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# The Blue Ribbon Committee II Report and Recommendations on Surgical Education and Training in the United States: 2024

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**Objective:** An expert panel made recommendations to optimize surgical education and training based on the effects of contemporary challenges.

**Background:** The inaugural Blue Ribbon Committee (BRC I) proposed sweeping recommendations for surgical education and training in 2004. In light of those findings, a second BRC (BRC II) was convened to make recommendations to optimize surgical training considering the current landscape in medical education.

**Methods:** BRC II was a panel of 67 experts selected on the basis of experience and leadership in surgical education and training. It was organized into subcommittees which met virtually over the course of a year. They developed recommendations, along with the Steering Committee, based on areas of focus and then presented them to the entire BRC II. The Delphi method was chosen to obtain consensus, defined as  $\geq 80\%$  agreement among the panel. Cronbach  $\alpha$  was computed to assess the internal consistency of 3 Delphi rounds.

**Results:** Of the 50 recommendations, 31 obtained consensus in the following aspects of surgical training (# of consensus recommendation/# of proposed): Workforce (1/5); Medical Student Education (3/8); Work Life Integration (4/6); Resident Education

(5/7); Goals, Structure, and Financing of Training (5/8); Education Support and Faculty Development (5/6); Research Training (7/9); and Educational Technology and Assessment (1/1). The internal consistency was good in Rounds 1 and 2 and acceptable in Round 3.

**Conclusions:** BRC II used the Delphi approach to identify and recommend 31 priorities for surgical education in 2024. We advise establishing a multidisciplinary surgical educational group to oversee, monitor, and facilitate implementation of these recommendations.

**Keywords:** educational technology and assessment, faculty development and educational support, medical student education, research training, residency education, structure and financing of surgical training, surgical education, surgical training, surgical workforce, work life integration

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In June 2002, inspired by the Presidential Address of Dr Haile Debas at the 122nd meeting of the American Surgical Association (ASA), the ASA and the ASA Council

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in partnership with the American College of Surgeons (ACS), the American Board of Surgery (ABS), and the Resident Review Committee for Surgery (RRC-S) established a Blue Ribbon Committee on Surgical Education (BRC I).<sup>1</sup> The committee was charged with “examining the multitude of forces impacting health care and making recommendations regarding the changes needed in surgical education to enhance the training of surgeons to serve all the surgical needs of the nation, and to keep training and research in surgery at the cutting edge in the 21st Century.”<sup>2</sup> They published 34 recommendations in 2005 which included the following key elements: restructure general surgery residencies to include a modular format with continued specialization through fellowships and a focus on creating a training environment that reduces fatigue and promotes balanced lifestyles; study the impact of the 80-hour work week; broader application of simulation to teach and verify basic surgical skills; develop an optional research module with possibility for an advanced degree; and develop a new curricula for training.<sup>2</sup> A decade later a panel at the 132nd ASA meeting identified persistent issues in general surgery training and recommended the following actions: the need to define and continually update the curriculum, broader use of simulation, more structured teaching and assessment and earlier specialty focus during residency training.<sup>3</sup> Most recently on September 19, 2022, the ABS convened a summit on entrustable professional activities (EPAs) in surgery and competency-based medical education (CBME). At that meeting there was a discussion of the current status of surgical training in the United States. The attendees agreed that it was time for an updated and comprehensive look at surgical education and agreed that the ASA and the ACS would be the appropriate organizations to lead this effort. After consideration the ACS, ASA, and ABS agreed to sponsor the Blue Ribbon Committee II (BRC II) which first met in February 2023.

The charge to BRC II was to consider contemporary issues that affect surgical education and make recommendations to enhance training in general surgery and its related specialties today and in the future. Although the focus is on general surgery and its related specialties, advances in other surgical disciplines informed the conversation of the committee. Thus, we are hopeful that the observations and recommendations will apply to the training of surgeons across all surgical disciplines. It is important for all surgeons to realize that as a profession we are more effective when we work together.

## BACKGROUND

Since the BRC I published its findings in 2005, the medical landscape has changed considerably.<sup>2</sup> Technical advances have transformed surgical practice, especially in abdominal and vascular surgery. Discoveries in molecular biology, genetics and immunology have changed our approach to cancer. New ways to organize surgical care have arisen as seen with acute care surgery and continued specialization. The delivery system has gradually merged, an electronic health care record has been developed and implemented, and the majority of surgeons are employed by hospitals, large multidisciplinary practices and even venture capital firms. A new generation of surgeons has assumed leadership in the profession with their own sensibilities about their role in the profession and its future. The COVID-19 pandemic put the spotlight on the tenuous

balance of the competing priorities of patient care and surgical education exposing the dilemma posed by these dual professional obligations.<sup>4</sup>

Some of the recommendations of BRC I have gained traction and been implemented. There is a well-organized national general surgery curriculum developed by the Surgical Council on Resident Education (SCORE)<sup>5</sup> and numerous educational offerings by national organizations representing all surgical specialties. There has been a greater emphasis on preparing faculty to teach and there are opportunities for professional advancement as an educator. The number of graduating residents has grown, although not at a pace to meet the country’s needs either by total number or geographic distribution. The number of women in the profession has increased considerably although racial diversity remains unchanged. The ABS and the RRC-S have provided increased flexibility in the training structure and a competency-based system is evolving.<sup>6,7</sup>

Importantly, surgical training is quite different than that of primary care or other medical specialties, due to the necessary portfolio of diagnostic and treatment options for surgical disorders as well as the development of surgical skills. Although we have adapted to an 80-hour work week, it has not been without major programmatic adjustments and the need for more training to develop the ability to provide high-quality surgical care.

Herein, we present the findings of this committee and its recommendations. Importantly, future manuscripts from each of the subcommittees will provide greater details of the issues and their recommendations.

