

## EVALUATING PHYSICIAN PERSPECTIVES ON BIOCHEMISTRY AND GENETICS: IMPLICATIONS FOR CURRICULUM REFORM AND CONTINUING EDUCATION

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### ABSTRACT

A number of studies have pointed out that many physicians hold a negative view of biochemistry and genetics. Many medical schools now follow a system-based curriculum that is enriched by connections to clinical practice. Even though this strategy is embraced across medical education, there aren't many studies measuring doctors' views on biochemistry and genetics. This study set out to judge physicians' attitudes about biochemistry and genetics, along with how their education in these topics matches what they see in practice. A group of randomly chosen 616 physicians located in both private and public settings was tested using a structured survey containing 40 different statements. The participants had earned medical degrees, locally or abroad and consisted of interns, residents and experts. More than half of students accepted that both biochemistry and genetics are hard topics and placed them among the subjects they preferred the least (59.1%). At the same time, more than half of the sample were comfortable with recent discoveries in biochemistry and genetics and recognized their application in the clinic (64.0%). A large number of participants thought that adding biochemistry and genetics to clinical courses would encourage students to try harder (74%). It was shown through univariate analysis that residents knew more and held more positive views than others about biochemical changes in diseases and new advances in biochemistry and genetics ( $P < 0.05$ ). Increased years of work experience or being part of the private sector boosted the positivity of physicians about these medical specialties ( $P < 0.05$ ). Physicians had a positive attitude about biochemistry and genetics. People who are residents, who have been in the field for more than five years and who work in private healthcare are especially likely to feel this way.

### INTRODUCTION

Medical schools include biochemistry and genetics as important subjects [1]. They seek to explain the operations of living things at the molecular level and to map various metabolic and signaling pathways inside cells as conditions change [1].

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This kind of understanding helps make sense of the reasons for a wide range of medical conditions. Furthermore, it provides the foundation for designing new ways to treat diseases and for finding biomarkers that make it easier to spot and monitor health problems early [2]. Because of next-generation sequencing and improvements in gene therapy, both have become key areas in medicine today [3]. Once only understood on a theoretical level, personalized medicine and pharmacogenetics are starting to be used widely in



clinical care [4]. Unfortunately, there are still important gaps in knowledge about biochemistry and genetics among most general doctors practicing medicine [5–7]. This issue has been linked to three reasons: (a) the usual teaching methods in medical education being generic and uninteresting, (b) many biochemistry and genetics curricula relying mostly on difficult facts and hard concepts and (c) a widespread belief among medical graduates that what is learned in biochemistry and genetics is irrelevant for their career [8-10]. Together, these things can make medical graduates think less positively about certain specialties. Surprisingly, many physicians seem to develop a stronger interest in biochemistry and genetics once they have graduated from medical school [11, 12]. Even so, students now report feeling that they should have learned more at the beginning [11]. It suggests that how biochemistry and genetics are taught should better align with lessons later in training or used in work or research to change physicians' feelings about these subjects [13]. Students at most medical schools are able to start their medical degrees straight after secondary school, without first getting a premedical degree [14, 15]. At the start, students learn basic biochemistry and genetics subjects separately within these curricula. Starting at the end of the second year and continuing in the third year, all subjects are introduced together in a module format targeting one organ system per module. Previously, both biochemistry and genetics were offered as separate subjects covering the first three years of the curriculum, but this model was recently replaced as integration became the main approach [14, 15]. This means that practicing physicians experience teaching that is either standalone or uses modules around different systems in the body. In addition, many physicians in the country have graduated from universities in other nations [16]. Therefore, healthcare professionals come from backgrounds that include a variety of educational methods taught in basic medical sciences at different points in history and in different places. Despite the different ways physicians have been trained in biochemistry and genetics and the known variation in views, there isn't much research on how these fields are viewed by physicians. With an aim to address this, the present research evaluated what physicians at different levels of training and experience know and think about current developments in biochemistry and genetics. In addition, the study looked at the courses offered in biochemistry and genetics in medical schools and how much they match clinical practice.

