such as the European Union. Additionally, this work addresses the variability among cardiothoracic, cardiac, and thoracic surgery pathways. After exhibiting a large body of tabulated comparisons, the authors formulate recommendations covering the assessed categories. Although the recommendations lack specificity for standardization, they acknowledge the unique needs of each country.

Cardiothoracic surgery has an ever-changing future as a specialty with ongoing diversifying scopes of practice because of emerging technologies and earlier specialization to address unmet needs of the ongoing disease burden.[5] The variation of training will only be intensified in this trajectory. As the Accreditation Council for Graduate Medical Education in the United States works to realign milestones for thoracic residency programs and the Society for Thoracic Surgeons continues to refine the national surgical curriculum, there is precedent for such a movement and a model of the personnel needed to achieve such an important task. As the Accreditation Council for Graduate Medical Education's Thoracic Milestones outline cardiac, thoracic, and professional standard requirements, training programs could use this as a format to distinguish objections and to guide a trainee on the basis of intended practice paths of a cardiac only, thoracic only, or combined cardiothoracic career. Definitive measures for producing guidelines for standardization must be at the highest level priority to our specialty worldwide. Although standardization might be a long road in development, the trainees and, ultimately, the trainee's future patients will benefit from its completion.

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Commentary: Learning cardiothoracic surgery: More similar than not

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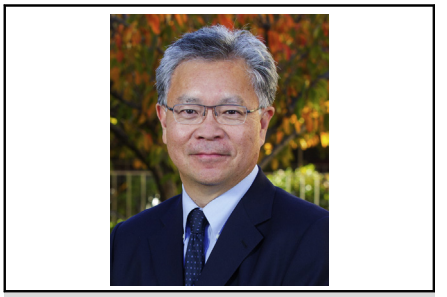

James I. Fann, MD

CENTRAL MESSAGE

Addressing challenges in cardiothoracic surgery training will benefit from continued dialogue, which in turn depends on better understanding of each program.

By combining previous reports of cardiothoracic surgery education and communication with educators in the many regions of the world, Nissen and colleagues[1] provide the reader with the most comprehensive comparison of training programs to date. On first pass, differences appear to exceed the similarities. Of these is the variability among programs in the assessment of trainees during and at the end of training. Worldwide and over several decades, leading surgical educators have addressed the needs and changes of the specialty and the trainees. Specifically and by design, the authors focus on ongoing issues related to workforce

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projections, assessment of trainees (including certification of competence), and dynamics of surgical practice and technology. In reviewing this report, which provides much clarity regarding many international programs, one cannot help but think that general concerns may be better addressed by a larger community of educators, perhaps harmonizing our approach to training, or at least some components thereof. The idea of globalization suggests that a broader approach to cardiothoracic surgery education may be warranted.

As a result of the convergence of an aging population, anticipated retirements, and previously declining rates of applicants for cardiothoracic surgery training positions in the United States and Canada, much attention is directed at the shortage of cardiothoracic surgeons. Similar patterns can be seen elsewhere, although there continues to be fewer slots for training than the number of applicants in many countries, presumably because of socioeconomic reasons or as simple as to ensure sufficient job opportunities after training. Although few countries, such as the United States, require completion of general surgery residency as one path to more advanced training, most have adopted a streamlined approach whereby trainees enter cardiothoracic surgery residency after medical school. The variability of educational requirements reflects the idea that the development of expertise is not strictly related to an external structure, a time constraint, or a high case number. What can be controlled is the time required and case number, but much research suggests that expertise and expert development is more complex with less well-defined characteristics, one important component of which has been termed "personal drive" or "motivation." Critical to the development of expertise is deliberate practice, which includes well-defined task to practice, providing detailed and immediate feedback, motivation to improve, variable level of difficulty of task, and ample opportunity for repetition and refinement.[2] Future research in deliberate practice and skills acquisition in our specialty will assist the resident in reaching his or her clinical potential.

As assessment continues to evolve in cardiothoracic surgery, well recognized is that we have a long history of developing reliable written examinations to assess knowledge. As information and data increase, the examination process (including high-stakes oral examinations at the end of training) has maintained much relevance. On the other hand, many consider assessment of technical skills as being less objective, evidenced by the varying approaches to such assessment, the commonality of which relies on the "signing off" by or at the discretion of the program director or senior mentor. Still investigational, competency-based advancement (ie, the Canadian model) purports to offer an avenue to ensure quality among trainees. Logistic questions remain with this model, such as the staffing of clinical rotations should there be unanticipated trainee advancement or remediation. True to the history of our specialty, cardiothoracic surgery is affected by technology, requiring surgeons to acquire additional expertise, which in the current era is in interventional or endovascular management of cardiac and thoracic disorders. Recognizing varying exposure to new technology, one approach is to establish formalized rotations at centers of excellence, ensuring access to interventional training.

Given the cultural and sociopolitical differences, it is not likely that a harmonized approach (eg, among the countries in this report) for cardiothoracic surgery training will be adopted in the near future. On the other hand, there are many programmatic similarities and challenges that may be better addressed collectively, such as improved training methods for existing and new procedures and assessment of competence and maintenance of skills. Addressing challenges will benefit from continued dialogue, which in turn depends on better understanding of each program, nationally and internationally.

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