## METHODS

We used the key issues of focus for BRC I as a blueprint for BRC II.<sup>2</sup> To guide the process a Steering Committee was formed (Supplemental Digital Content 1, Table 1, <http://links.lww.com/SLA/F128>). This group purposely chose and invited a diverse group with experience in surgical education and training to join BRC II.

Eight working subcommittees were established (Table 1). We invited the authors of the BRC I paper to take part in one of the subcommittees to assess the impact of its recommendations and future opportunities. The above groups joined the Steering Committee to form BRC II, which made a total of 67 members. BRC II designed an orderly workflow (Fig. 1). The subcommittees formed expert panels in specified areas of focus and developed initial recommendations. The subcommittees were instructed to submit a report on their area of focus. The number of expected recommendations was not specified. In December 2023 and January 2024, BRC II held 2 meetings to further discuss each recommendation by the subcommittees. The Steering

**TABLE 1.** Blue Ribbon Committee II Focus Areas and Subcommittees

Blue Ribbon Committee I Review: Findings and Impact
Medical Surgical Workforce
Medical Student Education
Work Life Integration, Wellness, and Resilience
Residency Education in Surgery
Goals, Structure, and Financing of Surgical Training
Faculty Development and Educational Support
Research Training
Educational Technology and Assessment



**FIGURE 1.** The process used for the work of Blue Ribbon Committee II. The goal from the beginning was to be as inclusive and transparent as possible with frequent virtual meetings of the subcommittees and the full panel. An in-person meeting was held on November 14 and 15, 2023 and allowed for discussion of all recommendations proposed by the subcommittees and the steering committee. Following this there were 2 additional virtual meeting designed to allow in depth discussion of the proposed recommendations before the Delphi analysis.

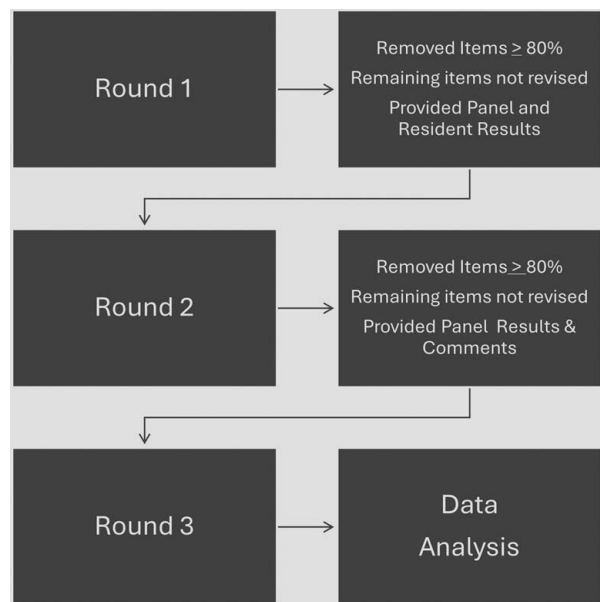
Committee processed and synthesized these, including feedback from the subcommittee co-chairs and other committee members. For more feedback, we presented the findings and recommendations of the subcommittees in separate virtual meetings to a sample of diverse general surgical trainees (January 2024) and education leaders representing all of the surgical disciplines (February 2024) (Supplemental Digital Content 1, Table 2, <http://links.lww.com/SLA/F128>). All subcommittees, including the BRC I members, were invited and participated in meetings of the BRC II and discussion of proposed recommendations as well as the Delphi process as outlined below.

We chose the Delphi method to obtain consensus of the BRC II recommendations. The process followed previously published guidelines.<sup>8</sup> We used Research Electronic Data Capture (REDCap) to create an anonymous survey that included all subcommittee recommendations and several suggested by the Steering Committee. We sent 3 rounds of electronic surveys for Delphi assessment with frequent email reminders (Fig. 2).

We emailed the first Delphi round survey as a link to all BRC II members (N = 63, excluding the 2 BRC II Co-Chairs and the 2 Delphi Consultants) that made up the expert panel for this process. Each panelist was asked to assess each of the 50 proposed recommendations for the goal of advancing and optimizing surgical training. They were asked to answer, “Should the following subcommittee recommendation be included in the final BRC II recommendations and paper based on its anticipated impact and feasibility” using a rating scale of Yes, Don’t Know, and No. Panelists could also provide free text comments on the recommendations. We computed the percentage of “yes” choice and the Cronbach  $\alpha$  for each individual recommendation to evaluate internal consistency (N = 50).<sup>9</sup> The following definitions of Cronbach  $\alpha$  were applied: where  $\alpha$  is internal consistency: >0.9 excellent; >0.8 good; >0.7 acceptable; >0.6 questionable; >0.5 poor; and  $\leq$ 0.5 unacceptable. The Consensus Rating (CR) was defined based on a proposed recommendation reaching a Cronbach  $\alpha$  >0.70 and the percentage of “yes” choice wherein CR1; 80% to 100%, CR2; 60% to 79%, CR3; 21% to 59%, and

CR4; 0% to 20%. Proposed and unmodified recommendations that did not reach CR1 ( $\geq$ 80%) a first round were included in the next Delphi round. In Round 2, panelists were also provided with the panel CR and the resident focus group CR from the initial survey. In Round 3, panelists were provided with the panel CR from Round 2 remaining items and the panelist comments from Round 1.

In addition, during the first Delphi round, each panelist was asked to evaluate the impact and implementation difficulty of each proposed recommendation using a 5-point



**FIGURE 2.** The Delphi method was chosen to obtain consensus defined as >80% agreement among panel members. Three rounds of voting occurred with frequent email reminders. After each round those recommendations reaching consensus were removed from the subsequent survey rounds, the statements were not modified, and additional information provided as indicated in the figure.

