acta medica

ORIGINAL ARTICLE

Eighteen years of the medical scientist training program at Hacettepe University

Şefik Evren Erdener[1,2]
ORCID: 0000-0002-5141-7899

Alev Özön[1,3]
ORCID: 0000-0002-2390-5123

Aygün Ertuğrul[1,4]
ORCID: 0000-0001-9885-9849

Turgay Dalkara[1,2]
ORCID: 0000-0003-3943-7819

[1] Hacettepe University Faculty of Medicine, Medical Scientist Training Program Coordinating Office, Ankara, Türkiye.

[2] Hacettepe University Institute of Neurological Sciences and Psychiatry, Ankara, Türkiye.

[3] Hacettepe University Faculty of Medicine, Department of Pediatric Endocrinology, Ankara, Türkiye.

[4] Hacettepe University Faculty of Medicine, Department of Psychiatry, Ankara, Türkiye.

Corresponding Author: Şefik Evren Erdener
E-mail: evrenerdener@hacettepe.edu.tr

Received: 8 August 2023, Accepted: 12 March 2024, Published online: 29 March 2024

ABSTRACT

Objective: Medical Scientist Training Program (MSTP) combining acquisition of both MD and PhD degrees, was implemented in 2003 at Hacettepe University. The purpose of this report is to evaluate the program outcomes by assessing the graduates from the first 18 years of the program.

Materials and Methods: A web survey was conducted with the 37 participants who graduated between 2009-2020. Data were analysed using descriptive statistical methods.

Results: About half of the graduates were found to devote a considerable amount of time to scientific research. Although nine participants do not perform any physician duties, about a quarter of graduates concomitantly pursue scientific as well as clinical activities. This implies that the program's primary goal, to train clinician-scientists in both MD and PhD curriculums have been achieved. 90% of graduates completed their residency in 24 different clinical disciplines. 40% of the graduates have already achieved faculty status at universities in Turkey or abroad. Academic performance indicators of MSTP graduates including the number of publications and citations in leading databases and the number of grants received were notably high.

Conclusion: This study reveals the role of the MSTP at Hacettepe University towards education of highly qualified clinicians with academic and scientific activities.

Keywords: Medical education, MD-PhD, medical scientist training program, students, graduates

INTRODUCTION

Understanding pathophysiological processes at the molecular, cell, and tissue level is essential for the development of novel diagnostic and treatment approaches, that is, the goal of modern biomedical research. Building bridges between basic research results from the laboratory bench and clinical applications at the bedside is necessary to achieve this goal. Researchers with experience in both clinical and fundamental sciences can successfully fill this bridging function owing to their capabilities and talents in both areas [1-3]. To match the growing demand for physician-scientists around the world, Medical-Scientist Training Programs (MSTP), which combine medical and Ph.D. trainings hold promise. The programs are most prevalent in the United States of America and Canada where they originated, but during the past 20 years they have spread across Europe, Australia, and New Zealand as well. The main goal of these programs is to expose medical students to basic scientific research at an early point in their career while maintaining their focus on the clinical curriculum. Students are selected based on their potential to concomitantly pursue a career in basic and clinical sciences, conduct independent research, and significantly contribute to their disciplines in the

future. Expectedly, studies examining the outcomes of primarily the National Institutes of Health (NIH)-funded MSTP programs in the United States since 1964 have revealed that a higher percentage of MSTP graduates obtain academic positions than typical for medical school graduates [4,5].

In Europe, MSTPs were initially introduced in the 1990s in England, Sweden, and Switzerland; however, the number of programs is significantly lower than in North American countries [3]. There are only few articles examining European program outcomes [6,7], unlike abundant reports on North American, Australian, and New Zealand programs [3,8-12].

