BMC Medical Education

RESEARCH

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Perception and willingness of Greek early career scientists to specialize in infectious diseases: a survey of the Hellenic Society of Chemotherapy Early Career Study Group

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Abstract

Background The recent pandemic has highlighted the role of Infectious Diseases (ID) Specialists. In Greece, ID is a two-year subspecialty of internal medicine or pediatrics. We aimed to discover the willingness of early career Greek scientists (ECS) to specialize in ID.

Methods A cross-sectional online survey was conducted among undergraduate 4th -5th -6th -year medical students, residents of internal medicine/pediatrics, and Master (MSc) graduates of the Program "Infectious Diseases" of the University of Athens. Data were collected via an electronic case report form (https://hsch.gr/erotimatologia/) from 17 September to 16 November 2025 and included demographics, level of education/training, satisfaction of ID training, willingness to specialize in ID, reasons if not, and suggestions how ID would attract more scientists. All society members were contacted by email, as well as, members of two panhellenic medical student societies.

Results In total, 556 ECS responded; 310 students, 192 residents, and 54 MSc graduates; 66.9% were female, aged 27 ± 6 years, and 81.5% were aware that ID is a subspecialty. Among medical students, 274 (88.4%) were exposed very often/often to patients with common infections, whereas 254 (81.9%) never or seldom to infections in special populations. Respectively, 189 (98.4%) residents reported being exposed very often to patients with common infections and 88 (45.8%) to infections in special populations. Among respondents, 22.6% of students declared intention to specialize in ID; 41.1% of residents and 81.5% of MSc holders ($p < 0.001$). 17.5% of medical students declared that although interested in ID, they do not wish to train in Internal Medicine/Pediatrics. When participants were asked "how ID would be more attractive", 39.8% responded by training for some time in an ID center in Europe/USA and 24.8% in a special field such as immunocompromised patients.

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Conclusion Results imply that it may be the case that independent training with a separate curriculum makes ID more attractive.

Keywords Survey, Early-career, Training, Infectious diseases

Introduction

The recent pandemic has highlighted the role of Infectious Diseases (ID) Specialists in pandemic preparedness. Establishment of ID as a distinct medical field began in the United States and Western Europe in the latter half of the 20th century following the rapid antimicrobial drug discovery and vaccine development, as well as the emergence of acquired immunodeficiency syndrome (AIDS) [1, 2]. ID has long been an independent subspecialty of Internal Medicine in the US, with a well-structured training program of a minimum two-year clinical experience and one to three-year research, whereas in Europe still remains quite heterogeneous [3–6]. In Greece, ID is a two-year subspecialty of internal medicine and pediatrics (https://www.moh.gov.gr/articles/health/epaggelmaties-ygeias/noshleytiko-proswpiko/ekseidikeyseis/ekseidikeysh-sth-loimwksiologia/11571-ekpaideysh-sthn-iatrikh-ekseidikeysh-ths-loimwksiologias).

In the recent years, there has been a reluctance among young doctors to specialize in ID and internal medicine, possibly as a result of the increasing complexity of managing hospitalized patients with medical problems, the heavy workload and mental health burden experienced during the pandemic, as well as concerns about modest associated economic benefits [7–14]. Based on a recent survey of European Society of Clinical Microbiology and Infectious Diseases (ESCMID) only 58% of European hospitals had an ID ward and the ratio of ID or clinical microbiology (CM) physicians per hospital beds was 1:100 [15].