## **MATERIALS AND METHODS**

### **Study Design**

This work adopted a cross-sectional approach. The project started after ethical approval and funding were granted from the Research Deanship (approval number 368/2016) and data were taken from the national medical association database for identifying interns (senior medical-training students), as well as residents and experts from the areas of gynecology, pediatrics, endocrinology and internal medicine. The database allowed us to take a random sample of 710 physicians (with interns, residents and specialists included) from several regions—northern, central and southern—using their registration numbers. According to the selection criteria, we invited 616 physicians, choosing those who: (a) qualified with an MD or MBBS between 1985 and 2016 and (b) had not attended advanced training in biochemistry or genetics, including postgraduate diplomas, MSc, PhDs, board certifications or CME courses beyond six credit hours. Over the course of January to July 2016, the study was conducted using face-to-face interviews, with two residents from the university hospital's public health residency carrying out those interviews. All participants were told what the study was about before giving their consent in writing which was fixed to the front page of the survey. The final number of completes for the survey was 514, making for an 83% response rate. Most of those who said no mentioned their busy lives or uninterested attitude toward the subject. Because most non-respondents were in the south, information from this region was not factored into the analysis.

### **Study Questionnaire**

A structured questionnaire consisting of 40 statements was developed and organized into four distinct sections. These sections aimed to evaluate physicians' attitudes and perspectives regarding: (a) the incorporation of biochemistry and genetics concepts into clinical practice (Table 2), (b) recent developments in molecular medicine (Table 3), (c) the importance of ongoing education in biochemistry and genetics (Table 4), and (d) the current level of knowledge in biochemistry and genetics among medical students (Table 5). The initial questions for each section were drafted by graduate students and subsequently refined by three faculty members from the Department of Physiology and Biochemistry at a university, each contributing their expertise in their respective fields. A senior statistician reviewed the survey to ensure clarity, content validity, and adherence to ethical standards. A pilot study involving 82 participants was conducted at a university-affiliated hospital to evaluate the survey procedures and assess the questionnaire's clarity. Following the pilot, the questionnaire was revised accordingly to improve its effectiveness.

### **Data Collection and Analysis**



We used IBM Statistical Package for the Social Sciences (IBM-SPSS) version 22 (Armonk, NY) to explore the data. Every variable used in this study was a categorical one. A breakdown was made by looking at practice region (central or northern), employment sector (private or public) and the institution that awarded the participants their MD or MBBS (domestic or international). The researchers then crossed the categories with each person’s professional status (intern, resident or specialist). For each of the two questions, we determined the number of times students responded ‘Yes’ along with the number of ‘No’ responses. Statistics were used to check if there was a difference in responses as a result of practice region, employment sector, degree origin and professional title. To complete multivariate analysis, participants’ ratings of each statement were recorded using a 5-point Likert scale. An average attitude for each domain was determined by adding all the responses (from 1 to 5) and dividing by the number of questions, with a higher result representing a better attitude. A general linear model (GLM) was used to assess the way different factors influenced mean scores. If the P-value was under 0.05, it was thought to be statistically significant.

**RESULTS**

The demographic information about those who took part reflects a good range of hospital and office locations, where people were trained, types of employers and levels of seniority. About three-quarters of interns,

four-fifths of residents and two-thirds of specialists were practicing health care in northern areas. A majority of participants got their medical degrees in their native countries in every professional group. Out of the 100% of intern, almost 80% of the specialist and above 80% of the whole population of residents, were connected to government jobs. The majority of physicians in the country worked for either the Ministry of Health or the Royal Medical Services which together comprised the main public hospital entities. When attitudes are analyzed toward various topics in biochemistry and genetics, clear trends appear. The place where physicians practiced showed little effect on their attitudes; except that there were subtle differences between the center and north regarding integration and molecular medicine progress. Similarly, the place where doctors graduated didn’t seem to have a big effect on their opinions. Despite this, job title did little to change attitudes and residents generally showed better results. The type of job people had had a strong relationship with people’s attitudes in nearly all domains. Private sector physicians tended to be more positive about the integration of biochemistry and genetics, progress in molecular medicine and ongoing learning, than their colleagues in public institutions. Those who had worked in the military for at least five years were more likely to view integration and lifelong learning in a helpful light. It becomes clear that while where one lives and their alma mater matter somewhat, a physician’s environment and years of experience really determine their views on essential biomedical topics.

