropriate rewards, financial incentives, sufficient time allocation, promotion and tenure have already been identified as stimulators in promoting research and

scholarly activity [91-93]. All opportunities to bring research-active staff and research enthusiastic undergraduates together must be explored and the value of undergraduate research must be recognized by funding authorities. Many studies have addressed the benefits of financial investment in research; likewise, many benefits have been provided from researches for the welfare of community. These studies have encouraged policy makers to invest in research and innovation [94]. Health research should be organized from a systems perspective with an emphasis on ethics and equity. An enabling environment for research requires vision, institutional support, adequate funds, appropriate training, and attractive career pathways. Collaboration across the region needs to be strengthened. Use of health research to inform health policy, professional practices, and public behaviour needs to be increased [29]. There also need to be effective international agreements to halt the "brain drain" of academic clinicians from low-income to high-income countries, since this migration robs medical students of role models [95]. Several medical schools are developing 'Student Research Offices' in order to facilitate participation in extracurricular research. Despite significant motivation for curriculum vitae, many are enthusiastic regarding extracurricular research opportunities, but frustrated by the obstacles faced [96]. Bangash MA, 2002 [97] suggested different recommendations for promoting undergraduate medical research which are equally applicable for homeopathic schools in India.

Our preliminary evaluation is limited by the paucity of existing evaluation model for assessing research perception of undergraduate homeopathic students. Another limitation of this study was that we did not look at the type of research done by the extremely limited number of study participants. Even though not a study objective, information of the quantity and quality of research would have given more information of research output and reflected on adequacy of research. Thirdly, a larger sample size would have allowed for a stronger analysis than the one performed in this study. Despite these limitations, this study was able to capture a wide sample across four academic institutions

allowing for a fair representation. The study was undertaken in India-based homeopathic schools making the generalizability of the results unclear. Future studies investigating such attitudes and participation in research would be welcome from other homeopathic schools in both India and abroad. In addition, it would be of interest to assess the effectiveness of potential educational interventions such as establishing a student research group within homeopathic schools to act as a way of coordinating and promoting extracurricular research in their institutions. Authors are also grateful to the students for their participation in the study.

References

[1] First cited as Rahman et al. [1] with Majumder MAA, Shaban SF, Ahmed M, Abdulrahman KB, and D'Souza UJ. Clinical research and trial involvement by physicians: challenges and solutions. *Medical Education and Clinical Practice*. 2011;2:85-93. PMID: PMC3661249. doi: 10.2147/AMEP.S14103.

[2] A cross-sectional research from Civil Hospital, Karachi, Pakistan, examined the reading and writing patterns of physicians (Khaliq MF, Noorani MM, Siddiqui UA, Anwar M.). (2012) 12:76 in the *BMC Medical Informatics and Decision Making* journal. This is the link to the article: <http://www.biomedcentral.com/1472-6947/12/76>.... PMID: 3537640; PMID: 22840218. This article has the DOI number 10.1186/1472-6947-12-76.

Referenced in [3] Askew DA, Clavarino AM, Glasziou PP, and Del Mar CB. Research in general practice: perspectives and participation of general practitioners in Queensland. *177:74-77. Medical Journal of America*. 2002 Oct 1. Reference: 12098342

Hollen RL, Raja JB, Collier CP, Clark AF, and Waugh JM. was cited in [4]. How a research option for undergraduates is seen by future doctors. *Medical Education Bulletin*. 2004;26:659-661. Reference: 15763861 The publication habits of medical students at British medical schools: their experiences, attitudes, and obstacles to publishing [5] Griffin MF, Hindocha S. *Medical Education*. 2011;33:e1-e8. PubMed ID: 21182368; DOI: 10.3109/0142159X.2011.530320.

(Dyrbye, Davidson, and Cook, 2016). From 1976 until 2003, students at Mayo Medical School

were expected to do research, which led to publications and presentations. *Academic Medicine*. 2008;83:604-610. Publication number: 18520471. The publication's DOI is 10.1097/ACM.0b013e3181723108.

Qayyum MA, Aslam F, and Shakir M. Why the medical students are vital to the future of research in South Asia. The link between the two is *PLoS Med*. 2005;2:e322. PubMed: 16288553, PMID: PMC1297528, doi: 10.1371/journal.pmed.0020322.

Medical students in Pakistan: their knowledge and attitudes about health research (Khan et al., 2008). *Medical Education Bulletin*. 2006;6:54. The following information is available: PMID: PMC1635552, doi: 10.1186/1472-6920-6-54.

[9] Bierer SB, Chen HC. A literature review on the effects of academic specializations on students: how to quantify success. *Academic Medicine*. 2010;85:438-452. Publication Information: 20182116; doi: 10.1097/ACM.0b013e3181ccc4bd4.

[10] An Analysis of Scholarly and Research Activities in Internal Medicine Residency Programs by Levine RB, Hebert RS, and Wright SM. Volume 20, Issue 2, pages 155-159, *Journal of General Internal Medicine*, 2005. Medline: 15836549. doi: 10.1111/j.1525-1497.2005.40270.x; PMID: PMC1490049.

In a study conducted by Goldhamer, Cohen, Bates, Cook, Davis, Singer, and Simon (2011), the authors were... Preserving a vanishing species: preparing doctors to participate in clinical trials. Publication date: 2009 and volume: 84, pages 439-445. Publication information: 19318774, doi: 10.1097/ACM.0b013e31819a7cb1.