In Greece, almost 945 students graduate every year from 7 medical schools. With 1500 registered residency positions, internal medicine or pediatrics are considered as the most popular medical specialties (representing 6.6% and 5.7% of all medical doctors at a national level, https://www.statistics.gr/el/statistics/-/publication/SHE09/-). Specialists in internal medicine or pediatrics, who wish to train further in ID are assigned to one of 36 registered positions. Although official data do not exist, it is roughly estimated that less than 5% of them will finally choose to specialize in ID, leading to a paucity of ID specialists in Greece. The Hellenic Society of Chemotherapy (HSC) is a non-profit scientific society dedicated to promote the rational use of antimicrobial therapy in an effort to combat antimicrobial resistance (https://hsch.gr/istoria-tis-e-e-x/). The Society focuses on proper education and scientific promotion of young physicians in the field of ID/CM and has recently launched the Study Group for Career Counseling of Early-Career Scientists in Antimicrobial Therapy and Resistance (https://hsch.gr/istoria-tis-e-e-x/). The Study Group investigated for the first time in Greece the perception of training and the willingness of early career Greek scientists and junior doctors to specialize in ID through a panhellenic survey.

Materials and methods

A cross-sectional online survey was conducted among (a) undergraduate 4th –5th –6th -year medical students in Greece, (b) residents of internal medicine or pediatrics under training in Greek hospitals, and (c) graduates of the Master's (MSc) Program "Infectious Diseases" of the National and Kapodistrian University of Athens (NKUA), to assess their satisfaction with medical training in Infectious Diseases and their willingness to follow a future specialization in ID. The MSc Program "Infectious Diseases" recruits either medical doctors or bachelor graduates of Life Sciences (nursing, biology, biochemistry, pharmaceutics) who wish to further train in ID, and is an academic degree beyond the level of BSc/MD but prior to PhD, independent of the National Specialty training in ID. The survey was approved by the Ethics Committee (EC) of Attikon University Hospital (EBD 514/15/10.09.2025), it was sponsored by the HSC and conducted in accordance with the Declaration of Helsinki. Data were collected anonymously via an electronic case report form hosted at https://hsch.gr/erotimatologia/ (Hellenic Society of Chemotherapy) over a two-month period, from 17 September to 16 November 2025. The questionnaire, provided in Supplement, shared some common questions but was adapted to each of the three groups of early career scientists/junior doctors. The survey platform allowed secure submission of responses, ensuring compliance with relevant data protection regulations. The survey platform was designed not to allow skipping of answers, so that partial completion was avoided. Informed consent of respondents was provided by initially accepting to respond the survey.

The survey was designed to capture demographic characteristics (sex, age), level of education/training, type of work/study hospital, research experience (only for residents), level of training satisfaction in common infections and infections in special populations (such as HIV, tuberculosis, malaria etc.), willingness to specialize in ID, reasons not to choose ID and suggestions on how ID would attract more scientists.

All members of the HSC (over 1,000) were contacted by email to participate and disseminate the survey to junior doctors and students under training in HSC-affiliated

departments. All Departments of Internal Medicine of the 7 Greek Medical Schools responsible to train medical students, were contacted by email to disseminate the survey to their students. Members of the Executive Committees of two medical student societies, the Hellenic Medical Students' International Committee (HelMSIC) and the Scientific Society of Medical Students of Greece (SSHMS), were also contacted to forward the invitation to their members after respective EC approval. All MSc graduates from the NKUA Program "Infectious Diseases" were also contacted per email. Emails were signed by the legal representatives of the Executive Committee of HSC and two reminders were sent throughout the survey period.

Table 1 Characteristics of respondents

All respondents (n: 556)	
Age in years, median (Q1-Q3)	26 (23–30)
Female sex, *n* (%)	372 (66.9)
Medical students (n: 310)	
Age in years, median (Q1-Q3)	23 (22–25)
Female sex, *n* (%)	223 (71.9)
Year of studies, *n* (%)	
4th –5th	165 (53.2)
6th	145 (46.8)
Residents of internal medicine/pediatrics (n: 192)	
Age in years, median (Q1-Q3)	29 (27–31)
Female sex, *n* (%)	115 (59.9)
Year of residency, *n* (%)	
1 st –3rd	123 (64.1)
4th –5th	69 (35.9)
Residency in Athens, *n* (%)	139 (72.4)
Residency in university hospital, *n* (%)	83 (43.2)
Participation in research, *n* (%)	
Never	129 (67.2)
In 1 project	26 (13.5)
In 2–10 projects	35 (18.2)
In more than 10 projects	2 (1.0)
MSc "Infectious Diseases" graduates (n: 54)	
Age in years, median (Q1-Q3)	35 (32–45)
Female sex, *n* (%)	34 (63.0)
Years after MSc completion, median (Q1-Q3)	2 (1–4)
Basic studies, *n* (%)	
Medicine	41 (75.9)
Nursing	9 (16.6)
Pharmacy	2 (3.7)
Biology, chemistry, biochemistry	1 (1.9)
Other	1 (1.9)
Participation in research, *n* (%)	
Never	12 (22.2)
In 1 project	12 (22.2)
In 2–10 projects	21 (38.9)
In more than 10 projects	9 (16.7)