Likert scale (5 = major impact/very difficult, 4 = high impact/difficult, 3 = moderate impact/neutral difficulty, 2 = low impact/easy implementation, 1 = no impact/very easy implementation). Mean score and SD were computed for impact and implementation difficulty for each recommendation.

We used JMP software (JMP Pro 16; SAS Institute) to perform all statistical analysis.

As part of the process, we also engaged the voice of surgical trainees to assess the 50 proposed recommendations per the goal of advancing and optimizing surgical training. To obtain their perspectives, we sent the first round survey link to a group of residents and fellows ( $n = 20$ ) who were purposely chosen considering sex, race, ethnicity, region, and specialty by the BRC II subcommittee co-chairs or steering committee members. The survey sent to them did not request their evaluation of impact or implementation difficulty of the proposed recommendations. This group of trainees was not part of the expert panel, but as mentioned above, they formed an important focus group that met with the BRC II Committee in January 2024. We did not report the trainee qualitative feedback analysis in this manuscript.

This report is an overview of the recommendations. It is hoped that future manuscripts prepared by the subcommittees and surgical trainee focus group will more fully describe specific recommendations and considerations. We present priority recommendations that reached at least 80% consensus and the panel's assessment of impact and implementation difficulty of each. Table 2 shows recommendations that did not reach consensus.

## RESULTS

### Panel Demographics

The detailed demographic characteristics of the panel are shown in Supplemental Digital Content 1, Table 3, (<http://links.lww.com/SLA/F128>). Of the 43 panelists, 16 identified as women (37%) and 26 as men (61%). Eighty-six percent (37/43) of panelists were older than 45 years. Seventy percent identified as White or Caucasian, and 9% as Asian/Pacific Islander, Black or African American, or multiple ethnicity or other (4/43). Experience as a surgical educator varied with 57% reporting > 20 years' experience. The majority had multiple leadership roles in surgical education and over 95% were engaged in the education of both medical students and residents with 75% also engaged with fellows. Over 50% (23/44) of the panel reported 20 or more publications in surgical education, 25% (11/43) reported overseeing a research laboratory, and 84% (37/43) reported having a leadership role in a national surgical organization.

### Delphi Analysis

The detailed Delphi analysis results are shown in Supplemental Digital Content 1, Table 4 (<http://links.lww.com/SLA/F128>). After 3 survey rounds, 31 recommendations met the criteria for CR1 with 23 occurring in Round 1, 4 in Round 2, and 4 in Round 3. Eight recommendations met the criteria for either CR2 or CR3 and 3 recommendations were in the CR4 category. The response rate by Delphi Round was as follows: Round 1 81% (51/63), Round 2 68% (43/63), and Round 3 57% (36/63). The Cronbach  $\alpha$  was consistent with "good" internal consistency for Round 1 (0.833) and Round 2 (0.825). Internal consistency was "acceptable" for Round 3 (0.792).

## Recommendations and Discussion

In this paper, we describe the surgical training priorities that were developed by a carefully selected group of experts in surgical education. We used a Delphi process to achieve consensus and the recommendations that met the criteria for CR1 are presented in rank order from highest level of consensus to lowest level of consensus for each area. Those recommendations that did not reach the predefined criteria for consensus are listed in Table 2. The organization below follows the issues that were considered by the subcommittees and/or BRC II. For reference, after each recommendation we provide the Consensus Rating (CR) 1 to 4; % Agreement; Impact and Difficulty (mean/SD).

### Surgical Medical Workforce

The consideration of the surgical and medical workforce was not assigned to a subcommittee, but rather was a focus of the full committee and steering committee. Five recommendations were discussed and included in the Delphi analysis of which one reached consensus.

### Recommendations

1. Meeting the demographic needs of the population served, as well as the sustainability needs of the surgical workforce is a priority for surgical training (CR1; 96%; Impact 3.51/0.92, Difficulty 3.90/0.76).

### Discussion

There was a clear consensus that the demographic needs of the population served, as well as the sustainability needs of the surgical workforce is a priority for surgical training. In the past 20 years, there has been a 40% increase in medical school graduates and graduates of training programs in general surgery and its related specialties. Yet there are still shortages and maldistribution today which are predicted to grow in the future.<sup>10</sup> Alternative strategies are needed. The committee could not reach consensus on ways to channel US trainees to needed specialties or practice areas. Nor could the panel reach a strong consensus about methods to enhance the role of international medical graduates in fulfilling these needs. Continued discussion and development of new solutions along these lines is desperately needed and should be a priority for the future. This will need collaboration between surgical organizations, the government, regulatory groups, graduate medical institutions, and oversight bodies.

### Medical Student Education

This subcommittee was charged with reviewing foundational curricula and newer approaches, including simulation and telemedicine in medical student surgical education. An important focus was on transition to residency. Of 8 recommendations included in the Delphi assessment, 3 reached consensus.

### Recommendations

1. Develop models embraced by medical schools at the national level that programmatically and financially support surgical faculty and trainees engaged in surgical education and career development of students interested in the surgical disciplines (CR1; 84%; Impact 3.50/0.85, Difficulty 3.95/0.83).
2. The ACGME, LCME, APDS, and ASE, and specialty societies should work at the national level to develop an