The MSTP in the Hacettepe University Faculty of Medicine was implemented in 2003, following approval by the Higher Education Council (Yükseköğretim Kurulu, YÖK) of Turkey. A total of 175 students were admitted to the program and 47 graduated earning both MD and PhD degrees by 2022, when this report was prepared. Briefly, the dual program begins with enrollment of selected medical students at the start of their third year of medical school (Phase III) (Figure 1). They are given privileged pre-PhD student status for the first two years (phases III and IV of medical school), which allows them to take PhD courses from various programs that correspond to their interests. After being matched to the core PhD programs at the beginning of the fifth year of medical school (phase V), they complete the courses required by the core PhD program, then pass the proficiency exam, and prepare the subject of their dissertation project. At the end of phase V, they freeze their medical education for 2 years, during which time they work on their dissertation project full time. They resume to the final year of their medical education (internship, phase VI) after this 2-year break to complete their medical education and Ph.D. dissertation study. At the end of the eighth year of medical and sixth year of Ph.D. training, the students first receive their M.D. and then Ph.D. degree after successfully defending their dissertation. The 2-year break was implemented in 2016 to allow them to solely focus on their dissertation projects and to avoid conflicts with other curricular activities including residency programs.

In this first systematic analysis of the program outcomes, we have assessed the professional and academic standing, attitudes and opinions toward the program of our 37 students who graduated within the first 18 years (2020 and before).

MATERIALS and METHODS

Study Design

The study protocol and survey were approved by the Hacettepe University Ethics Board (Approval No. GO 22/1215). Students who graduated

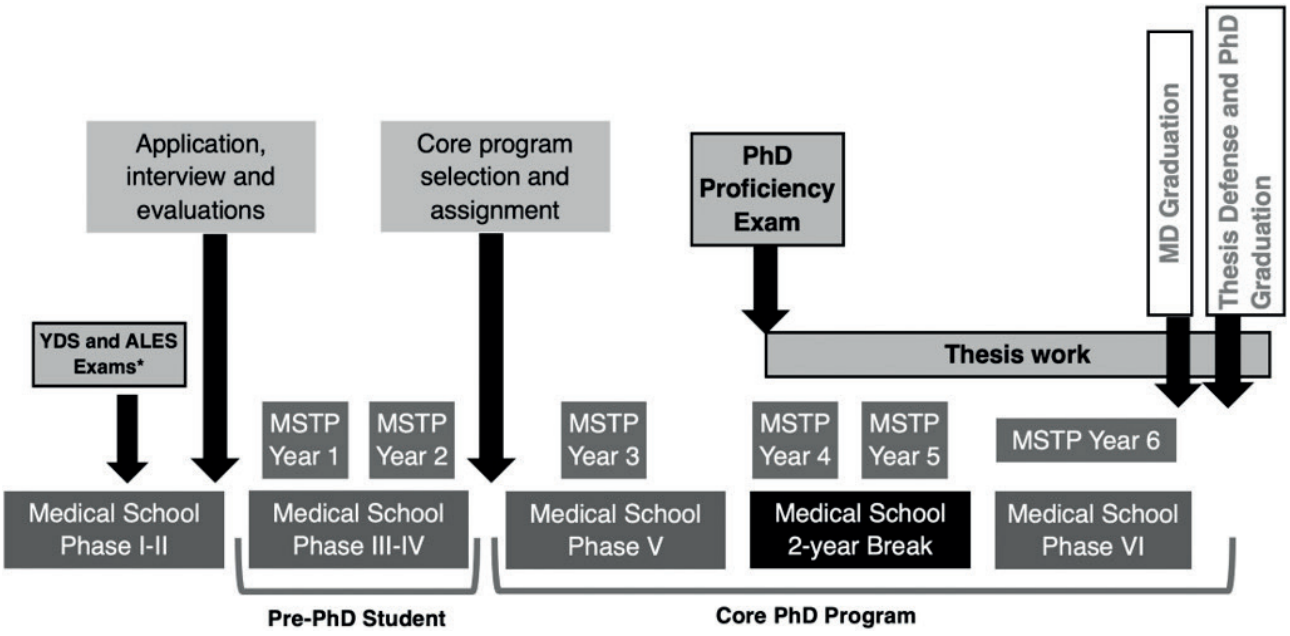

Figure 1. Flowchart of the curriculum for the Hacettepe University Medical Scientist Training Program
YDS: Foreign Language Proficiency Exam (for English), ALES: Academic Personnel and Graduate Education Entrance Exam.

between 2009 and 2020 (corresponding to their admission between 2003 and 2012) were selected from our student database. The survey form (a Google Web form) and study information were sent to the students through email. Two reminder emails were issued to non-responders at intervals of two weeks and the survey responses were electronically saved in Microsoft Excel format, and 25 graduates responded to the survey at the end of the survey response period, out of a total of 37 graduates. The names of 12 non-responders were entered into the Google search bar together with the phrase "Hacettepe", and the institutional web sites of those positions identified from the search results were used to record the current positions and academic activities of the non-responders. Current online professional profile of one of the non-responders could not be reached. Details of the Ph.D. education records of the 37 graduates were acquired from our student database, while their academic performance indexes were obtained from Web of Science. These investigations were conducted during the first quarter of 2022.

