

Validated Assessment Tools and Maintenance of Certification in Plastic Surgery: Current Status, Challenges, and Future Possibilities

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Background: The transition to the Next Accreditation System is well underway, and a shift toward competency-based assessment in the form of milestones is now the standard. A significant effort has been completed by the Plastic Surgery Milestones Working Group to develop specific milestones and assessment tools for plastic surgery training.

Methods: The history of the development toward competency-based assessment was reviewed. Data regarding the trends and regulations associated with board certification and the role of maintenance of certification were reviewed.

Results: The work of the Plastic Surgery Milestones Working Group has sparked interest in assessment and created an opportunity for further development. The efforts toward validating assessment tools by our colleagues working in other surgical specialties serve as a suitable roadmap for further progress. Board certification is an integral part of successful practice and should be regarded as an expectation. Despite the burdens associated with maintenance of certification, it serves a valuable function in ensuring optimal patient care and is often retrospectively seen as an important component of practice.

Conclusions: The competency-based milestones are the new standard, and work on this new methodology of assessing plastic surgery trainees is expected to continue. Accurate assessment is critical to the pathways for board certification and maintenance of certification, which serve important roles for all parties involved in the delivery of medical care. (*Plast. Reconstr. Surg.* 137: 1327, 2016.)

DEVELOPMENT OF A VALIDATED SURGICAL CURRICULUM

As the Next Accreditation System and milestones become widespread and mandated by the Accreditation Council for Graduate Medical Education, each specialty is required to have specific assessment tools. Thoughtful critique of the available methods and practices currently in place is required to ensure reliability and validity. An ideal result will be a standardized, uniformly accepted set of assessment tools that are reliable and have been validated specifically for training plastic surgeons. A reasonable starting point in selecting which methods to use initially is to

learn from the experience and efforts of other large governing surgical bodies.

Recently, the American College of Surgeons in partnership with the Accreditation Council for Graduate Medical Education, members of certifying boards, residency review committees, program director organizations, and professional societies representing the breadth of surgical specialties convened for an invitational conference to define key issues in surgical training, transition to practice, and adoption of the Next Accreditation System. There was a consensus that the surgical residency-training model needs to be redesigned with a focus on competency-based assessment.¹

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Steps taken to this point include movement toward a standardized general surgery curriculum and adoption of modern assessment tools (Table 1).²⁻¹³ The conference participants also emphasized the importance of the assessment and verification of knowledge and skills of residents before graduation, which currently has taken the form of credentialing certificates, intended as summative assessments. General surgery programs have laid plans to incorporate stepwise proficiencies, some procedurally based, required for promotion through training.¹⁴⁻¹⁶ The major limitation to implementation is significant costs in time and resources that accompany them. To date, there has been no solution offered to offset this dilemma.

DEVELOPMENT OF VALIDATED PLASTIC SURGERY ASSESSMENT METHODS

In August of 2011, the Plastic Surgery Milestone Working Group met to define specific milestones¹⁷ for plastic surgery residency and to select specific assessment methods.¹⁸ Group members included leaders and experts in plastic surgery and representatives from the Accreditation Council for Graduate Medical Education (J.E.J. and N.B.V. were participants). The set of 36 Plastic Surgery Milestones created were tested in 21 residency programs.¹⁷ The initial pilot testing of the 21 programs showed the practicality and utility of the adopted milestones, and the authors believe them to be valid metrics.¹⁹ However, more detailed evaluation of the milestones after widespread implementation is still awaiting, and definitive comments on validity and reliability cannot be made.

It is anticipated and intended that over time there will be refinements and modifications. As the milestones are implemented in all programs, the resulting data will be used to retrospectively and prospectively evaluate validity. However, the ongoing challenge of ensuring that our methods of

assessment of the milestones are reliable and valid remains. The initial working group proposed several assessment tools.¹⁸ These include a chart audit, Clinical Evaluation Exercise, speaking presentation evaluation, quality improvement review, resident teaching evaluation, and surgical skills evaluation.¹⁸ These measures were created by the Plastic Surgery Milestones Working Group by amalgamating and refining existing tools solicited from plastic surgery and general surgery training programs.

The Accreditation Council for Graduate Medical Education has put forth guidelines for grading and choosing assessment tools,²⁰ and on review of the existing prior research regarding available tools, Swing et al. found that nothing currently available was indicative of a class 1 rating (recommended as a core component of assessment). The Mini-Clinical Evaluation Exercise,²¹ chart audit and feedback,^{22,23} and Objective Structured Assessment of Technical Skills²⁴⁻²⁷ are the only methods to receive a class 2 rating (recommended to be considered as one component of assessment). Several of the suggested assessment tools offered by the Plastic Surgery Milestone Working Group mirror those tools that received a class 2 rating. However, there are no defined intraoperative, procedure-based, nontechnical, communication or educational assessment tools that received a rating for suggested use.

The remaining assessment tools provided by the Working Group should not be considered inaccurate or insufficient; rather, they are yet unproven. They are constructed in agreement with fundamentals of accurate assessment described previously.²⁸ Critical to their effectiveness fundamentally is the manner in which they are implemented. Frequent sampling by multiple evaluators will help to eliminate multiple forms of bias. Previous studies have described intervals and models of hierarchical assessment^{29,30} that can be used as a model.