**TABLE 2.** BRC II Recommendations That Did Not Meet 80% Consensus Threshold

Recommendation	Delphi analysis results Consensus Rating (CR) 1-4; % Agreement; Impact (mean/SD); Difficulty (mean/SD)
<b>Surgical Medical Workforce</b>	
Streamline pathways for internationally trained surgeons to enter the surgical workforce while maintaining high standards for quality care	CR2; 75%; Impact 3.24/0.86, Difficulty 3.94/0.93
Streamline pathways for International medical graduates to enter surgical training in the US while maintaining high standards for quality care	CR2; 67%; Impact 3.29/1.08; Difficulty 4.06/0.97
Design a matching and support system for the selection of medical students with a commitment to working in underserved communities	CR3; 47%; Impact 3.33/0.91; Difficulty 3.67/0.97
Design a matching and support system for the selection of medical students with a commitment to working in needed specialties, inclusive of true general surgery	CR3; 36%; Impact 3.35/0.89; Difficulty 3.73/0.92
<b>Medical Student Education</b>	
The ACS in consultation with the House of Surgery should develop and establish a national curriculum for basic and modular surgical specialty focused surgical education to be required by students entering surgery, ideally reinforced before entering internship at their matched location	CR2; 67%; Impact 3.34/0.96; Difficulty 3.57/0.97
To enhance the pipeline to surgery, develop national models required for medical school accreditation (LCME) for structured engagement programs targeting different educational levels (grade school, high school, college, etc.) and underserved and rural communities	CR3; 36%; Impact 3.25/1.08; Difficulty 3.86/0.95
Develop models at the national level to be required by the medical school accrediting bodies (LCME) for mentorship, early exposure, and creation of an inclusive environment for all medical students interested in surgery with a special emphasis on the needs of those from diverse racial, ethnic, and social backgrounds	CR3; 36%; Impact 3.14/1.05; Difficulty 3.68/0.93
Surgical leaders in collaboration with the Council of Deans and others, should develop a longitudinal surgical major to be recommended for all students planning to enter graduate surgical education	CR3; 36%; Impact 3.18/1.06; Difficulty 3.61/0.78
To better reflect the practice of the surgical disciplines surgical education leaders at the national level develop disease oriented educational modules focusing on cross specialty collaboration and expectations (call, etc.) to train students in surgery, with modular approach to those not entering a surgical specialty (basic) and those applying into surgery (advanced)	CR3; 22%; Impact 2.93/1.04; Difficulty 3.68/0.98
<b>Work Life Integration, Wellness, and Resilience</b>	
Codify national guidelines regarding resident trainees (surgery included), wages, and benefits	CR2; 75%; Impact 3.84/1.00; Difficulty 4.02/0.87
Establish an intentional national framework for examining program culture, Department Chair leadership, and program leadership	CR2; 67%; Impact 3.11/1.23; Difficulty 3.67/1.02
<b>Residency Education in Surgery</b>	
A digital literacy curriculum (teaching aimed at the learner's ability to use information and communication technologies to find, evaluate, create, and communicate information) should be incorporated into SCORE and other national curricula for surgical training	CR2; 72%; Impact 3.11/1.01; Difficulty 2.57/0.85
Transition from training to independent practice should be mentored, informed by competency assessment, and be the primary responsibility of terminal training	CR4; 20%; Impact 3.28/1.05; Difficulty 3.89/1.08
<b>Goals, Structure, and Financing of Surgical Training</b>	
Reduce the training time for general surgery to a minimum of 4 yr if the trainee has met the required competencies	CR3; 56%; Impact 3.80/0.92; Difficulty 4.16/0.95
Develop advanced 2-yr certificate programs in general surgery that define a period of required conditional independence (Promotion in Place)	CR4; 17%; Impact 3.42/1.12; Difficulty 4.02/0.75
At the national level, define and include the successful attainment of a professional surgical identity as a goal of surgical training	CR4; 14%; Impact 2.58/0.99; Difficulty 3.47/0.99
<b>Faculty Development and Educational Support</b>	
Establish a task force to define the levels of faculty appointment as surgical educators including education administration, providing lectures and didactic activities, or teaching clinical skills via an apprenticeship model	CR2; 69%; Impact 2.86/1.03; Difficulty 3.55/1.02
<b>Research Training</b>	
For Track 3 (surgeon-scientist): Establish efforts to incorporate research training throughout residency/fellowship (instead of dedicated research years) and compress clinical training to not extend overall training time—similar to early specialization pilots	CR2; 72%; Impact 2.98/0.94; Difficulty 4.00/0.80
Provide a suite of video-based education modules focused on foundational research training	CR3; 33%; Impact 2.78/0.82; Difficulty 2.62/1.09

optimized residency selection process that adopts enhanced objective metrics in residency applications with a shift in focus from traditional cognitive tests to a holistic assessment approach that evaluates leadership, decision-making, ethics, technical skills, and standardized competency-based assessments of required skills (CR1; 82%; Impact 3.80/0.90, Difficulty 4.20/0.88).

3. At the surgery department level optimize availability of role models of diverse backgrounds to create a nurturing atmosphere and educational environment consistent with standards of the surgical profession (CR1; 82%; Impact 3.30/1.02, Difficulty 3.36/1.12).

## Discussion

Departments of Surgery have traditionally focused on surgical care delivery, development of research programs, and the training of residents and fellows. Medical student education has sometimes taken a backseat to these missions and has often been overlooked or not appropriately prioritized. It is important that departments take a longitudinal approach to surgical training, recognizing that exposing students to surgery and surgeons early in the continuum will give students an understanding of the diverse options in a surgical career. This can begin with involvement in medical student curriculum design, providing didactic lectures in the preclinical years, and shadowing experiences before third year clerkships. It requires commitment of time by surgical faculty, and ideally would include role models that are diverse in subspecialty practice, clinical versus research focus, sex, and race/ethnicity. Increasingly, faculty compensation models that primarily rely on clinical productivity for faculty salaries diminish a department's ability to support the education mission. Faculty and programmatic support is needed as are models of how to finance these efforts.

Successful transition from medical school to residency training relies upon adequate preparation and a fair selection process. While the fourth year of medical school is under the purview of each school, students interested in training in surgical specialties must be provided with meaningful experience during subinternships, including exposure to overnight call. Working with the Association of Program Directors in Surgery and the Association for Surgical Education, the ACS has developed a curriculum to prepare medical students for residency.<sup>11</sup> Implementation of standardized curricula during the core surgery clerkships merits thoughtful consideration as it should help in providing students a solid foundation for the next phase of their professional development.