Survey Form

40 multiple-choice or short-answer questions about the profession, positions, scholarly output, financial support and grants, and career goals were included on the survey form. Additionally, they were asked to rate five statements on a 5-point Likert scale (1=Totally disagree; 2= Disagree; 3= No idea; 4=Agree; 5=Totally agree) based on their subjective attitudes and opinions about the program. Finally, they were asked two open-ended questions about the aspects of the program that they thought were the most successful and where they thought it might be improved.

Data Analysis

Data were analyzed using SPSS Version 23 for descriptive statistics, and graphs were prepared using GraphPad Prism 7. Data are expressed as median and interquartile range (IQR), unless otherwise indicated. Responses to open-ended questions were grouped into common thematic categories and analyzed.

RESULTS

PhD Education

In 2022, the median age of graduate responders was 37 (30-38). The gender split was 19:18 (M:F). The average number of years from admission to graduation was 8 (Range: 5–15). It should be noted that students who graduated within 5 years of admission did not have a mandatory 2-year break as they had been enrolled before the year 2016. Two students graduated 15 years after admission had initially been expelled from the program but returned with academic amnesty. Tumor Biology and Immunology had the highest number of graduates among all the programs with 10 participants. It was followed by Neuroscience, Medical Biology and Medical Pharmacology programs. Figure 2 shows the distribution of 37 graduates within the core programs.

Post-Graduate Activities

Thirty-three participants (89 %) have already completed or are about to complete their medical residency program. Table 1 shows the distribution of speciality fields. One postdoctoral researcher living in Turkey and three others abroad chose not to pursue residency. Fifteen graduates completed residency as well as postdoctoral fellowship, 4 of whom additionally completed their obligatory medical service (OMS) in Turkey[1]. Notably, 18 except one graduate did their postdoctoral fellowship at universities abroad, whereas residency training preference was split between hospitals in Turkey and abroad. The majority of 19 graduates who performed their OMS chose to continue their career with clinical duties mainly in Turkey, without doing a postdoctoral fellowship,

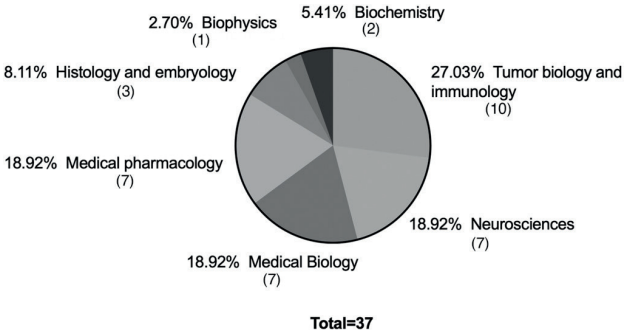

Figure 2. Distribution of graduates within the core programs

1 Medical education, residency and fellowship, each has an obligatory medical service carried out in the field for 1-2 years in Turkey.

Table 1. Distribution of medical residency fields

Department	Number of students (Percent%)
Neurology	3 (9%)
Internal medicine	3 (9%)
Psychiatry	2 (6%)
Obstetrics-Gynecology	2 (6%)
Pulmonology	2 (6%)
Cardiology	2 (6%)
Pathology	2 (6%)
Pediatrics	1 (3%)
Pediatric neurology	1 (3%)
Pediatric metabolism	1 (3%)
Pediatric nephrology	1 (3%)
Pediatric gastroenterology	1 (3%)
Pediatric immunology	1 (3%)
Pediatric pulmonology	1 (3%)
Radiation oncology	1 (3%)
Cardiovascular surgery	1 (3%)
Medical genetics	1 (3%)
Medical biochemistry	1 (3%)
Radiology	1 (3%)
Neurosurgery	1 (3%)
Hematology and oncology	1 (3%)
Otorhinolaryngology	1 (3%)
Dermatology	1 (3%)
Ophthalmology	1 (3%)
TOTAL	33 (100%)

while those who postponed the OMS went abroad as postdocs except one out of 19, suggesting that the decision of performing OMS appears to depend on the decision of where early career postgraduate training will be performed, abroad or Turkey (Figure 3).