**Table 1: Sociodemographic characteristics of the participants**

	Interns, N (%)	Residents, N (%)	Specialists, N (%)
Location			
Northern	120 (72.5)	185 (68.0)	45 (60.0)
Central	45 (27.5)	87 (32.0)	30 (40.0)
Country of MD or MBBS			
Domestic	135 (81.2)	210 (77.2)	55 (73.3)
Others	31 (18.8)	62 (22.8)	20 (26.7)
Employment sector			
Private	5 (3.0)	40 (14.7)	10 (13.3)
Public	160 (97.0)	232 (85.3)	65 (86.7)
Public hospital affiliation			
Royal Medical Services	60 (36.4)	70 (25.7)	55 (73.3)
Ministry of Health	105 (63.6)	202 (74.3)	20 (26.7)

**Table 2: Multivariate analysis of variables associated with the attitude of physicians toward the integration of biochemistry and genetics into clinical practice, advances in molecular medicine, the need for continuous education, and medical students’ knowledge on biochemistry and genetics**

Variable	Attitude toward the integration of biochemistry and			Attitude toward contemporary advances in molecular			Attitude toward the need for continuous education in			Attitude toward medical students’ knowledge on		



	genetics concepts into clinical practice			medicine			biochemistry and genetics			biochemistry and genetics		
	Mean	SD	P	Mean	SD	P	Mean	SD	P	Mean	SD	P
Location			0.832			0.412			0.275			0.398
Central	4.12	0.38		3.88	0.53		3.72	0.49		3.74	0.50	
Northern	3.98	0.44		3.82	0.61		3.84	0.59		3.69	0.54	
Country of graduation			0.245			0.699			0.782			0.812
Domestic	3.99	0.43		3.84	0.59		3.75	0.55		3.71	0.52	
Others	4.15	0.39		3.77	0.49		3.62	0.57		3.68	0.48	
Job title			0.184			0.140			0.113			0.732
Intern	3.91	0.35		3.70	0.54		3.60	0.50		3.62	0.51	
Resident	4.11	0.47		3.90	0.62		3.80	0.61		3.75	0.53	
Specialist	3.95	0.52		3.68	0.58		3.59	0.61		3.69	0.54	
Employment sector			0.003			0.037			0.001			0.504
Private	4.22	0.57		3.95	0.74		4.15	0.54		3.88	0.59	
Royal Medical Services	3.89	0.48		3.72	0.55		3.58	0.59		3.65	0.54	
Ministry of Health	4.03	0.42		3.84	0.51		3.70	0.52		3.70	0.49	
Years of experience			0.011			0.089			0.075			0.298
<5	3.96	0.39		3.83	0.54		3.72	0.57		3.67	0.51	
≥5	4.08	0.49		3.81	0.59		3.69	0.60		3.72	0.54	

Figure 1: Medical Participants Demographics, Comprehensive Sociodemographic Analysis (Total n=512).