The current selection process for students aspiring to match into a surgical specialty merits reevaluation. Although standardized tests are important measures of test taking abilities, a holistic review of applicants' other attributes can allow selection of students for interview and eventual matching based on the program values, and specific program priorities, including research interests, commitment to caring the underserved, and racial/ethnic diversity.

## Work Life Integration, Wellness, and Resilience

This subcommittee investigated the various needs of today's trainees and recommended changes to meet those needs and improve work-life balance, physical as well as psychological safety, and program culture. Of 6 recommendations that were included in the Delphi assessment 4 reached consensus.

## Recommendations

1. Create best practice recommendations for program and department leadership for creating a culture of belonging for surgical trainees (CR1; 87%; Impact 3.53/1.06, Difficulty 3.09/1.06).
2. Convene a multidisciplinary national group to achieve an equitable value-based and sustainable improvement in resident wages, taking into consideration the economic value (ROI) of a surgical trainee (CR1; 82%; Impact 3.69/1.04, Difficulty 3.89/0.96).
3. Develop a national framework defining workplace safety for surgical trainees (CR1; 82%; Impact 3.51/1.08, Difficulty 2.89/0.88).
4. Creating a just pathway for reporting of workplace mistreatment that provides an equitable investigation free of retaliation (CR1; 81%; Impact 3.29/1.01, Difficulty 3.76/1.03).

## Discussion

The life of surgical trainees has dramatically changed in the last 20 years. Adoption of duty hour limits has not negatively affected patient care.<sup>12</sup> However, trainees work in an environment that is fast paced, and care for an increasing number of complex patients. Thus, the learning environment is pressured, focusing on patient care, often at the expense of wellness, personal and family priorities. The hierarchical relationship between trainees and surgical faculty may prevent honest reporting of concerns such as harassment, discrimination, and abuse.<sup>13</sup> This has possibly contributed to the alarming rates of burnout and suicidal ideation.<sup>14</sup> To help mitigate these concerns, Departments of Surgery are encouraged to create a culture of belonging for surgical trainees. Belonging can be defined as the feeling of security and support achieved when there is a sense of acceptance, inclusion, and identity for the trainee in the surgical department. This feeling of group acceptance helps protect the individual from the untoward effects of psychological stress.

While human resource policies and ACGME program requirements define avenues for reporting of mistreatment, they are often ineffective due to trainee reticence to report. The ACGME has 2 mechanisms for residents to report issues in the training program: an ombudsman whose job is to resolve issues outside of the accreditation system; and a formal complaint mechanism that goes directly to the ACGME.<sup>15</sup> A just pathway does exist; however, department and institutional practices need to be aligned with these national guidelines and best practices. A better understanding of what constitutes workplace safety standards for surgical trainees can lead to a safer environment for trainees as well as a greater sense of belonging. Standards for anonymous reporting concerns of harassment or abuse should be widely adopted.

While the cost of living, varies throughout the country, there are situations where the trainee salaries are barely adequate, despite the fact that the resident workforce, including those training in surgery provide immense value to hospitals and health systems for the direct patient care they provide. This complex issue affects all trainees, and data should be gathered on salary, benefits, and value of their work to inform national multidisciplinary discussions to address these financial concerns.

## Residency Education in Surgery

This subcommittee reviewed current curricular efforts, including competency-based medical education. They considered simulation and newer modalities such as telemedicine and artificial intelligence. In addition, they examined trainee assessment in competency-based education and the use of EPAs. The transition from residency to practice was of particular interest. Of 7 recommendations considered in the Delphi analysis, 5 reached consensus.

### Recommendations

1. National guidelines should be promulgated to support a comprehensive approach to competency-based reform, inclusive of curricular and assessment reforms, as well as faculty and trainee development (CR1; 96%; Impact 3.64/0.87, Difficulty 3.81/0.85).
2. Entrustable professional activities (EPAs) should be implemented as a competency-based assessment strategy for all surgical disciplines (CR1; 85%; Impact 3.11/1.01, Difficulty 2.57/0.85).
3. A mechanism for ongoing review and revision of SCORE should be implemented to ensure currency, including addition of updated content and elimination of nonessential or outdated elements (CR1; 85%; Impact 3.38/1.02, Difficulty 2.45/0.88).
4. A national research consortium should be established to critically review the effectiveness of competency-based reform, including a focus on implementation and correlation of educational and patient outcomes through data integration strategies (CR1; 81%; Impact 3.59/0.93, Difficulty 3.72/1.05).
5. Transition from training to independent practice should be mentored, informed by competency assessment, and be a shared responsibility between terminal training and index practice contexts (CR1; 80%; Impact 3.65/0.95, Difficulty 4.11/0.85).

### Discussion

Competency-based medical education is an accepted method for medical students and residency training. An effective process to implement EPAs across all surgical disciplines needs to be developed. Surgical faculty will require training in assessment and evaluation, with the understanding that these activities must be integrated into the daily activities of busy clinicians who are essential to resident education. The success of competency-based education and adoption of EPAs have relevance to general surgery residency training, the surgical specialties, and fellowship training programs. National guidelines for CBME and EPA's must be developed and will be most successful if proven for all surgical specialties. EPA's are task oriented but specifically avoid being focused on surgical technique or judgment alone, rather they address multiple domains of the ACGME competencies including communication and professionalism among others. It is always a risk, however, that EPA's will trend towards assessments of operative skill alone. This must be guarded against, or we may risk impeding the development of our trainees clinical thinking processes, curiosity, innovation, and development of effective and compassionate surgical care. Procedural training is crucial, but not sufficient. Thus, ongoing evaluation of these efforts will require critical review of the effectiveness of this reform, which might be best done as

national research consortium aligned with intentional data integration to allow objective assessment of educational and patient outcomes.