As of 2022, 20 of our graduates (54 %) are employed in Turkey. Fourteen of the 16 graduates who are still employed abroad (38 %) are based in the United States, while two are in Europe. Out of 36, only three graduates practice as physicians, two in private healthcare facilities and one in a state hospital. The remaining 33 graduates work at Turkish or international academic institutions. Of these, 10 (30%) have achieved the title of principal investigator, 6 are postdoctoral or staff researchers (18%), while 17 graduates (52 %) are primarily practicing medicine (Figure 4a). One graduate who is known to have done postdoctoral fellowship after residency in Turkey, has been eventually lost

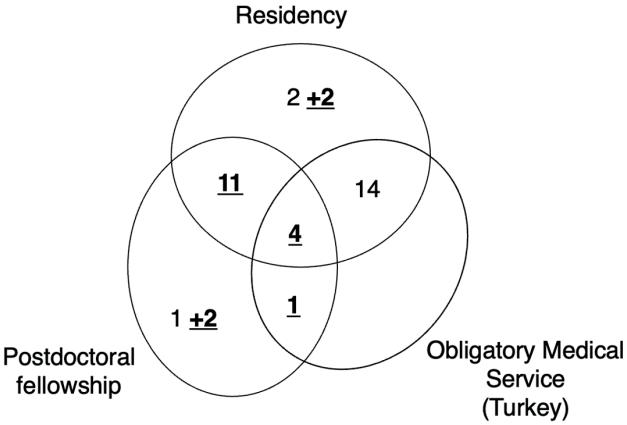

Figure 3. Venn diagram showing number of participants who completed their residency, postdoctoral fellowship or obligatory medical service. Regular typeset numbers indicate all positions held in Turkey, whereas bold and underlined numbers indicate either residency or research fellowship completed abroad.

to follow up and her current academic position or location is unknown. It took a median of 6 years (Range: 1–10 years) for graduates to acquire their first independent position as principal investigator. Seven graduates returned to Hacettepe University as academicians, and 5 more are employed as faculty members by other Turkish universities, bringing the total number graduates who achieved faculty positions to 12, as of 2022.

Eleven out of 36 graduates (31 %) devote at least 70% of their working hours to scientific research

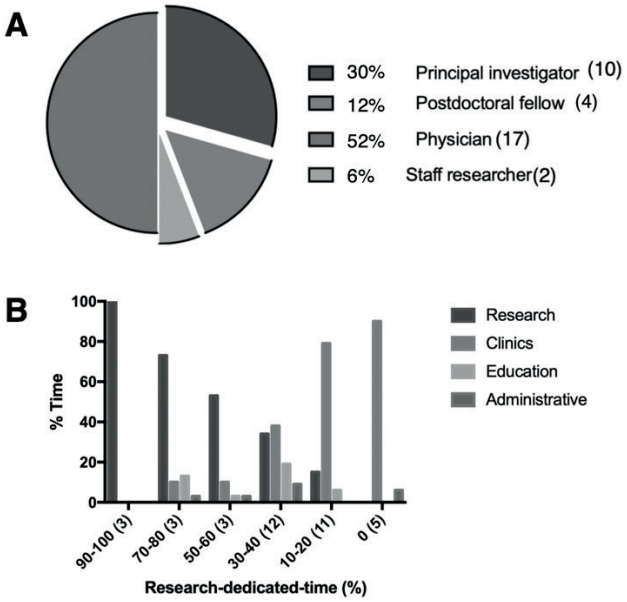

Figure 4. (A) Distribution of employment categories of graduates working at academic institutions (B) Distribution of clinical, educational and administrative activities relative to the time devoted to scientific research.

and educational activities. Nine of these eleven do not have clinical responsibilities. The remaining 16 graduates have at least 70% (or 44%) of their working hours dedicated to clinical activities. Five of these 16 do not engage in any scientific research. On the other hand, 9 graduates (29%) reported that they divided their time equally between clinical work and scientific research. Figure 4b displays the distribution of the time devoted to research and other activities.