Abbreviation: *MSc* Master of Science

Before initiating the survey, the number of 4th-5th-6th-year medical students in Greece was calculated (*n*: 2,835), as well as the number of residents of internal medicine and pediatrics working in Greece (n: 1,500) by online available data (https://aeitei.gr/isakteoi.php, https://www.patt.gov.gr/koinonia/igeia/igeia-edms-3/). The number of MSc graduates (*n*: 170) was provided by the Program Director. Estimating a 10% sample would be representative of the three groups, a total of 450 respondents was calculated [16]. As it was impossible to contact all students and residents not having the right according to General Data Protection Regulation (GDPR) to use their electronic addresses, invitations were restricted to those providing right to use their electronic addresses to at least one of the above-mentioned scientific societies. Before initiating the survey, the questionnaire was pilot tested in 15 respondents (5 of each category) of both sexes.

Survey responses were summarized using descriptive statistics. Categorical data were presented as frequencies and confidence intervals (CI); continuous variables with normal distribution as mean with standard deviation (SD) and data with non-normal distribution as median and quartiles (Q). Comparison of categorical data was performed by the chi-square test and Student's t-test or non-parametric Mann Whitney test for the comparison of continuous data, as appropriate. Any two-sided *p* value lower than 0.05 was considered statistically significant. Statistical analysis was performed using the software SPSS version 29.0. Reporting of survey results followed published European standards [17].

Results

From 17 September to 16 November 2025, 556 early career scientists responded (about 37% of 1500 invitations sent); 310 (55.8%) undergraduate students, 192 (34.5%) residents, and 54 (9.7%) MSc "Infectious Diseases" graduates, of which 372 (66.9%) were female; their median (Q1-Q3) age was 26 (23–30) years. Their characteristics are presented in Table 1.

In total, 453 participants (81.5%) were aware that ID is a subspecialty of Internal Medicine or Pediatrics with a training duration of two years and 422 participants (75.9%) were aware that an MSc Program "Infectious Diseases" is provided by the NKUA. Among MSc graduates, 44 (81.5%) and 34 (62.9%) reported they have improved their theoretical background and practical skills in ID, respectively. Fifty MSc graduates answered that completion of the MSc Program moved forward their career very much or moderately; main ways of moving forward were networking (28.3%), bonus or salary increase (28.3%) and promotion, new or better job (26.4%) whereas only 17% reported continuing with PhD.

