Review Article

Fundamentals required for foundation of a noteworthy PhD in biomedical sciences from Pakistan

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Abstract

There are only a few Doctors of Philosophy (PhDs) in Biomedical Sciences from Pakistan and there are a number of misconceptions in our country regarding them. This may be due to a lack of knowledge regarding the existence of available programmes or a lack of will or interest in acquiring such a degree. While several PhD programmes exist all over the world, such programmes are lacking in our region even though the Higher Education Commission (HEC) is trying to promote PhD through multiple means and resources. This review discusses the concepts of academicians and clinicians about a PhD, especially in Biomedical Sciences; importance of such a programme; whether Pakistan should have this programme; state of current PhD holders and companies that employ them in well-developed countries e.g. the United States of America. At the same time it also emphasises the need for supervisors to be interested in and promoting availability of PhD programmes, and recognising that there are very few qualified supervisors who have a research experience at an international level.

Keywords: Researchers, Pakistan, Physicians.

Introduction

What is a PhD (Doctor of Philosophy) in Biomedical Sciences?

The concept of PhD is one that is still largely misunderstood, even by educated professionals. The purpose of this review is to clear the cloud of confusion that surrounds this highest level of educational degree worldwide.

A PhD is a Doctor of Philosophy, it can be obtained in any field ranging from Arts and Humanities to Finance to Physical and Medical Sciences. This degree is an advanced postgraduate programme involving three or sometimes more years of research with the support of an academic supervisor, on an original topic related to a field of the candidate's choice which should make a significant contribution to pre-existing knowledge.[1] It is an academic degree usually acquired after a Masters degree — such as MPhil or MSc — in the subject through intense high-quality research. The degree-holder is considered a teacher and researcher in the field of his/her PhD. However, Masters or PhD in medical specialties do not provide clinical training.

Physicians from various specialties may obtain a PhD related to the field of Biomedical Sciences, generally labelled as Medicine, but can include any of the following disciplines: gastroenterology, hepatology, paediatrics and public health, etc. Physicians pursue a PhD mostly to enhance and improve their careers in terms of research and academics. The research bench work done by them is a full-time, fully paid involvement or a part-time one, along with continuation of their routine clinical work, depending upon the programme offered by the university. Some clinicians may work full time at the research laboratory (bench work) while taking a break from their clinical responsibilities completely and pursue their PhD with more zest and focus, provided adequate funds are available from the university concerned or outside sources. Most universities offer a PhD in Biomedical Sciences which is recognised nationally and internationally. Biomedical Sciences involve basic, applied and translational research. In the translational research, basic biomedical research is linked with clinical research, and performed at some university hospital. Such patient-oriented studies in university hospitals are coordinated by the Clinical Trials Centre (CTC) of those institutes.[2,3]

Clinical PhD programmes all over the world

A PhD in Clinical Sciences (Biological Sciences) is offered all over the world, and some areas worth mentioning include Europe, United Kingdom (UK), Belgium, Germany, USA and Malaysia. In the UK, for example, the National University of Ireland offers a PhD in various specialties, including that of paediatrics.[4] It is not easy to enrol in the required programme as scholarship is not easily available to everyone and the programme itself is expensive, especially for a candidate from a developing country.

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Certain colleges offer a Doctor of Medicine (MD)/PhD programme so that the total time duration may range from 8 to 9 years of training, with initial MBBS/BSc Medicine or Graduate Medicine. The course consists of three years of research taken either after completion of BSc for those following the six-year programme or after the second year of the graduate programme.[5]

Others offer PhD in clinical specialities such as paediatrics, hepatology, etc.[6] The PhD offered by various countries[2] requires funding and availability of a competent and humane supervisor after all the pre-requisites of the concerned university have been met.

Universities in Europe[3] offer PhD as the highest qualification for individuals with a baseline medical degree such as MBBS. In Europe to become a professor, it is essential that the concerned physician holds a PhD qualification. Various multi-disciplinary areas are offered which may include the candidate working in both a major hospital and doing bench work in an affiliated lab of the university hospital. Biomedical Sciences at the Katholieke

Table-1: Common misconception of medical professionals depicted in a table.