After completion of terminal formal training (residency or fellowship), new graduates benefit from continued mentorship, and potentially competency assessment. The responsibility for transition to independence should be shared by the training program as well as the practice they enter and might be enhanced by communication between these entities.

SCORE has become the standard national curriculum for general surgery residency training, as well as vascular surgery, pediatric surgery, complex general surgical oncology, and surgical critical care. The available knowledge for surgical residents has expanded incredibly due to electronic information available to trainees. Other surgical specialties have developed similar online curricula. Currently reviewed and revised every 3 years, these online learning materials must continue ongoing review and evaluation with the intent of highlighting current material relevant to the surgical trainee, with addition of new essential information and of elimination of outdated or unnecessary content.

### Goals, Structure, and Financing of Surgical Training

In this category, we considered the financial models supporting residency training and how current and future goals could be conducted and needs met within a changing paradigm. Specific considerations included: selection of candidates for surgical training; the importance of diversity alignment with workforce needs; the desired end product; essential resources (human, infrastructure, and finances); and sustainable financing. Eight recommendations were included in the Delphi analysis including 3 proposed by the Steering Committee. Of these, 5 reach consensus.

### Recommendations

1. Convene a summit of national surgical organizations to address funding shortfalls for surgical graduate medical education, to include stakeholders such as policymakers, government representatives, insurance company representatives, philanthropic development experts, and others (CR1; 91%; Impact 3.91/1.06, Difficulty 3.78/1.11).
2. Convene a summit of national surgical organizations including AAMC Representation (ie, Council of Deans and others) to define pathways to introduce medical students to the surgical disciplines in the first 2 years of medical school (CR1; 86%; Impact 3.18/0.98, Difficulty 3.24/0.98).
3. Convene a summit of national surgical organizations including AAMC Representation (ie, Council of Deans and others) to define best practices in providing financial support for surgeons involved with undergraduate and graduate surgical education (CR1; 84%; Impact 3.53/1.08, Difficulty 3.42/1.14).
4. Define the competencies for initial board eligibility in general surgery while simultaneously requiring a minimum of 4 years of training (CR1; 83%; Impact 3.53/1.06, Difficulty 3.53/1.10).
5. Move towards initial board eligibility for general surgery to occur when the trainee has met the required competencies (CR1; 82%; Impact 3.91/0.90, Difficulty 4.00/0.95).



## Discussion

Primary training in general surgery has been mostly unchanged for decades. Over the last 20 years, there have been developments in subspecialty training, including integrated residencies in vascular surgery, thoracic surgery, and plastic surgery. In addition, flexible pathways have been successful in terms of providing residents with an opportunity to have practice specific or fellowship specific training during residency. As surgical training moves toward a competency-based paradigm, EPA's hold promise of an even more efficient training system that allows individuals to meet their professional goals. If there is a shift from time-based training to a truly competency-based education, the competencies for completion of training need to be proven. Once these are reached (at a minimum of 4 years), board eligibility could be possible, which could create an opportunity for increased autonomy and even "promotion in place." There are potential barriers concerning implementation of EPAs including tradition and inertia as well as the need for added funding for a trainee that does not meet the expectations defined in the EPAs and will take longer to finish training.

The current method for financing graduate medical education relies primarily on funding from Medicare. As training programs have expanded, there is often inadequate funding for the number of training positions in hospitals. Given ongoing physician shortages including nearly all surgical specialties, we urge the federal government to find ways to invest more in graduate medical education. At the same time, it would be worthwhile to investigate alternate sources of funding. A meeting of surgical organizations should be planned and include broad stakeholder input.

Added financial concerns exist for funding of surgical educators. Engagement with the Association of American Medical Colleges (AAMC) is a reasonable starting point to explore options for financial support for surgical education and increased involvement of surgeons in the preclinical years of medical school.

## Faculty Development and Educational Support

This subcommittee investigated the demands on surgical faculty and proposed recommendations to promote and sustain that work into the future. Of the 6 recommendations included in the Delphi analysis, 5 reached consensus.

## Recommendations

1. Work across surgical disciplines to develop a national curriculum for faculty training in surgical education principles, including: teaching in the OR and the use of EPAs; coaching, mentorship, and sponsorship; creating a learning environment devoid of bias and a culture that supports surgical education (CR1; 91%; Impact 3.55/0.93, Difficulty; 3.57/1.11).
2. Establish a multidisciplinary surgical task force to develop a faculty teaching performance assessment tool based on the best available evidence (CR1; 84%; Impact 3.36/0.99, Difficulty 3.32/1.05).
3. Surgery RRC to work with APDS to define minimal faculty FTE requirements for program accreditation in the areas of teaching learners, including using simulation, for quality assessment and improvement, and database and portfolio development (CR1; 83%; Impact 3.18/0.97, Difficulty 3.70/0.95).
4. Establish a task force of leaders from all surgical disciplines, hospitals, and medical schools to define and

validate a system to pay surgeons for their efforts in graduate and undergraduate surgical education (CR1; 82%; Impact 3.82/1.06, Difficulty 4.09/0.94).

5. Establish a task force of leaders from all surgical disciplines and hospitals to accurately define the economic value of a surgical trainee (ie, resident, or fellow) for the purposes of negotiating hospital payment for their work (CR1; 81%; Impact 3.66/1.12; Difficulty 3.91/0.86).

## Discussion

Professional development for faculty is necessary to improve teaching skills, and training in evaluation and assessment is needed for successful implementation of competency-based medical education. As we improve our teaching skills, a tool to assess the quality of the teaching will be useful. A national teaching curriculum for faculty should be developed that involves all surgical specialties, including a focus on how to effectively implement EPAs and CBME in surgery. The issue of compensation for surgeons teaching time to offset lost clinical productivity is real and needs to be addressed with solutions found and implemented. To provide livable wages for trainees, it is essential that we define the economic value of all trainees to the hospitals including those in surgery. Strategic initiatives should be undertaken by surgical education leaders and colleges of medicine and osteopathy in collaboration with the AAMC and other oversight groups with regular meetings and monitoring of the progress.