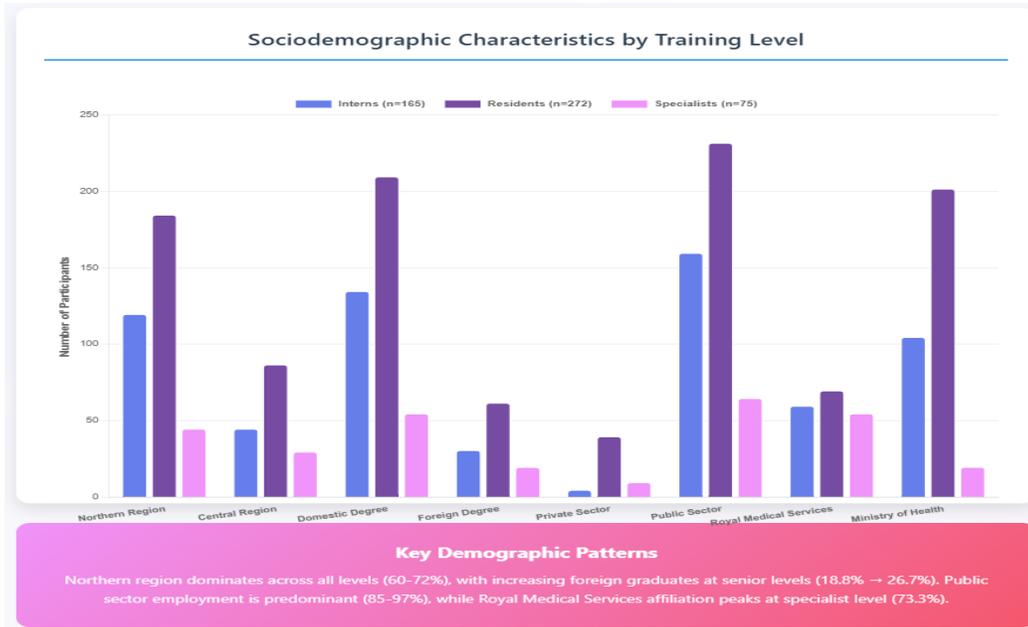
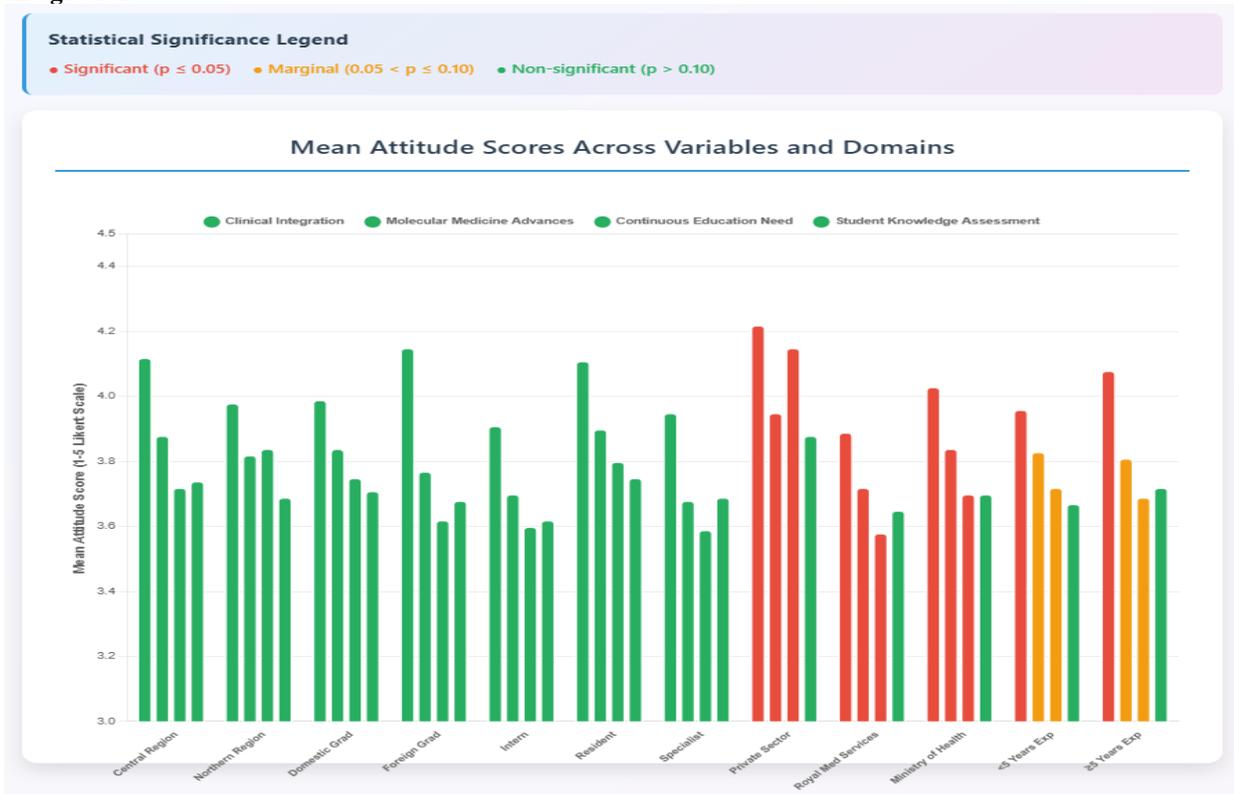