S#	Question	Prof.			Assistant Prof			Assoc. Prof			Registrars			Lecturer			Demonstrator			Post-graduate		
		Y	N	Dk	Y	N	Dk	Y	N	Dk	Y	N	Dk	Y	N	Dk	Y	N	Dk	Y	N	Dk
1.	Have you heard of Ph.D in Bio Medical science	6	2	0	9	7	0	7	3	2	2	4	0	1	0	0	3	4	0	25	06	0
2.	Are you aware of anyone who has a Ph.D. in biomedical sciences	4	4	0	5	10	1	4	6	2	0	6	0	0	1	0	3	4	0	9	22	0
3.	Is it a waste of time doing a Ph.D.	2	6	0	3	13	0	1	10	1	1	5	0	0	1	0	0	7	0	2	29	0
4.	In your opinion after doing a Ph.D.																					
	Improves you as an academician	7	0	1	15	1	0	10	1	1	5	0	1	1	0	0	7	0	0	28	01	2
	Improves you in research	7	0	1	15	1	0	9	1	2	4	0	2	1	0	0	7	0	0	29	00	2
	Improves your patient care	6	0	2	11	4	1	9	2	1	4	2	0	1	0	0	6	1	0	19	10	2
	Helps you get national and international fame	6	0	2	14	2	0	9	1	2	3	1	2	1	0	0	5	2	0	23	06	2
	Gives better job prospects	7	0	1	15	0	1	10	1	1	5	0	1	1	0	0	7	0	0	27	03	1
	Increase pay scale	6	1	1	16	0	0	10	1	1	3	1	2	1	0	0	6	1	0	22	07	2
5.	How many years does a PhD require																					
	<1 Year	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	2	0	0
	1-2 Years	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	5	0	0
	2-3 Years	1	0	0	3	0	0	2	0	0	4	0	0	0	0	0	1	0	0	9	0	0
	3-4 Years	3	0	0	8	0	0	3	0	0	0	0	0	0	0	0	3	0	0	7	0	0
	>4 Years	4	0	0	4	0	0	4	0	0	1	0	0	1	0	0	2	0	0	8	0	0
6.	Ph.D. student in Biomedical sc. can examine patients in clinic?	5	3	0	4	11	1	6	4	2	2	4	0	1	0	0	3	4	0	10	19	2
7.	Do you know what is:																					
	Basic Research	8	0	0	12	3	1	10	1	1	3	2	1	1	0	0	6	0	1	21	07	3
	Translational Research	4	1	3	4	9	3	6	4	2	2	2	2	0	1	0	2	4	1	8	18	5
	Applied Research	5	1	2	9	7	0	8	2	2	2	3	1	1	0	0	4	2	1	15	13	3
8.	Does HEC offer a Ph.D. in Biomedical Sciences?	5	0	3	6	4	6	6	4	2	5	1	0	1	0	0	2	2	3	20	10	1
9.	Does HEC give added Income/benefit to and individual with a PhD?	5	0	3	9	4	3	8	3	1	2	4	0	1	0	0	2	3	2	15	15	1
10.	Does CPSP recognize a Ph.D. (in biomedical sciences) from a international university	2	2	4	6	6	4	5	4	3	3	3	0	1	0	0	1	3	3	11	17	3
11.	Does PMDC recognize a Ph.D. in biomedical sciences	3	0	5	9	4	3	8	1	3	2	4	0	1	0	0	2	2	3	18	11	2
12.	Is it beneficial for Pakistan to have quality Ph.D. in Biomedical sciences	7	0	1	15	1	0	9	1	2	6	0	0	1	0	0	6	0	1	27	04	0
13.	Maximum number of Ph.D. in Biomedical sciences are present in																					
	Pakistan	1	0	4	0	0	3	1	0	5	1	0	2	0	0	0	0	0	4	7	0	8
	India	2	0	0	5	0	0	4	0	0	3	0	0	1	0	0	3	0	0	13	0	0
	Nepal	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bangladesh	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Malaysia	1	0	0	5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0
	Iran	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	Afghanistan	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14.	Should there be a Ph.D. programme in Pakistan	8	0	0	13	1	2	9	2	1	5	1	0	1	0	0	6	0	1	30	01	0
15.	Should it be mandatory to do a Ph.D. in Pakistan to become a senior faculty	6	2	0	7	8	1	9	2	1	2	4	0	1	0	0	5	1	1	20	0	11

Universiteit Leuven (KU Leuven),[7] Belgium, has three faculties, which include Medicine (covering all sub-specialties), Pharmaceutical Sciences and Kinesiology.