## Research Training

This subcommittee was asked to review current efforts to train surgeon-scientists and how those efforts could be perfected to provide a universal minimum standard of research education simultaneously creating a research track for those pursuing an academic surgery career path (basic science research, education, quality outcomes, etc.). Specifically, they considered the best timing of research training in residency, curriculum, and advanced degrees. Of the 9 recommendations considered in the Delphi analysis, 7 reached consensus.

## Recommendations

1. Create a national research curriculum using a competency-based medical education (CBME) framework to meet the needs of the proposed tracks (CR1; 89%; Impact 3.11/0.98, Difficulty 3.58/0.92).
2. Update SCORE content for foundational research training (CR1; 89%; Impact 2.76/0.88, Difficulty 2.58/0.94).
3. Change the selection process for competitive surgical fellowships so that they do not hinge on a certain type of research experience but rather provide alternative ways to expose trainees to subspecialty disciplines and to reduce the barriers for surgical trainees to access fellowship training positions (CR1; 89%; Impact 3.64/0.88, Difficulty 3.47/1.06).
4. Establish nationally required research tracks as specified by the ACGME: foundational (Track 1), flexible (Track 2), and surgeon-scientist (Track 3) (CR1; 82%; Impact 3.76/1.03, Difficulty 3.98/1.06).
5. Establish national processes to evaluate the impact of the proposed changes in research training on resident wellness, fellowship matching, career trajectories, research discoveries and innovations, and other outcomes (CR1; 82%; Impact 3.07/0.78, Difficulty 3.18/1.01).
6. Implement the Track 2 (flexible) research pathway to enhance research training, scholarship, and professional

development to meet the future needs of academic programs and health care delivery systems (CR1; 80%; Impact 3.11/0.75, Difficulty 3.60/0.96).

- For Track 3 (surgeon-scientist): Develop a research track to prepare surgeon scientists to enhance competitiveness for extramural funding and allows board subspecialty certification. These programs will require a well-developed training program infrastructure (including dedicated program leadership, staff, and mentors), institutional commitment, and high-quality research environment (CR1; 80%; Impact 3.53/0.99, Difficulty 4.04/0.85).

## Discussion

Surgical research has led to transformational advances in the treatment of human disease, from the development of antiseptics, anesthesia, blood transfusion, nutritional support, and organ transplantation to the discovery of insulin and the targeted treatment of cancer. Yet the accelerating pace and deepening complexity of scientific discovery pose significant challenges to the ongoing role of surgeons, from the creation of new knowledge to its thoughtful translational application in the clinical setting.

All surgeons by the completion of their training should gain a fundamental appreciation for research that prepares them to ethically apply future scientific breakthroughs and technological advances to their clinical practice over the course of a career. To this end, a competency-based curriculum should be developed that includes interpretation of evidence, implementation, innovation, statistical approaches, bioinformatics, and scientific communication. This should apply to most trainees (Track 1). All programs regardless of setting or size should be able to readily access common resources for this curriculum through platforms such as SCORE.

Although some surgical scientists have been successful with a 2-year concentrated research experience during residency, it is becoming more widely appreciated that this limited research experience during residency is insufficient preparation for a career as an independent investigator. In fact, most trainees do not pursue such experiences with the goal of becoming a surgeon-scientist. Extension of research time beyond 2 years for the resolute few is usually impractical and may excessively disrupt clinical training. Because of the time needed to later complete residency and fellowship, a research hiatus of 4 to 6 years places the budding surgical investigator at considerable disadvantage. Individuals with advanced research credentials (eg, MD, PhD) may be discouraged from entering surgical training because of the total length of clinical training, during which their ability to conduct research is effectively on hold. To encourage the pursuit of careers as surgeon-scientists, it is important to set up a more efficient and effective pathway (Track 3) that better integrates research and clinical training, extending through subspecialty fellowship. Similar physician-scientist training pathways already exist within other clinical specialties such as Neurosurgery and Pediatrics and may serve as a useful blueprint. Because Track 3 requires substantial infrastructure, investment, and the availability of surgeon-scientists to serve as role models and mentors, it is predicted to be available in only a handful of programs and to apply to < 10% of trainees. The Track 3 strategy may maximize chances for the aspiring surgeon-scientist to achieve extramural funding and other metrics of success.

For trainees, dedicated time during residency for research and other professional development activities is

still a valuable experience that may provide skills and perspectives that further their individual academic, personal, and career goals as surgeons. However, some feel obliged to undertake these experiences during residency primarily to increase their perceived competitiveness for coveted subspecialty fellowship positions. Thus, a flexible approach to research and professional development time ("Track 2") should continue to be available to develop future leaders and meet the diverse needs of academic programs, but this should ideally be dissociated from the selection process for subspecialty fellowship.

## Educational Technology and Assessment

This subcommittee reviewed the technological advances in education since BRC I. They constructed a framework for applying these technologies to improve the effectiveness and efficiency of surgical education and assessment. They considered the implications of innovative technologies, including artificial intelligence, on learner-centered surgical education. They recommended a framework for applying these in surgical education. Five recommendations were made. After discussion with the full BRC II committee, these were combined into a single recommendation which reached consensus.

## Recommendations

- Given the rapidly changing landscape in surgical education and evolving technology, it is recommended that a Multidisciplinary Surgical Educational Council be established with the collaborative efforts of the ACS, ABS, ACGME, ASE, APDS, and the parallel surgical specialty boards and oversight groups to serve as an oversight body and convene subcommittees to: (1) monitor and facilitate implementation of BRC II recommendations, (2) establish, assess and maintain an up to date toolbox of new recommended educational technologies, and (3) develop consensus and road maps on best practices for technology implementation and prospective assessment (CR1; 93%; Impact 3.93/1.00, Difficulty 3.93/1.00).

