Editorial

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Step 1 in encouraging young people to pursue careers in nuclear medicine involves an EAEM Oncology and Theranostics Committee survey to learn about the expectations of the upcoming generation.

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INTRODUCTION

In 1985, the European Association of Nuclear Medicine (EANM), a non-profit professional medical organization, was established. In 1989, the "Union Européenne des Médecins Spécialistes" (European Union of Medical Specialists, or UEMS) acknowledged nuclear medicine (NM) as a separate medical profession. Since then, the number of doctors practicing nuclear medicine in Europe has grown. At the EANM Oncology and Theranostics Committee (OTC) meeting last year, tactics for drawing in and encouraging the engagement and participation of younger generations in New Mexico were the subject of a lively discussion. In certain nations, compared to past generations, it appeared that residents are more drawn to clinical practice than to academics or research, or that they are forsaking their NM training in favor of another specialization.

Additionally, the lack of labor in Europe is a concern (https://www.ela.europa.eu/en/news/labour-shortages-europe-labor-market-tightening). also have an impact on the medical industry, as predicted by the World Health Organization (https://www.who.int/health-topics/health-workforce#tab=tab_1), there will be a 10 million shortage of health workers by 2030. Due to a combination of rising demand and an aging labor supply, radiology and even larger imaging sub-specialties like NM are affected (https://www.acr.org/Practice-Management-Quality-Informatics/ACRBulletin/Articles/March-2022/The-Radiology-Labor-Short Age). Between 2003 and 2021, the proportion of board-certified NM physicians in Germany who were over 60 and 65 years old rose dramatically (from 16.3 and 1.5 to 27.0% and 9.5%, respectively). First, the provision of therapeutic services is impacted by this lack of youthful talent. Second, encouraging and supporting the quickly developing field of NM requires that younger generations participate in research. Despite the fact that various training programs exist in different nations (for example, NM is integrated with In recent years, there has been a decline in the number of residents choosing NM as their specialty in several nations (such as radiology residency in certain countries) [1]. An analysis of the 2017 American College of Radiology Commission on Human Resources Workforce Survey reveals that, while the number of NM/NR physicians hired increased between 2014 and 2017, the number of traditional NM residencies and NR fellowships decreased (from 79 to 58 programs) as well as the total number of NM and NR trainees (173 to 82 trainees) [1]. Additionally, the number of first-year ACGME (Accreditation Council for Graduate Medical Education) Residents and Fellows in Radiology and Diagnostic Sciences decreased by about 7%.

[https://www.aamc.org/data-reports/workforce/data/percentage-change-frst-year~acgme-residents-fellows-specialty-2016-2021] shows the percentage change in radiology between 2016 and 2021. There are several possible causes for the growing difficulties in drawing medical students to the field of diagnostic imaging: distinct expectations from younger generations (e.g., more focused on pursuing high standards for medical care between physicians and institutions; increased requests to resolve/manage bureaucratic issues; contentious compensation given the number of hours worked and frequently insufficient workforce capacity); competition/stress to achieve higher scientific impact factor; inadequately equipped departments (e.g., complex liaison with basic research, inadequately equipped radiopharmacy with few accessible radiopharmaceuticals, lack of medical physicist for radiation protection and dosimetry); deficient working conditions (e.g., lack of digital clinical process where data are

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easily collected, lack of data manager/statistician for big data analysis and/or medical librarian for a precise literature search), as well as the absence of a defined professional route (such as the inability to advance professionally or the lack of fresh challenges to maintain motivation).

Gaining a deeper comprehension of the difficulties, requirements, and shortcomings of the current configuration is the first step towards perhaps resolving such an issue. The EANM Oncology and Theranostics Committee (OTC), with support from the EANM Board, promoted a survey addressing current NM residents from countries belonging to the EANM National Member Societies to explore their points of view on the perceived needs and expectations of younger generations in an effort to find ways to objectively measure young colleagues' involvement in research and active participation in EANM activities.

Inside the EANM OTC, a series of eighteen questions were developed. The survey (Table 1) was deemed appropriate for an online evaluation of New Mexico residents' expectations and perceived needs for their peers to improve their engagement in EANM research and activities after being approved by the committee coordinator.