The National University of Singapore launched a MBBS-PhD programme in 2005 to encourage medical students by integrating clinical and research training as a way to nurture clinical medicine and bring advancements in applied research. It aims to train clinical-scientists who will solve biomedical problems with research initiatives. Successful students can pursue a career in a range of arenas from medical research to the biotechnology industry.[8]

Role of the Higher Education Commission of Pakistan in PhD of Biomedical Sciences - Requirement for general faculty

The requirements set by Higher Education Commission (HEC) of Pakistan for enrolment as a PhD student are available on their website.[9] The HEC also offers scholarships for the programme and funding for the students. The pre-requisites required for the programme are also available. The clinical students and physicians who enrol for this programme generally find it to be extremely difficult in the long run. The reason being that the research background of these individuals is very weak compared to those from the basic sciences or students of Molecular Biology, etc., who have spent their entire career in a competitive atmosphere that is conducive to bench-work-related research. Although these physicians are excellent in their own field in terms of patient care, they have had no interest or prior experience in research work, especially senior physicians. The common concept of a PhD holder is mostly of someone who can do only statistics as experienced by the author. Also, for them their clinical degree is the highest degree attainable and a PhD is something sort of mundane; not required for their career or in other words, they are content with their lives and private consultations with minimal interest in their personal educational development. All consultants are not of the same opinion. However, the majority have the concepts of PhD described above. For this purpose, we also conducted a survey (Table-1).

There are other clinicians who say that they can do and publish research without a PhD and do not require a PhD to attain fulfilment in their career; some of them may in fact have sufficient research papers that have an excellent impact factor as well. In some cases the publications might only be a requirement of the university, where they are working, and not necessarily their personal goal. The medical universities of Pakistan have to this day not insisted on pursuing a PhD in addition to a basic clinical degree like, a Fellowship of the College of Physicians and Surgeons (FCPS) for becoming a professor. The reason being that there is lack of coordination and similar objectives between the College of Physicians and Surgeons Pakistan (CPSP), Pakistan Medical and Dental Council (PMDC) and HEC and hence the confusion or rather a lack of focussed approach at the national level.

Evidence

Number of clinical PhDs as per HEC at present in Pakistan

HEC took on the challenge of collecting and compiling the number of PhD degrees awarded every year since 1947 by various universities (Table-2).

The highest number of PhDs produced over the years was 872 by Karachi University in the public sector, and 47 by National College of Business Administration & Economics, Lahore, in the private sector.[10] It is astonishing to see that the passage of years, has not necessarily translated into a great increase in PhDs compared to degrees in other fields. This may highlight some of the pre-existing notions about pursuing this degree in Pakistan.

Table-2: Total number of PhDs produced from 2010-2014.[10]

	2010	2011	2012	2013	2014
Public Sector	775	952	1038	1142	1248
Private Sector	57	72	80	69	103
Grand Total	832	1024	1118	1211	1351

The scarcity of PhD holders in medical sciences has been noted elsewhere by Memon[11] who discussed the difficulties faced in medical education because of the near extinction of PhD in anatomy in Pakistan, standing at an appallingly low count of only four nationwide.