Figure 2: Physician Attitudes Analysis, Multivariate Analysis of Attitudes Toward Biochemistry and Genetics Integration.



## DISCUSSION

This survey's results demonstrate how physicians with diverse backgrounds feel about the content of biochemistry and genetics and compare it to what is used in clinical settings. It is hoped that the

findings will help guide medical teachers and policy leaders as they look for ways to enhance current teaching of biochemistry and genetics. Remarkably, more than half the physicians indicated that they were familiar with how biochemistry and genetics have impacted recent



changes in medicine. Personalized medicine, genome-wide studies and pharmacogenetics were concepts about which physicians were aware. It was also clear that many physicians consider biochemistry and genetics important for modern disease diagnosis and treatment choices. Nevertheless, a lot of these physicians were not eager to make use of clinical biochemists for these purposes. The reason for this reticence might be (a) that few certified professionals in clinical biochemistry work within the healthcare system and (b) because there are no national programs or fellowships in clinical biochemistry. As a result, physicians are rarely used to including clinical biochemists on their teams. The survey achieved a good response rate of 83%, except that most nonrespondents were from the south, where non-private facilities dominate healthcare provision. Heavy patient workloads in these places may have stopped physicians from taking part. As a consequence, data from the region was not included in the final review of results. At present, medical schools introduce basic biochemistry and genetics first and later combine them with other subjects. While the areas are changing, the majority of respondents consider these subjects are not covered thoroughly. Experts pointed out that including more clinical examples in the curriculum would be helpful, based on what researchers had found in similar studies. Changes in what students study have not been paired with changes in teaching which largely involves speaking at students with little opportunity for them to actively participate. According to the univariate analysis, residents commonly had better attitudes and more knowledge about biochemical processes related to disease compared to the other groups. People in the area took advantage of continuing medical learning opportunities. It may be that they stay in the same specialty for longer because their profession is highly competitive, so they must keep up with new advancements. Multivariate analysis showed that physicians practicing in private clinics had better attitudes toward biochemistry and genetics when it came to necessary continuous education, compared to those practicing in the public health system. Because public-

sector doctors may have more responsibilities or less motivation to keep learning, this difference can arise. If supported by further research, the results could push policymakers to allocate more resources to helping public healthcare providers better use new insights from biochemistry and genetics in their day-to-day practice and studies. The researchers encountered several challenges during this study. Since results from southern areas lack data from physicians, the survey cannot be applied equally to the whole country. To get a better picture, we first need to do a nationwide study. Also, participants' opinions toward biology were taken at face value and their actual understanding of genetics and biochemistry was not objectively checked. Glowing responses to a few questions might have biased the study's results. Even so, this investigation is the first in the region to look at this topic and gives essential information for medical educators because of its structure and participant number.

## CONCLUSION

In summary, physicians—particularly residents—demonstrated a generally favorable attitude toward biochemistry and genetics. Nonetheless, they expressed the need for further reform of the medical school curriculum to enhance student engagement in these subjects. Such reform should incorporate more interactive teaching methods that promote active problem-solving and introduce clinical case scenarios early, prior to bedside training. Additionally, greater recognition of the clinical biochemist's role in patient care may be fostered through the establishment of national certification programs in biochemistry and genetics. The multivariate analysis indicated that physicians working in the private sector or those with over five years of experience tend to have a more positive outlook toward these disciplines. Therefore, continuing medical education (CME) initiatives focusing on biochemistry and genetics would be particularly beneficial if directed toward physicians in the public sector and those early in their careers.

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