The prospective anonymous survey was made using a Google module, and the link was shared via the OTC EANM social media platforms (Facebook and LinkedIn), by direct involvement from the co-authors of this manuscript, by personal contact from the EANM National Member Societies (who distributed the survey within the national NM societies), and by representatives of the residents' national associations (where available). The website was open from March 28, 2023, until May 18, 2023. Reminders were posted on the OTC website and other social media sites during this period. Thematic analysis and descriptive statistical techniques were used to collect and analyze both quantitative and qualitative data, respectively.190 people in total responded to the anonymous online poll. Of the total respondents, 52.1 percent were over 31 years old (with 28% being over 33 years old), and 47.4% were under 30 years old (Fig. 1A; Q1). The distribution of respondents was uniform across the various residency years (about 20% in the first through fourth years, 15% in the fifth year, not all countries included; Fig. 1B; Q2). Participants came from all across the world.

Europe is made up of more than 20 nations, the most common being Italy (14.2%), Germany (9.5%), Sweden (7.9%), Belgium (7.4%), and Romania (7.4%) (Fig. 1C; Q3). It should be noted that these percentages are calculated for the full sample and do not account for the overall number of NM citizens in each nation.

The majority of respondents (111/190, 58.4%) said they would like to be more involved in the association's activities, with EANM receiving the highest percentage (69.4%), followed by the European School of Multimodality Imaging & Therapy (ESMIT) with 29.7% (Fig. 2; Q4, Q5). Over 60% of participants expressed a desire to allocate a greater portion of their leisure time to EANM pursuits (Q10; 118/190, 62%). Their interest was mostly focused on taking part in educational activities (Fig. 2; Q6; results categorized from free text). (workshops, mentoring, get-togethers that encourage mingling with other residents, the EANM annual conference), which is succeeded by involvement in research projects. Participation in EANM committees was desired by a minority. Only countries with at least five respondents were included in the analysis. Of these, 86% of respondents were interested in becoming more involved in the association's activities (6/7) and Romania (12/14), 63% in the Netherlands (5/8), 62% in Switzerland (8/13), 61% in Germany (11/18), 52% in Italy (14/27), and 50% in Belgium (7/14).

A little over half of the participants (52.6%) have authored a minimum of one work that has been published in a peer-reviewed journal (Fig. 3; Q7), with the majority of these being the first author (Q8; 67/100, 67%).

At least one research project or subject was undertaken by 60% of respondents at their center (Q9). When asked where they would like to work professionally in ten years (Q11, Fig. 4), the majority of residents (143/190, 75.3%) said they would prefer to combine clinical and research activities in their future work, even though this would probably mean doing research in their spare time. This was followed by 40/190 (21.1%) who said they would prefer to work exclusively in clinical settings, and a small minority (3/190, 1.6%), who said they would prefer to work exclusively in research settings. Theranostic NM (diagnostic plus therapeutic, 152/190, 80%) was the area of greatest interest for the responders (Q12, Fig. 4), followed by diagnostic NM solely (32/190, 16.8%) and therapeutic NM exclusively.The two most common suggestions made when asked for ideas on how to encourage young people to participate in association activities (Q13, Table 2) were to have mentoring programs (68/190, 35.8%) and to host more resident-oriented events (77/190, 40.5%; e.g., how to do statistics, how to design a study, how to write an effective paper, etc.). A smaller percentage of respondents, 25/190 (13.2%), wanted to be directly involved in the planning of the annual conference events that are dedicated to residents. 7/13 of the 13/190 (6.8%) respondents who selected "other" for question 13 gave a detailed text description (Q14) of the steps that, in their opinion, were required: Mentoring, living compared to their forebears, a potential perceived reduction in professional reputation, and cultural/society changes were among the recommendations.

(e.g., more difficult family structures and engagement in extracurricular activities), a different relationship with patients that tests the mutual trust between doctors and patients

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(e.g., the requirement for malpractice insurance, pressure, and criticism between patients and medical professionals), a changed dynamic among residents, reduced conference fees; one respondent proposed that research participation should be made profitable.