Subject and Methods

We obtained first-hand data from faculty and students of different public and private medical universities in Karachi, Pakistan, including Karachi Medical and Dental College, Dow University of Health sciences (DUHS), Jinnah Sindh Medical University (JSMU) and Ziauddin University (ZU), of which only DUHS and ZU offer PhD programmes. We designed a questionnaire with 21 close-ended questions assessing the existing thinking/opinion about a PhD in Pakistan. This survey was the first of its kind, according to our knowledge, to be conducted in a major city of Pakistan. Data was collected from 81 participants from January to August 2016. It was a blinded survey;

participants were not required to write their names or university names on the questionnaire; only their category title was inquired. All the participants belonged to one of the following categories: Professors, Assistant Professors, Associate Professors, Registrars, Lecturers, Demonstrators, and Postgraduate Students. The number of respondents in each category and their responses were noted (Table-1).

Claim
Concept of clinicians in Pakistan about PhDs

A PhD is still an alien concept for many people and is surrounded in a shroud of mysticism. Many do not even know a PhD in Biomedical Sciences exists or can be pursued by clinicians. Astonishingly, some medical professionals still believe that a PhD takes over 5 years of study, and are unsure of how it works and deem it an unattainable educational degree. They believe that is not recognised by the PMDC, might not necessarily lead to salary increments or does not improve a clinician in any way. Many physicians still believe that a PhD is not an actual doctor, the word they should be using, however, in this scenario would be 'healer'. Although this belief is not justified because a biomedical sciences PhD spends years of his or her life working on an original research idea that makes significant advancements in the field of medicine. The results of these researches often benefit in developing a new technology or cure that physicians then go on to apply into their clinics and hospitals. A quick search on the internet will show examples of this. Recent stem cell studies being investigated in many foreign universities, which are also sourcing out good researchers from other countries such as ours to participate in them, have a potential to treat multitudes of diseases that currently have ineffective or long-term cures. Similarly, nearly all current treatment procedures or medicines were once the subject of research such as vaccines and surgical techniques, and undoubtedly had a lot of contribution from PhD holders of different fields.

Another common belief of medical professionals is that a PhD should not be a compulsory requirement to become senior faculty, such as a professor, and this might owe to the misconceptions about the number of study years involved (Table-1), and the general confusion that surrounds the degree. It is also astonishing to see a large number of medical students and physicians alike think that a PhD student in Biomedical Sciences cannot examine patients in a clinic, whereas, no such compulsion exists anywhere else in the world. The majority also does not have any idea about what applied research or translational research are.

Reason
Statisticians not Clinicians; they think FCPS is better

Some Pakistani physicians believe that being a Member of the Royal College Physicians (MRCP) or Fellow of the College of Physicians and Surgeons Pakistan (FCPS) is more prestigious than being a PhD. They believe a PhD is only a goal for statisticians or doctors who want to become teachers at a university. This stems from the lack of awareness about a continuation pathway uniting both practice and research in any field of medicine.

Discussion
Should Pakistan have a clinical PhD?

Yes, owing to the worldwide trends in medical and health education and the rate at which universities all over the world are adapting to biomedical sciences PhD programmes,[12] it is high time we do too. The need for this is derived from the fact that just FCPS or MRCP or Member of the Royal College of Obstetricians and Gynaecologists (MRCOG) or Fellow of the Royal College Physicians (FRCP) etc, does not necessitate a clinician to focus on research, and to homogenise and streamline our system of healthcare provision as per international standards we must match their educational standards. Without thorough investigations, changing scenarios linked to diet and lifestyle, treatment procedures and plans, surgical outcomes and development of new medicinal compounds this does not seem like a likely event. The process of developing a thought-provoking idea and producing an authentic dissertation also considerably builds a physician's individuality, giving them an upper hand over the others. The thesis or dissertation written by a FCPS student does not always require research papers and duplicate topics are produced and written, as the CPSP requires that a topic can be chosen from his/her institute, provided it has not been written in the last five years.[13] However, if a topic has been written from another institute in the same city recently, it is still acceptable to use the same topic for one's own institute for FCPS dissertation. Therefore, there is nothing unique in the published dissertation, which lies on the shelf of the candidate concerned or in the CPSP. Also, it has been the observation of the author during her years of experience that it is done very half-heartedly by the candidate. Most supervisors are also not interested in this part of the training of the candidate and consider it a waste of time.