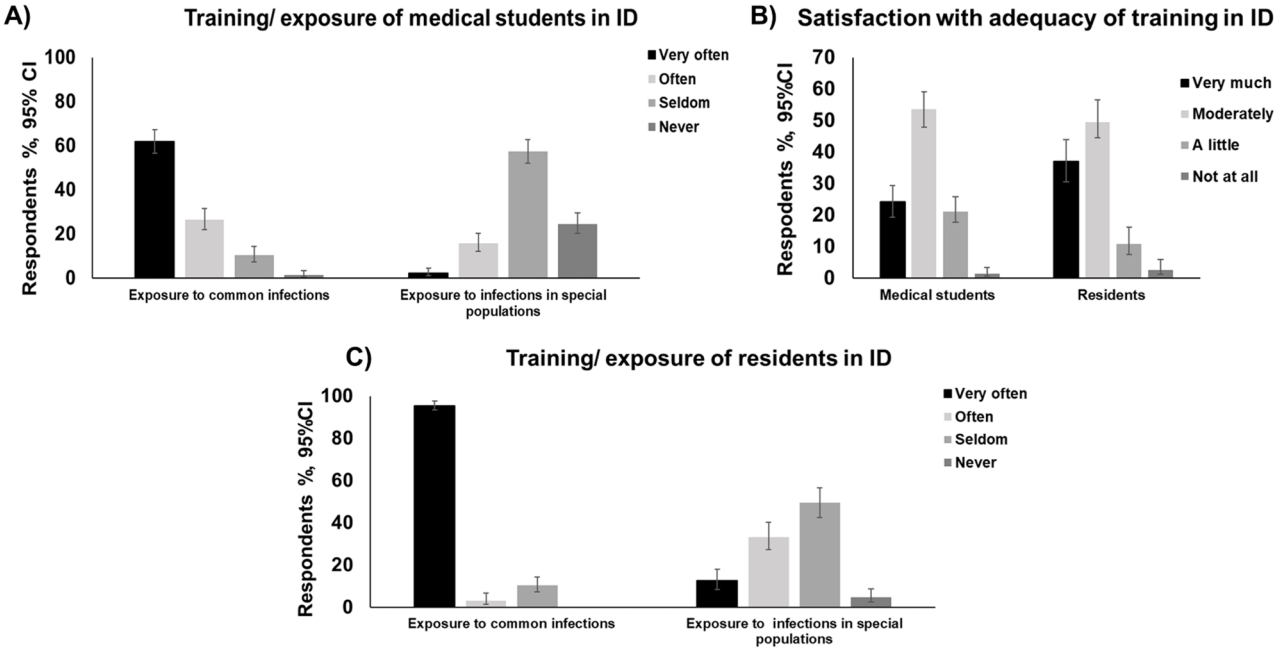

Fig. 1 Training/exposure of respondents to Infectious Diseases (ID) and satisfaction with adequacy of training. **A** Training of medical students in ID; **b**) satisfaction of medical students and residents with training in ID; and **c**) training of residents in ID

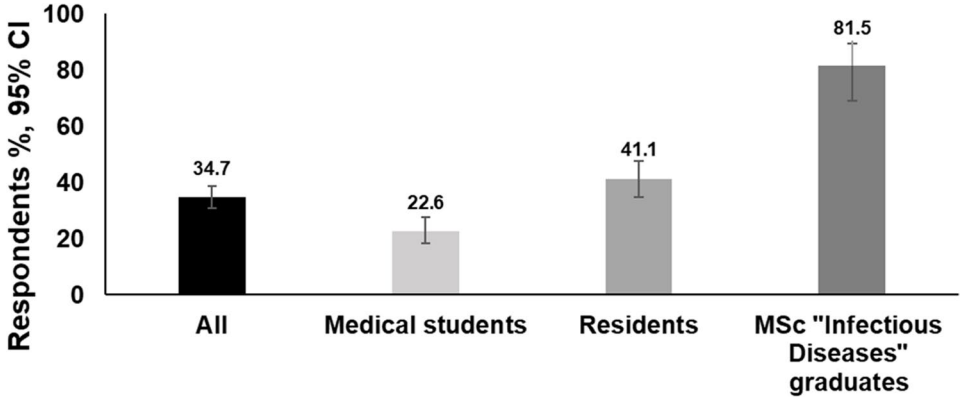

Fig. 2 Proportion of respondents with intention to specialize in infectious diseases (ID). Abbreviations: CI, confidence interval; MSc, Master of Science

Among medical students, 274 (88.4%) were exposed very often/often to patients with common infections (pneumonia, urinary tract infection etc.) whereas 254 (81.9%) reported never or seldom having cared for patients with infections in special populations (Fig. 1a). ID training was considered very adequate by 24.2% and moderate by 53.5% of students (Fig. 1b).