78/190 (41%) respondents gave their expectations for EANM as free text (Q15, Table 3). These respondents are young professionals. The responses were grouped into a few major areas in Table 3, with the most common categories being educational programs (49%), which included more practical courses; high-quality publications/guidelines and research (14%); study and networking guidance (10%); and resident-oriented activities (10%). A few respondents requested more affordable rates that were exclusive to locals.

The majority of respondents (Q16; Table 4; 143/90, 75.3%) said they would be open to participating in an exchange program or internship overseas. These responses were primarily related to recognized academic exchanges in Europe (Q17; 57/143, 30%), internships in Europe (42/143, 22.1%), or internships outside of Europe (equally distributed between academic recognized 23/143 and internship 23/143, 21.1%). Conversely, 45 out of 190 respondents (23.7%) expressed no interest in traveling overseas. 83/190 respondents (43.7%) provided free text responses to the question (Q18, Table 4) regarding their reasons for wanting to participate in a working term abroad. The most common response was to expand their professional experience (on procedures, working standards, different protocols, broaden practical skills, and be exposed to a wider variety of clinical cases; 86%). In order to meet the growing demand for NM diagnostic procedures (PET/CT is routinely used in the work-up of most tumors) and theranostic applications, as well as to replace the aging labor force, it is imperative that we draw in young talent to New Mexico. The future of research in NM in particular, as well as in medicine generally, is represented by younger generations. Compared to internal medicine, surgery, or cardiology, NM is a relatively minor and "newborn" specialty. But the last 20 years have brought about a radical shift in how doctors, the general public, medical students, and residents view New Mexico. The introduction of computed tomography (CT) in hybrid imaging and the general improvement in diagnostic sensitivity and specificity was facilitated by magnetic resonance imaging (MRI).

PET/CT (positron emission tomography) was first used to detect [18F]FDG ([18F]fuoro-2-deoxy-D-glucose). This was made possible by the development of numerous different positron-emitting radiopharmaceuticals, which in turn allowed PET/CT to be included into most tumors' routine diagnostic flow charts. In contrast to the diagnostic setting alone, theranostics has recently been introduced into clinical practice (e.g., neuroendocrine tumors and prostate cancer), which may pique the interest of younger students who want to maintain a close relationship with patients and their management.

NM is a quickly developing field that is directly related to the creation and clinical use of novel radiopharmaceuticals or radioactive devices for both diagnosis and treatment. For this reason, every effort should be made to enhance the involvement of the younger generation in research. Although there are a lot of academic programs, conferences, and online resources available—possibly even more so now than when most of the authors of this study were still in their early years of education—younger generations could find it challenging to get started in research and to find their "place."

190 present inhabitants of New Mexico responded to this anonymous online poll, which consisted of 18 questions. Five nations had higher response rates than the others: Italy, Germany, Belgium, Sweden, and Romania. The survey produced five important findings: (1) Generally speaking, 60% of respondents desire to get more involved in EANM (EANM >ESMIT), however there is significant variation among nations; (2) 60% of respondents are presently engaged in research, which has frequently led to participation in a paper published in a peer-reviewed journal; (3) respondents strongly prefer to combine clinical work with research activities and be active in the broad field of theranostics (imaging and therapy); (4) respondents ask for more resident-oriented events, mentoring programs, guidance for studying and networking, and educational programs/guidelines in order to enhance their careers; and (5) seventy-five percent of respondents want to take part in an exchange program to improve their professional experience.

Remarkably, theranostics was mentioned as NM's most alluring feature. On the one hand, this outcome is predicted given the quickly advancing field of study and the exponential rise in the number of centers activating theranostic facilities, largely as a result of the 2019 approval of [177Lu]Lu-DOTATATE and the recent developments in prostate cancer theranostics, which are anticipated to further sharply increase demand for and require the services of theranostic professionals. However, it also demonstrates that younger generations are open to participating in the new patient care period, where the NM physician actively participates in the multidisciplinary team of treating physicians.