Clinicians who have an additional qualification in, for example, a research degree such as MS or MD e.g. in epidemiology (one-year course) related to their sub-speciality can become better academicians, and are likely

to have a better grasp of writing and conducting research projects and teaching their students how they should conduct them. Such clinicians generally have more publications of international standards, especially if they have had an international exposure in terms of course studies involving their postgraduate qualifications and training.

Furthermore, another concept that is completely unheard of in Pakistan is one of PhD-holding nurses. Generally, all PhD students are caught up in a tension of the shift from a clinical expert's identity to a research scientist; the transition of a nurse's role into a scientist should be for the purposes of cultivating a spirit of inquiry and acquiring scholarly skills, and needs to be supported from the beginning.[14]

Fundamentals required for a PhD

A good supervisor will always advise his students to carry out an extensive literature search, focusing on quality over quantity, and include many citations. Arora, et al. investigated the degree of influence these three factors make to build a good researcher, coining a term 'author citation networks', including highly-ranked authors' collaborations and citations while comparing them with standard citations by other authors.[15]

A successful PhD student is determined by I-determinants, as registered by Sorenson.[16] They include an obvious Interest in the PhD programme; an Incentive, an Idea of what they want to investigate; Initiative, and high personal Integrity and good Interpersonal skills. He further lists Implementation ability in terms of being able to implement decisions, Identity, Independence, Image, Innovative and Important topics, In-depth knowledge of the research topic, being Interactive and Integrated with the scientific community, and being Internationally-oriented as factors to turn a researcher into a leader.

The state of current PhD holders in Pakistan and the need for Authenticity

Mass production of PhD compromises quality; a phenomenon being experienced in many top-tier developed countries with renowned PhD programmes.[17] The story in Pakistan is, however, somewhat different. As PhDs become more mainstream companies start turning to quality-branded institutions while assessing candidates for employment. In Pakistan, however, the small number of PhDs allows them to enjoy the benefits of being a minority.[18] The foundation is laid early on in the career as many PhD thesis are often uninteresting and frequently based on trivial subject matter. Professors holding PhDs wear them pompously like a medal of honour and are highly paid. A small number of genuine academicians in the country mean few academic policemen, hence publications are built upon internet-sourced data, plagiarism is spreading like plague, and thesis reports are frequently doctored.[17,18] There is a strict requirement for transparency and ethical committee should be functioning in every programme to evaluate manuscripts before publishing; a small number of PhD holders in a country should not in any way validate handing out substandard degrees.

A comparison of PhD holders in Europe

In 2014, there were an estimated 738,000 PhD students in Europe. Women made up a slightly less than half of this number at 46%, and the overall number of PhD students in science-related fields of study surpassed all other non-European countries including superpowers USA and China.[19]

However, a study conducted by Muijrers[20] signified a disparity in evaluation procedures at different European universities that is taking a toll on their students; some of them being given a minimum requirement to publish at least five papers to qualify for a PhD, favouring quantity over quality. In addition to this, there is too much control by the research supervisor over how long they spend in the programme, and lack of effective guidance. This leads to too many boring and useless PhD projects and hurt the morale of the students who are often stuck in the programme for seven years or even more.

Jacobs[21] effectively argues that in an attempt to becoming perfect, supervisors have taken over the projects of PhD students. These programmes should rather train their post-doctorate students to take setbacks in their stride and undertake risky, original projects instead of worrying about research productivity.

A quick comparison of PhD holders in the USA

Contrary to Pakistan, the physicians in the United States have proceeded towards acquiring PhDs at such a rate that there is currently an imbalance of the reproductive equilibrium i.e. the reproductive capacities of tenure-track professors exceed the balanced quotient of 1. At an explosive rate of 6.3 per tenure,[22] PhD-holders are competing in the ratio of 6 to 1 for one tenure position at an institute, resulting in various other challenges such as new PhDs having to take temporary and lower-paid positions in academia, pursuing their futures outside academia, or migrating to other countries. In the land of opportunity, better known as the US, migration is not the desired plan of course for more than 95 per cent of PhD graduates. In other words, at the current birth rate, for every new biology and biomedical science PhD who

secures a tenure-track academic position there are at least another 5.3 who should consider pursuing other opportunities, making up an astounding 84 per cent of new PhD graduates.