Among residents, 189 (98.4%) reported being exposed very often to patients with common infections and only 88 (45.8%) very often/often to infections in special populations (Fig. 1c). ID training was considered adequate in 37.0% and moderate in 49.5% of residents (Fig. 1b). Training satisfaction rates were similar in residents working in hospitals in Athens vs. rest of Greece (p: 0.536) as well as in academic vs. non-academic hospitals (p: 0.299). Level of training/exposure to ID in special populations correlated with the duration of residency (Spearman rho: 0.197; p: 0.006); this was not the case for the level of training/exposure to common ID (Spearman rho: 0.033; p: 0.646).

Among respondents, 22.6% of students declared intention to specialize in ID; 41.1% of residents and 81.5% of MSc holders ($p < 0.001$; Fig. 2). Exposure to common infections did not correlate with interest in choosing ID as a specialty (r_s: −0.064; p: 0.150); however, respondents exposed to infections in special populations were more likely to consider a career in ID specialty (r_s: 0.160; $p < 0.001$). Female respondents were less likely to follow ID than male (29.6% vs. 45.1%; $p < 0.001$). Main reasons of unwillingness to specialize in ID for medical students were lack of interest in ID in general and interest in surgical/interventional specializations and only small

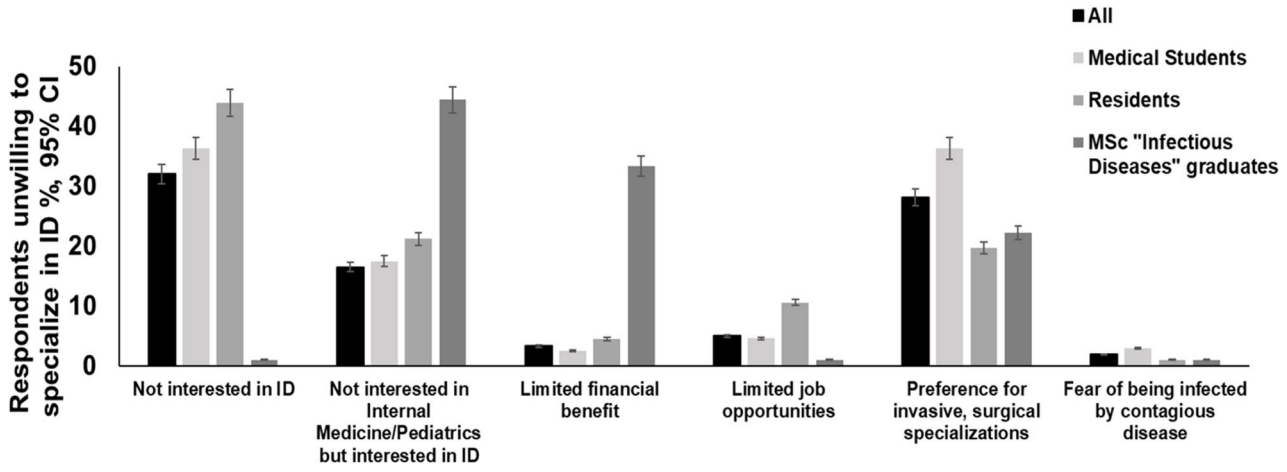

Fig. 3 Reasons of unwillingness of respondents to specialize in infectious diseases (ID). Abbreviations: CI, confidence interval; MSc, Master of Science