Academic Performance

Twenty graduates (56%) published at least one article prior to receiving their PhD and 19 graduates (53%) had their dissertation published by 2022. The median number of SCI-indexed publications for our graduates is 15 (IQR: 15.4). They have a median of 5 (IQR: 7) first-author publications, and 10 graduates have published at least one article as the last author. Five graduates have H-indices above 10, and the median H-index is 4 (IQR: 5). The median number of citations is 64 (IQR: 274). Fourteen graduates (39 %) have received honors from at least one international academic organization, and two graduates (5 %) have authorized patents.

Participants graduating in 2016 or earlier (i.e., at least 5 years have passed since graduation) were more likely to have grants as principal investigators if they hold research-focused positions or equally divided their research and clinical employment. Seventeen graduates (47%) have ongoing or completed research grants (national or international). Six of these principal investigators devote almost all their time to scientific research. Four of the 16 graduates who devote less than 30% of their working time to research also have active or completed grants. Participants who graduated in 2016 or before are more likely to hold grants as principal investigators, particularly if they have research-focused or balanced research-clinical employment positions (Figure 5).

Currently, six participants are serving as PhD student advisors. Five of these six participants devote practically all their working hours to research, and one equally splits his time between clinical and research responsibilities.

Attitudes and Opinions Toward the Program

Among the 25 responder 96% agree that the MSTP has significantly affected their professional careers and contributed to the creation of Turkey's new generation of young scientists in medicine (Table 2). Fourteen (14/25) of these graduates feel to have profited from the curriculum by developing their skills and perspectives in scientific research. Four participants see the creation of an opportunity to work at distinguished scientific centers overseas as the main advantage of the program. For five of the participants, it provided a chance to network and be introduced to eminent scientists on a local, national, and international scale.

Two of our graduates do not advise a new medical student to enroll in the MSTP. One of them saw uncertainties in the future of the program as the main issue, while the other graduate has expressed concern about the lack of a workable and practical plan. It is interesting to note that both graduates concur that the program was successful in steering their careers and that it significantly contributed

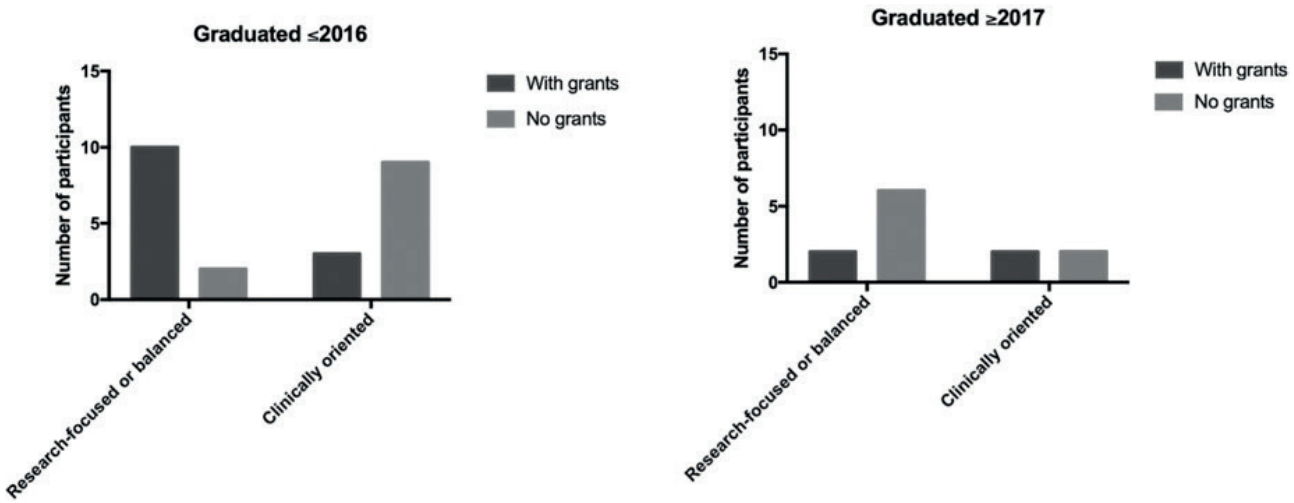

Figure 5. Grant ownership as principal investigators with respect to post-graduation and research-devoted time.

to the education of scientists in Turkey, suggesting that they expected a more structured roadmap to be offered for the program.