## Discussion

This subcommittee found innumerable technologies available for surgical education, and included simulation, telementoring, artificial intelligence, video, and haptic sensors for assessment of technical skills. While these products and services have provided value to the end users, a comprehensive warehouse of educational technologies does not exist. An important work product was creating a toolbox of new educational technologies with guidelines for implementation. Further advances and evaluation of existing products would receive help from the establishment of Multidisciplinary Surgical Educational Council to coordinate efforts of the ACS, ABS, and surgical education societies in advancing educational technology and assessment as well to monitor and facilitate the implementation of the recommendations made by BRC II.

## LIMITATIONS

The findings of this report must be considered within the context of its limitations. Although we tried to include in a diverse panel of experts in surgical education, an unanticipated shortcoming is that the demographics of the panel was not balanced with most members being White or Caucasian and

older than 45 years. Thus, they were limited by their unique perspectives and lacked the potential diversity of opinions necessary for a robust discussion. This may be in part the consequence of including the BRC I panel from 20 years ago. That said the work was primarily performed by the subcommittees focused on current issues. These groups were younger, gender diverse with more balance in racial and ethnic makeup. Furthermore, the panel sought input from residents and fellows through a focused group meeting as well as non-general surgery specialists who may be directly affected or interested in the statements. The majority of panelists were surgeons and hence there is an unavoidable bias in that sense. There were no patients on the panel, however, a member of the steering committee was a public member with board service on the American Board of Surgery and an understanding of the financing graduate medical education. The recommendations will require annual review to monitor implementation. We defined consensus as achieving >80% agreement to include proposed recommendations. It could be argued that the bar for consensus was too high. Many of the proposed recommendations have merit and may warrant consideration as well. Regarding the Delphi survey process there was a falloff in the response rate over the 3 rounds. This could have negatively affected the final overall consensus ratings. Despite this, the internal consistency was good in Rounds 1 and 2 and acceptable in Round 3. The priority recommendations will require annual review to monitor implementation.

### SUMMARY

It is clear from this contemporary assessment that the landscape of surgical education and training is rapidly changing with countless challenges and opportunities. The progress following the report by BRC I took 2 decades and was made primarily in areas controlled directly by surgeons in collaboration with the ABS, ACS, and RRC-S combined with the organic need-based expansion of medical schools and then post graduate surgical training programs. In this report, several key recommendations emerged as shown in Table 3. These will be further amplified by forthcoming reports from each of the subcommittees. It is clear that there is much more work to do.

We must realize that the pace of change in medicine is greater today than it was in the days when one was limited to practice by the knowledge that you could carry around with you.<sup>16</sup> What our residents and fellows are trained in today is not likely to be what they will be doing in 20 years. For our patients sake, we cannot wait another 20 years let alone 5 years. We must act now with ongoing review and oversight to bring these recommendations to reality in a maximum of the next 5 years. Implementation will require dedication and meaningful collaboration of surgeon educators and leaders collaborating with like-minded partners in government, as well as regulatory and oversight organizations. Although we did not provide a description of implementation pathways, we have proposed a framework for successful change. This includes establishing a multidisciplinary surgical educational group to oversee, monitor and facilitate implementation of these recommendations. It is now up to our profession.

### CONCLUSIONS

The members of BRC II are motivated by our commitment and dedication to providing the highest quality surgical care to all while we continually earn the

**TABLE 3. BRC II Key Recommendations**

Prioritizing the sustainability of the surgical workforce in training programs
Optimizing the preparation of medical students for a possible surgical career
Selecting surgical trainees through a more holistic process
Establishing a culture of belonging and safety for our trainees
Implementing competency-based training for all surgical specialties
Providing trainees a mentored transition to practice
Solving the financial underfunding of surgical education
Developing a national curriculum for faculty development in education, EPAs, and assessment
Developing a surgeon-scientist training pathway
Providing a framework for change implementation and oversight by a Multidisciplinary Surgical Education Council

trust of our patients. In this report, we propose recommendations to optimize surgical education and training. In the broader sense, as surgical educators, we must keep focus on our overall goal which is to prepare the current and future generations of surgeons to meet the ever-changing health care needs of society while keeping the trust of those we serve. Our trainees must be competent in essential skills but also learn how to think through the complexities of surgical disease and to be inspired by an unrelenting commitment to quality keeping the patient at the forefront at all times. The scope of our initiative is broader than general surgery and broader than the current portfolio of procedures in our toolbox. We must be prepared to safely integrate advances in surgical care in our educational programs and practice. Although, we believe the proposed changes in surgical education and training will need to be driven by surgeons, we also appreciate that for these to be successfully implemented will require help and collaboration of organizations overseeing undergraduate and graduate medical education as well as the certifying boards. It is imperative that we must act with a real sense of urgency lest we lose valuable time in the face of unrelenting change.

As for next steps, as the highest priority, we recommend establishing a Multidisciplinary Surgical Educational Council to work with current organizations and regulatory bodies to design a plan for implementation including monitoring. One might consider the following prioritization framework based on the CR category derived from the Delphi analysis of 50 recommendations: CR1 ( $\geq 80\%$ ) (N=31) may be considered as high priority items and implementation should proceed; CR2 (60% to 79%) (N=8) may be considered as a moderate priority and warrant thoughtful consideration; CR3 (21% to 59%) (N=8) may be considered a low priority and at some time in the future may need additional investigation; and CR4 (14% to 20%) (N=3) would be considered a very low priority and may not need further investigation at this time.

### Acknowledgment of Collaborative Group

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