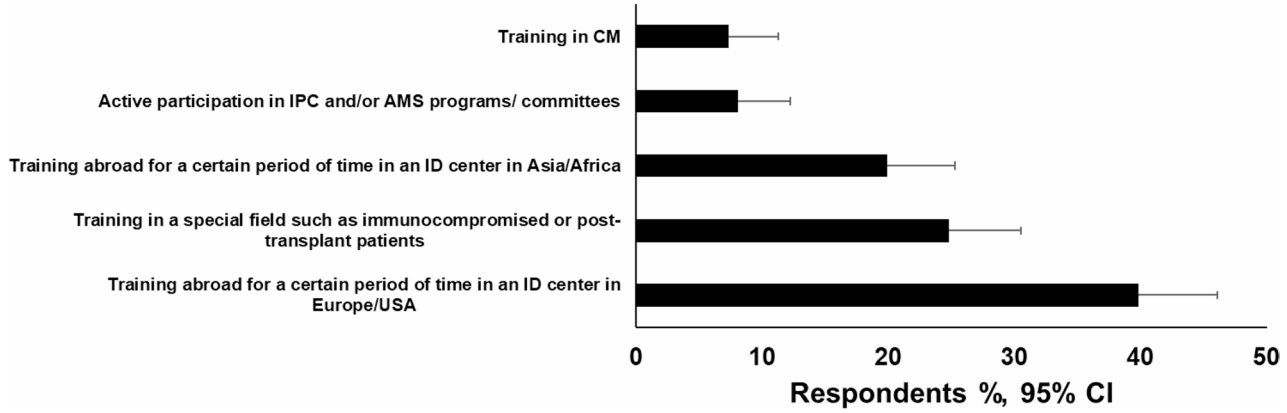

Fig. 4 Suggestions of respondents on how Infectious Diseases (ID) specialization would attract more early career scientists. Abbreviations: AMS, Antimicrobial Stewardship; CI, confidence interval; CM, Clinical Microbiology; IPC, Infection Prevention Control; MSc, Master of Science

proportions of medical students reported on limited job opportunities, limited financial benefits and fear of being exposed to infectious diseases (Fig. 3). Among residents, limited job opportunities and limited financial benefits were more often reported as reasons for not following ID (Fig. 3). A considerable proportion (17.5% of medical students; almost half of MSc graduates; and surprisingly 21.2% of residents) of all three types of responders declared that although they are interested in ID they do not wish to specialize in internal medicine/pediatrics first, expressing a need for separate ID curriculum as independent specialty and not subspecialty (Fig. 3). The proportion of residents that do not wish to specialize in internal medicine/pediatrics is hard to understand as they have already made their choice; either they do internal medicine/pediatrics only to go for ID afterwards or they have already regretted their choice.

Among residents, the intention to follow ID specialization was higher in residents of university hospitals (53.2%) compared to non-university (46.8%; p: 0.026). The intention to follow ID was also associated with the duration of residency in years (OR 1.32; 95% CI, 1.09–1.62; *p*: 0.005) and the participation in clinical trials on ID (OR 1.66; 95% CI, 1.17–2.37; *p*: 0.005).

When residents and MSc holders were asked "how ID could be more attractive", 98 (39.8%) responded by training abroad for a certain period of time in an ID center in Europe/USA; 61 (24.8%) by training in a special field such as immunocompromised or post-transplant patients; 49 (19.9%) by training abroad for a certain period of time in an ID center in Asia/Africa; 20 (8.1%) by active participation in Infection Prevention Control and/or Antimicrobial Stewardship programs/committees; and 18 (7.3%) by training in clinical microbiology (Fig. 4). Responses were similar between residents and MSc holders (*p*: 0.369).

Discussion

Our panhellenic survey among early career scientists/junior doctors showed that over 80% of respondents were trained in common ID but only 20% in ID in special populations such as tuberculosis, malaria or HIV. Almost 35% of respondents would specialize in ID; 16.5% of

those who would not, do not wish to train first in internal medicine. Training for a short time in an ID center in Europe or the US is considered attractive.