Fourteen respondents believe that they need to spare more time to engage in scientific research but do not have enough time to do so (Table 2). Six of these graduates are employed in clinically focused positions, while five of them have more balanced time for research and clinical duties.

The conflict between clinical internship and doctoral course programs, is the most frequent criticism about the program voiced by 9 participants who had been enrolled before 2016, i.e. before the 2-year break was implemented. The other primary complaints included the insufficient financial support for research projects, scholarships, and international activities (5 participants) and the limited time allotted for research and dissertation studies (5 participants).

DISCUSSION

The first 18 years of Turkey's first MSTP are reported in this study together with the distribution of alumni output and current professional status of the graduates. The program's primary goal, to train clinician-scientists who have mastered both MD and PhD curriculum seems to have been largely achieved since at least half of the program graduates devote a sizable amount of time to scientific research, and especially since nearly a quarter of them conduct both scientific and clinical activities simultaneously. Altogether, 32 (86%) of the 37 graduates are involved in scientific research to some extent, and more importantly, they wish to increase the time they devote to scientific research. The amount of time devoted to research and clinical activities varies considerably, similar to previous reports from MSTP graduates in the USA [5]. Therefore, like earlier surveys, this study also suggests that incentives should be considered for nearly half of the graduates who cannot devote enough time to advance their experience in scientific research. Although it is concerning that only 50% of doctoral theses written by graduates have been published (the publication process for theses that are ready to be published may still be in progress), the requirement that the PhD thesis be published before the thesis defense has recently been added to the graduation requirements, which may soon significantly increase the rate of published theses.

The majority of graduates have also completed their residency training in diverse specialty fields, comparable to graduates from MSTP programs abroad [5,13]. Compared to the regular graduate program, MSTP motivates students to stay in academia at a high rate, as evidenced by the fact that almost 40% of the graduates hold faculty status at Turkish and international institutions. However, the data from MD PhD candidates who were not elected due to the quota limits could have been a better comparator to separately investigate the impact of the intuitive motivation of the student with the motivation MD PhDs earned during training. Yet, the program's recognition and its contribution to the number of qualified researchers in our country are particularly evident in the fact that 12 of our graduates hold academic positions in various Turkish universities. Our graduates take six years on average to obtain their first independent academic position, which is comparable to graduates of similar programs in the United States [13]. The outstanding academic performance indicators of

Table 2. Some subjective attitudes of graduates towards the MSTP

	Strongly agree	Agree	No idea	Disagree	Strongly disagree
My professional career has been significantly influenced by the MD-PhD Integrated program.	17 (%68)	7 (%28)	0 (%0)	1 (%4)	0 (%0)
I would recommend a student who is just starting medical school to join the MD-PhD program.	15 (%60)	4 (%16)	4 (%16)	2 (%8)	0 (%0)
I'd like to spend more of my working hours on scientific research, but I can't seem to find the time.	11 (%44)	3 (%12)	4 (%16)	2 (%8)	5 (%20)
I believe that Turkey's MD-PhD program helps to train scientists in the field of medicine.	22 (%88)	2 (%8)	1 (%4)	0 (%0)	0 (%0)
My financial situation would have been better if I hadn't started this program.	3 (%12)	3 (%12)	10 (%40)	2 (%8)	7 (%28)

MSTP graduates, such as the number of citations and the number of research grants obtained, are also in line with those of the North American MSTP programs [2,14].

CONCLUSION

In conclusion, this study reveals the role of the Hacettepe University Faculty of Medicine's MSTP in educating highly qualified academicians and medical scientists in Turkey. We believe that this contribution will be strenghthened even further when more MD-PhD graduates are promoted to the top academic administration posts in Turkey and have greater access to research funding. The Higher Education Council of Turkey have recently approved the establishment of new MD and PhD programs ina some of Turkey's leading medical schools. Together these encouraging developments may lay down the foundations of world class scientific discoveries in Turkey within the next decades. We conclude that the MSTP has a significant potential to increase interest in science among medical students at an early stage of their career and to recruit increasing number of clinician scientists in medicine.