The overflow of these PhDs into other lower-wage research positions in the industry and research centres creates a positive feedback effect. Positions that did not require higher-level degrees are occupied by highly trained PhDs that could have otherwise been filled by a bachelor's or master's degree holder, as companies benefit from this low wage requiring, highly advanced workforce. However, this leads to individuals deeming a higher education even more necessary in order to secure credentials for a position that was ironically more suitable for a degree lower than PhD. The reason more PhD holders consider stepping down the work-ladder in this manner is to gain more research experience, publications, and increase their chances of landing a tenure-track position; leading us back to square-one.[23]

A study conducted in Latin America showed that despite an impressive growth in the number of PhDs in Latin America, a concomitant growth in scientific fields by Latin Americans has not occurred.[23] This means that a perceived 82% lack of employment of the respondents and unsatisfactory government policies are the culprits.

Why does a person want to pursue a PhD degree?

The reasons for pursuing a higher education degree are simple; a person looking to cultivate excellence, impelled by a spirit of curiosity and wishing to rise above mediocrity may choose to pursue a high-level degree. A student on a mission for new information and new approaches to deal with disease, diagnosis, treatment, and prevention, as a physician-scientist who commits a great amount of his or her time with zeal to this learning opportunity than to routine clinical care may also choose to chase a PhD.[24] Other reasons could be aiming for employment by academic medical centres, universities, research institutes. Or he/she could be a person who values creating a link between medical training, clinical skills and research skills to become someone who would guide others in ways that a non-physician scientist could not.

Some programmes offering PhD opportunities such as those existing at National Institute of Health (NIH) are highly coveted positions because they provide full tuition and stipend support to their trainees and it usually plays an important role in helping students from developing countries such as ours to decide their future path.

Availability of qualified supervisors

An academic department's expertise, dedication and meticulousness shape the growth and productivity of PhD students. Several studies highlight the importance of a positive co-author experience with the supervisor and learning research management skills through guidance as important in academics and knowledge production.[25-27]

Jacobs has mentioned several flaws that, if present in a supervisor, can lead to an obedient PhD without much independent thought or inventiveness.[21] A PhD is often seen as tangible proof of the researcher's ability to execute a seamless experiment, but since a supervisor's own success is assessed by the outcome of his post-doctorates, the PhD students often receive a tailor-made research plan with a set of instructions to follow religiously. Changes in these patterns would require funding and commitment to the cause.

A study conducted in Asia examined the link between research productivity, doctoral mentoring practices, and doctoral research experiences of mentees in PhD programmes.[28] It was observed that the burden of writing the manuscript fell to the mentee in co-managed projects with their supervisors.

HEC has published a list of requirements that should be fulfilled by supervisors of all disciplines to avoid exploitation of students by a person in command. It guarantees that each student is paired with a competent guide.[29]

Funding agencies/resources

There are several funding agencies in Pakistan that encourage medical professionals to pursue a PhD in biomedical sciences, some of them being United Nations Educational, Scientific and Cultural Organisation (UNESCO),[30] United States Agency for International Development (USAID), etc.[31]

HEC also provides scholarships and grants[32] to encourage more people to take this route.

Conclusion and Recommendations

The fundamentals required for a sound foundation of a noteworthy PhD in Biomedical Sciences requires well-qualified, dedicated PhD supervisors available locally, with availability of proper infrastructure and experience in clinical research. In addition, universities having a PhD programme should have a standard curriculum supported by HEC, PMDC and CPSP with clear objectives for the candidates. Quality and quantity of PhD in the country should be emphasised with full scholarships offered to the candidates. It is suggested that after MBBS

academicians interested in working at a university hospital may do FCPS, MRCP, FRCS, MD followed by a PhD and a post-doctoral scholarship be given to them in a developed country to give exposure according to international standards. The latter is a must, without which they cannot develop the distinction required for an international calibre PhD.

Disclaimer: None.

Conflict of Interest: None.

Funding Sources: None.

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