A recent web-based study including 35 countries pointed out existing diversities in Europe regarding ID specialty, duration and form of training programs [6]. ID is considered as an independent specialty in 77% of the countries, while as a subspecialty of internal medicine in 20%. The median duration of ID training in Europe is 5 years. Internal medicine training is mandatory in all programs, with a median duration of two years; this is not always the case for CM training [6]. ID in Greece has been recognized as a subspecialty of internal medicine and pediatrics since the early 2000s. Training in internal medicine or pediatrics, lasting 5 years, must be complete before the two-year training in ID with final exams at a national level. The formal curriculum does not differ significantly from that of other European countries focusing on prevention, diagnosis, and care of patients with common and complex infections, like patients with immunocompromising conditions, critical illness, opportunistic infections, AIDS, tuberculosis, prosthetic-device infections, and principles of infection prevention and antimicrobial stewardship (https://www.moh.gov.gr/articles/health/epaggelmaties-ygeias/noshleytiko-proswpiko/ekseidikeyseis/ekseidikeysh-sth-loimwksiologia/11571-ekpaideysh-sthn-iatrikh-ekseidikeysh-ths-loimwksiologias). Training in CM is predicted but tailored to specific requirements of each center. There are thirteen authorized centers for ID training across the country, most of them academic (https://www.moh.gov.gr/articles/health/epaggelmaties-ygeias/noshleytiko-proswpiko/ekseidikeyseis/ekseidikeysh-sth-loimwksiologia/11571-ekpaideysh-sthn-iatrikh-ekseidikeysh-ths-loimwksiologias).

Similarly to other European countries, Greek young doctors are not interested in pursuing careers in ID as they prefer surgical specializations. Main concerns about ID include restricted job opportunities, inadequate financial rewards, and completion of training in internal medicine or pediatrics. In our survey 16.5% of early career doctors do not want to follow ID because of obligatory full internship in internal medicine or pediatrics; burnout in internal medicine is as high as 70% [18]. Popularity of ID tends to decrease in Europe similar to Greece [5]. Financial earnings play a key role, as ID sub/specialties are poorly paid in relation to the demanding workload [12, 14]. Salaries vary widely across Europe driving physicians to emigrate for better conditions resulting in vacancies even in the heart of Europe [5, 6]. Surprisingly, internal medicine workload is the main obstacle for residents and students who are interested in ID in our survey, while limited financial benefit becomes important only later, when they actually become involved with ID. The shortage of ID personnel, the frequent on-call duties, high responsibilities, and work-life imbalance lead trainees and young specialists to burnout [18, 19]. These challenges may be faced unevenly by early career women, as compared to their male colleagues, possibly explaining lower intention for ID among female participants in our study [20], however this remains speculative in the context of the current analysis. This is reflected in our results; intention for ID is lower in female participants. Interestingly, a small but still existing proportion of respondents reported about fear of being infected when facing patients with ID. Training of frontline healthcare providers to safely manage and control an ID emergency is of paramount importance and should be included in the training curriculum [21].

Intention to specialize in ID is lowest among medical students and higher, as expected, among residents of internal medicine or pediatrics as those mainly interested in surgical training are already gone. In a US representative sample of graduating internal medicine residents, most develop an interest in their ultimate career before residency [22]. Factors influencing this decision reside in both medical school and residency, which is consistent with career decision-making constructs. With this in mind, internal medicine residents with a special interest in ID may choose to work in academic departments located in large cities which are also official centers for ID subspecialty training. However, it is not entirely clear whether students are truly more interested in other specialties or are simply still undecided at this stage. As many students reported limited exposure to infections in special populations, the lower level of interest may reflect not only lack of interest in the field itself, but also limited clinical exposure and familiarity. Of course, those completing an MSc Program have already expressed a preference towards ID and among them, intention to specialize in ID is highest.

Absence of interactive mentorship and insufficient financial support for research [12, 13, 18] have also been pointed to affect career decisions. However, during COVID-19 pandemic an unexpected increase in funded positions for ID trainees and established ID physicians was presented compared to 2021, especially in Finland, Greece, Ireland, Italy, and Turkey [6]. Results of our survey highlight that early exposure of students to ID (especially to ID in special populations) seems to enhance their interest for this subspecialty. Focusing training on in-person practical, interactive discussions and/or simulations with audit and feedback to trainees, may help in building ID related skills in everyday practice [23]. Moreover, strengthening research opportunities for young physicians, promoting mobility and networking within and outside Europe, as well as encouraging leadership skills, professional development and interdisciplinary teamwork are deemed important to raise interest

of early careers towards ID [24]. Similar to our results, almost 80% of French early career ID doctors are in favor of completing part of their training abroad to discover a new culture, improve skills in a specific area or foreign language skills and to discover a new health-care system [25]. Given the low percentage of respondents having experience in research projects, a vision for explicit mechanisms for developing ID trainees into independent physician scientists is urgent.