Referenced in [12] Dickler HB, Korn D, and Gabbe SG. Teaching hospitals and medical schools play an essential role in advancing both clinical and translational research. *Public Library of Science and Medicine*, 2006, 3:178, doi:10.1371/journal.pmed.0030378.

The views of the dwindling number of physician-scientists on the topic of medical research funding from the Veterans Administration [13] Zucker et al. 2004;18:1481-6. *FASEB J*. doi:10.1096/fj.04-1573lfe. PubMed: 15466355.

Public health disasters. *Lancet*. 2004;363:1553. [14] Aslam F, Qayyum MA. Reference: 15135611. The given DOI is 10.1016/S0140-6736(04)16161-8.

Rahan N. Medical studies in Pakistan [15]. Published in 2003, the article may be found in the *Journal of Coll Physicians Surg Pakistan*, volume 13, issue 617. The PMID for this article is PMC2780986, and the DOI is 10.1186/1472-6920-9-68.

[16] Majumder MAA. Research on medical education in Asia: challenges and opportunities. *Academic Medicine Singapore Journal*. 2004;33(2):257-63. Reference: 15098645.

The viewpoint of Pakistani medical students on health research knowledge, attitudes, and practices [17] (Khan, Khan, and Iqbal, 2017). 2009;9:46. *BMC Medical Education*. Reference: 10.1186/1472-6920-9-46; PMID: PMC2719622; PMID: 19615071.

Medical students' career aspirations between 1957 and 1982 at Grant Medical College, Bombay [18] Pai SA. "National Journal of Medical Sciences in India" (2009, 22(3):121-32). PubMed: 19764686.

Teaching critical appraisal skills in health care contexts [19] by Parkes J, Hyde C, Deeks J, and Milne R. Systematic Review and Cochrane Database, 2001;3:CD001270.

In [20], Marusi A, Marusi M, Vodopivec I, Ivanis A, Sambunjak D, Hren D, and Vujaklija A. Is it possible to change students' minds about science by teaching them how to do research? Observational research and controlled experiment conducted at a single medical institution. *Medical Research*. 2010;58(2):282-6. doi:10.231/JIM.0b013e3181cb42d9. PMID: 20130460.

According to Ley TJ and Rosenberg LE, "Build it and they will come" was the 2005 motto for the physician-scientist career pipeline. 2005, July 14, 2005, in the *Journal of the American Medical Association*. Reference: 16174692.

Authors Solomon SS, Tom SC, Pichert J, Wasserman D, and Powers AC were cited in [22]. Influence of medical student research on the formation of physician-scientists. *Research in Medicine*. 2003;51(3):149-56. Reference: 12769197

The opinions towards research in medical school were surveyed [23] by Siemens DR, Punnen S, Wong J, and Kanji N. *BMC Medical Education* 2010;10:4. doi: 10.1186/1472-6920-10-4; PubMed ID: 20096112; PMID: PMC2823602. [24] Inam SNB. Teaching Undergraduate and Postgraduate Students Critical Appraisal of Scientific Literature at Ziauddin Medical University, Karachi, Pakistan. *Global Journal of Health Sciences (Qassim)*. 2007;1(1):119-24.

There is a PMID for this case: PMC3068664.
The corresponding PMID is 21475461.

[25] Windish DM, Huot SJ, Green ML. A research study on medical residents' knowledge of biostatistics and its findings published in medical journals. PMID: 17785646; Journal of the American Medical Association. 2007;298(9):1010-22.

[26] In the New England Journal of Medicine, Horton and Switzer discussed statistical approaches in 2005 (353(18):1977-9; PMID: 16267336).

[27] The Institute for Statistics of the United Nations Educational, Scientific, and Cultural Organization. The US is the profiled country. Quebec: Institute for Statistics of the United Nations Educational, Scientific, and Cultural Organization, 2005.

The authors of the cited study are Sadana, D'Souza, Hyder, and Chowdhury [28]. Critical role of health research in South Asian countries. Britannica, 2004;328:826-30. Reference: 10.1136/bmj.328.7443.826; PubMed ID: 15070643; PMID: PMC383385.

The research output of the medical faculty of the American University of Beirut [29] Dakik HA, Kaidbey H, Sabra R. The article is published in the Postgraduate Medical Journal and has the following DOI: 10.1136/pgmj.2005.042713, PMID: PMC2563770, and a length of 462-4. What are the significance of research credentials in medicine? [30] Gadit AA. "Journal of the Pakistan Medical Association" 2008; 58: 93-94.

Reference: 18333532
Yousefi-Nooraie R, Shakiba B, Mortaz-Hedjri S, and Soroush AR were the authors of the study (31). Where do faculty and postgraduate medical students get the information they need to do clinical practice? A conceptual map. The article "J Eval Clin Pract" was published in 2007 and can be found on page 564-564.

Reference: 17683297
The authors of the cited work are Ejaz K, Shamim MS, Hussain SA. Participation in studies by current and recent medical students and residents of Karachi, Pakistan. Pakistan Medical Association Journal, 2011;61(2):115-20.
Reference: 21375155

Bibliometric examination of homeopathic research from 1991 to 2003: a review by Chiu WT and Ho YS. Scientometrics 2005;63(1):3-23.

Arya JS, Choubey G., Kundu B., Mondal R., Purkait R., Koley M., Saha S., Ghosh S., Mukherjee R. Studying how happy patients are with their care in a public homeopathic hospital in India's West Bengal state. Applied Journal of High