Acknowledgements

We are grateful to Prof. Dr. Iskender Sayek (Dean of Medical School) and Prof. Dr. Tunçalp Özgen (Rector of Hacettepe University) for their invaluable contributions to the establishment of the MD-PhD Program. We also thank Vehbi Koç Foundation (Vehbi Koç Vakfı), Ali Rıza Dalkara and Hacettepe Science Association (Hacettepe Bilim Derneği) for providing scholarships and support for our students. We thank Adam P. S. Bennett, PhD for the English language editing of our manuscript.

Author contribution

Study conception and design: ŞEE, AÖ and TD; data collection: ŞEE, AÖ; analysis and interpretation of results: ŞEE, AÖ, AE and TD; draft manuscript preparation: ŞEE, AÖ, AE and TD. All authors reviewed the results and approved the final version of the manuscript.

Ethical approval

The study was approved by the Clinical Research Ethics Committee of Hacettepe University (Protocol No: GO 22/1215).

Funding

The authors declare that the study received no funding.

Conflict of interest

The authors declare that there is no conflict of interest.

REFERENCES

[1] Schafer AI. The vanishing physician-scientist? Transl Res. 2010;155(1):1-2. https://doi.org/10.1016/j.trsl.2009.09.006

[2] Ley TJ, Rosenberg LE. The physician-scientist career pipeline in 2005: build it, and they will come. JAMA. 2005;294(11):1343-1351. https://doi.org/10.1001/jama.294.11.1343

[3] Alamri Y. The combined medical/PhD degree: A global survey of physician-scientist training programmes. Clinical Medicine, Journal of the Royal College of Physicians of London. 2016;16(3):215-218. https://doi.org/10.7861/clinmedicine.16-3-215

[4] Andriole DA, Jeffe DB, Hageman HL, et al. Variables associated with full-time faculty appointment among contemporary U.S. Medical school graduates: implications for academic medicine workforce diversity. Acad Med. 2010;85(7):1250-1257. https://doi.org/10.1097/ACM.0b013e3181e10159

[5] Brass LF, Akabas MH. The national MD-PhD program outcomes study: Relationships between medical specialty, training duration, research effort, and career paths. JCI Insight. 2019;4(19). https://doi.org/10.1172/jci.insight.133009

[6] Cox TM, Brimicombe J, Wood DF, Peters DK. The Cambridge Bachelor of Medicine (MB)/Doctor of Philosophy (PhD): graduate outcomes of the first MB/PhD programme in the UK. Clin Med (Lond). 2012;12(6):530-534. https://doi.org/10.7861/clinmedicine.12-6-530

[7] Kuehnle K, Winkler DT, Meier-Abt PJ. Swiss national MD-PhD-program: an outcome analysis. Swiss Med Wkly. 2009;139(37-38):540-546. https://doi.org/smw-12790

[8] Alamri Y, Wilkinson TJ. Career outcomes of students of an intercalated MBChB/PhD: experience from New Zealand. NZMJ. 2020;17:1508. www.nzma.org.nz/journal

[9] Alamri Y, Beckert L. Clinician-scientist training in New Zealand: historical notes and current trends. NZMJ. 2020;133:1525. www.nzma.org.nz/journal

[10] Eley DS, Jensen C, Thomas R, Benham H. What will it take? Pathways, time and funding: Australian medical students' perspective on clinician-scientist training. BMC Med Educ. 2017;17(1):242. https://doi.org/10.1186/s12909-017-1081-2

[11] Eley DS. The clinician-scientist track: An approach addressing Australia's need for a pathway to train its future clinical academic workforce. BMC Med Educ. 2018;18(1). https://doi.org/10.1186/s12909-018-1337-5

[12] Pietrobon A, Cook EK, Yin C, Chan DCH, Marvasti TB. INTERNATIONAL TRAINING CONSIDERATIONS OF CANADIAN CLINICIAN-SCIENTIST TRAINEES—A NATIONAL SURVEY. Rev Colomb Obstet Ginecol. 2021;71(4):2-7. https://doi.org/10.25011/CIM.V43I4.35003

[13] Akabas MH, Brass LF. The national MD-PhD program outcomes study: Outcomes variation by sex, race, and ethnicity. JCI Insight. 2019;4(19). https://doi.org/10.1172/jci.insight.133010

[14] Dyrbye LN, Lindor KD, LaRusso NF, Cook DA. Research productivity of graduates from 3 physician-scientist training programs. Am J Med. 2008;121(12):1107-1113. https://doi.org/10.1016/j.amjmed.2008.08.015