Disparities among European countries regarding career and research opportunities have been already identified. A quarter of ID specialists, mainly from South-Western Europe, report discrimination in European hospitals and universities, primarily due to gender and geographic origin [18, 26]. Our results imply that disparities do exist in selecting candidates for ID subspecialty in favor of doctors having trained in academic departments.

Limitations of the study include the self-reported nature of the data, which may introduce recall or reporting bias. The response rate, while substantial for survey research in professional societies, limits generalizability, and some regions may have been underrepresented. The survey was disseminated through the network of HSC and the 2 student organizations to conform with GDPR so that contacting residents/students' emails without use consent was not possible. This may have resulted in an overestimation of reported outcomes as the sample may have been enriched with respondents already inclined towards ID. The three groups (students, residents, MSc graduates) are not directly comparable because of inherent differences in baseline interest and exposure. Specifically, MSc graduates constitute a highly selected population already committed to ID, so that comparisons across these groups require cautious interpretation. Last, as this type of survey was conducted for the first time at a national level, comparison with pre-pandemic data was not possible to detect to which extent COVID-19 pandemic influenced junior doctors' interest for ID. Despite these limitations, the study provides a valuable baseline for understanding early career needs for a better ID training in Greece.

Conclusion

Our survey results imply that it may be the case that independent training with a separate curriculum makes ID more attractive. ID should follow a standardized training program and early career physicians should be given more research as well as exchange/networking opportunities in Europe and abroad. Further research is needed to conclude if ID may be preferred if it is an independent specialty and not subspecialty in Greece similarly to other European countries.

Abbreviations

AIDS	Acquired immunodeficiency syndrome
CI	Confidence interval
CM	Clinical Microbiology
ECS	Early career scientists
ESCMID	European Society of Clinical Microbiology and Infectious Diseases
HelMSIC	Hellenic Medical Students' International Committee
HSC	Hellenic Society of Chemotherapy
ID	Infectious Diseases
NKUA	National and Kapodistrian University of Athens
SD	Standard deviation
SSHMS	Scientific Society of Medical Students of Greece
Q	Quartile

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12909-026-10152-7.

Supplementary Material 1.

Acknowledgements

The authors want to express their gratitude to the Executive Committees of the Hellenic Medical Students' International Committee (HelMSIC) and the Scientific Society of Medical Students of Greece (SSHMS) for disseminating the survey among their members; to Mrs Katerina Angelou and Mr Alexandros Alatsatianos for their technical support with the online platform; and to all early career scientists and students who participated in the survey.

Authors' contributions

MEA drafted the manuscript. FN, KA, EC, CD, SG, IK, EKarakike, PK, EKranidioti, SL, PM, ON, IN, VP, ASiampanos, ASpyrou, OT collected data and reviewed the manuscript for important intellectual content. IB conceptualized the study and reviewed the manuscript for important intellectual content. EKyriazopoulou performed data analysis, drafted the manuscript, conceptualized and supervised the study. All authors have read and approved the submitted manuscript.

Funding

This work was sponsored and funded by the Hellenic Society of Chemotherapy.

Data availability

All data and materials are presented in the manuscript, tables, figures and supplement.

Declarations

Ethics approval and consent to participate

The survey was approved by the Ethics Committee of Attikon University Hospital (EBD 514/15/10.09.2025). Informed consent of respondents was provided by initially accepting to respond the survey.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Received: 25 February 2026 / Accepted: 10 August 2026
Published online: 20 August 2026

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