About 40% of those asked how they would recommend encouraging youth involvement in association activities said they would be open to going to resident-focused events. Participants expressed interest in attending events aimed at advancing and improving their understanding of research methodology, including statistical analysis, study design, and effective paper writing. It most likely highlights the inadequate representation of particular research-oriented courses

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across the various academic programs. Given that most specialties and medical training programs teach statistics and methodology, it is possible to hypothesize that more practically oriented courses are needed to teach students how to handle the various stages and challenges of doing real-world research, such as study design, ethical committee approval, data collection and analysis, and paper writing. An additional noteworthy finding from the poll is that over 36% of participants indicated a desire to get mentorship. This can point to the necessity for a supervisor—either inside or outside the department—to encourage and test the resident. This could also help to facilitate certain institutional or organizational challenges and offer a free-form channel for communication of concepts and an opportunity for ideation. Remarkably, a minority of respondents expressed interest in participating in committee activities. This could indicate a lack of understanding of the EANM committees' responsibilities. It may also be a sign that older colleagues should be mentoring junior colleagues who will be serving on committees in the future. According to the current batch of responders, the main goals of EANM are to support educational initiatives, offer advice on studying and networking, and serve as a resource for guidelines and research. This outcome was surprising given the extensive EANM efforts (such as Learn & Improve Professional, Continuing Medical Education (CME) courses, and ESMIT The annual conference's Skills (LIPS) Track courses) are already devoted to promoting learning opportunities, such as monthly free webinars. The proportion of locals who belong to the EANM is still unclear. This would often grant them complete access to the various on-site and online learning modalities that are accessible.

To reach a larger potential audience, it can be thought of improving the social media promotion of these already-existing educational activities run by EANM and ESMIT in the future. Additionally, it could be possible to combine a number of activities aimed at preparing residents for a future in research with the more formal academic programs through more hands-on workshops.

Given that two-thirds of participants were prepared to accept The goal of an academic exchange program or internship abroad is to provide residents with a broader medical experience. To that end, every effort should be made in the future to improve and facilitate residents' experiences abroad by increasing their knowledge of various procedures, working standards, and protocols, as well as by broadening their practical skills and exposing them to a wider variety of clinical cases.

However, because the survey's results could be skewed by a variety of circumstances, it is important to evaluate them cautiously. It's possible that the poll was more widely publicized in other nations, even with the assistance of national residents' associations (where applicable).

The fact that the majority of respondents were authors of at least one publication in a peer-reviewed journal and participated in at least one research activity or project at their center suggests that the respondents may perhaps be more driven than those who are not yet actively involved. This can cause a bias in the pool of respondents during selection.

It's also important to note that different countries have different percentages of citizens who would like to participate in association activities (only those reporting with at least five respondents are included): 86% for Israel (6/7) and Romania (12/14), 63% for the Netherlands (5/8), 62% for Switzerland (8/13), 61% for Germany (11/18), 52% for Italy (14/27), and 50% for Belgium (7/14).

It was not possible to derive a cause for this variability from the current survey. All years of residency had a fairly equal representation of responses (the fifth year of residency should have had fewer respondents, but this is not the case everywhere), suggesting that all years of residency respondents are worried about their training and prospects for the future.

Surprisingly, considering the length of medical degree programs, the majority of responders were older than 31, with 28% of the cohort as a whole being older than 33. This could be the result of a number of factors, such as the fact that some students completed their degrees later, switched to nuclear medicine from another course or specialization, prolonged their specialist training term (for example, by taking a pregnancy leave during their specialty), or engaged in research during their residency.

In order to meet the growing need for New Mexico specialists and to foster the state's scientific advancement, it is imperative that we increase the participation of younger generations in research and encourage aspiring medical students to specialize in New Mexico. It is encouraging to observe that younger generations are drawn to New Mexico, mostly for the combination of research and medical care. It is unexpected that residents' top desire, out of all the events offered—many of which are free or available online—is to improve educational opportunities. On closer inspection, though, this probably reflects the need for more realistically focused courses, as well as programs that create and supply the foundational knowledge required to foster and advance a career in research.

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