There are some omissions in the assessment measures provided. First, nontechnical skills are undoubtedly very important for plastic surgery, regardless of which is being assessed: professionalism, communication, leadership, decision-making, or teamwork. The Non-Technical Skills for Surgeons and Observational Teamwork Assessment for Surgery have been shown to have reliability and validity in certain applications, specifically, when applied by attending raters.³¹ It seems appropriate that these be considered for development and addition to the tools provided. Second, there are several Objective Structured Assessment of Technical Skills instruments and

Table 1. Surgical Assessment Tools

Objective Structured Assessment of Technical Skills (OSATS) ⁶
Global Operative Assessment of Laparoscopic Skills (GOALS) ⁷
Patient Assessment and Management Examination (PAME) ⁸
Objective Structured Clinical Examination (OSCE) ^{4,9}
Fundamentals of Laparoscopic Surgery (FLS) ^{10*}
Advanced Trauma Life Support (ATLS) course ^{11*}
Advanced Trauma Operative Management (ATOM) course ¹²
Advanced Surgical Skills for Exposure in Trauma (ASSET) course ¹³

*Requirement of completion by the American Board of Surgery for certification.

problem-based assessment tools for specific procedures in other surgical specialties. The use of assessments specific to index plastic surgery procedures at different levels of training may be beneficial. The Stanford Microsurgery and Resident Training Scale³² is a good example of focusing on a particular surgical skill that training programs aim to ensure graduates attain. In addition, Davis and Lee have created a plastic surgery-specific Objective Structured Clinical Examinations that showed promising initial results.³³

Currently, the Accreditation Council for Graduate Medical Education expectation of plastic surgery program directors is that they will complete a milestone evaluation of all residents on a biannual basis. Beyond this, sovereignty is left to the programs to decide which assessment tools to use and the manner in which they will be used. The work of the Plastic Surgery Milestones Working Group and the tools they supplied are appropriate; adoption by all programs would be beneficial because a universal system will allow for more accurate comparisons and validity testing. Given the small size of many plastic surgery residencies, there exists the inherent challenge to perform meaningful analysis of the assessment measures available within an individual program.

The Plastic Surgery Education Network continues to evolve toward its goal of creating a standardized plastic surgery curriculum. Online modules in clinical and nonclinical topics have successfully been incorporated into the didactic activities of many residency programs. These standalone modules also provide an excellent resource for self-study and assessment with pretest and posttest evaluations. The comprehensive coverage of nonclinical topics by the Plastic Surgery Education Network such as professionalism and ethics, which have an inconsistent representation in many didactic programs, can facilitate the assessment of these nontechnical skills. This area of competency is often not given appropriate focus despite data to show the importance that surgeons place in this arena.^{31,34}

Simulation in training and assessment will undoubtedly experience dramatic growth in the next several decades. Accordingly, the number of assessment tools available for plastic surgery trainees and potentially for those already practicing will also increase. The major drawback is the wide variability in access to simulation laboratories and resource availability discrepancies across programs; some programs will likely be able to excel and grow in this field and others will be unable to afford it. As the field of simulation

grows and accessibility increases, ideally it will be incorporated widely into plastic surgery curricula. The American College of Surgeons has begun a phased approach to incorporating simulation into training and assessment. Rosen et al. have previously described how the American College of Surgeons strategy can be modified to plastic surgery training.³⁵ Given that this area creates the opportunity for repetitive, safe, and effective practice, we encourage programs to implement simulation opportunities with accompanying assessments.

Others have previously investigated the ideal calendar for assessment application.^{28,29} The major force at play when determining how often to perform assessments is cost, in both time and money. In keeping with the principles of competency-based assessment, the goals should be to perform the appropriate number of assessments to achieve reliability and validity of judgments, and to provide guidance to learners. As mandated by the Accreditation Council for Graduate Medical Education, a biannual milestone evaluation will be standard. With regard to the other assessment tools, there is currently no research regarding how often or when they should be used, with the exception of assessment of operative skill.²⁹

Williams et al. described principles for operative assessment. First, they found that two or three observations per trainee per month affords an accurate composite sample. Second, the goal should be to obtain assessment from 10 or more raters, across a variety of procedures throughout each year. Finally, performing a single annual overall assessment is appropriate to capture growth and trajectory of skill, and more frequent assessments do not give more robust information.^{29,36} We support an assessment structure that is congruent with these principles with regard to operative assessment, with the addition of procedure-specific index case Objective Structured Assessment of Technical Skills for plastic surgery that are training level appropriate.

Whatever the method selected, it is essential that the trainee be included and informed during the assessment process. In doing so, the formative component of assessment will increase. Residents should be aided in their ability to identify areas of weakness and develop goals for growth.³⁷ In addition, there is important benefit to both reliability and validity in obtaining a breadth of evaluations from multiple evaluators.

Previous studies have investigated the impacts of the rater on the assessment process. It is important that the tasks raters are asked to complete are manageable, well defined, and easily

disseminated.^{28,38} If raters do not focus on specific performances, they are more likely to provide a one-dimensional view that often is of lower value and biased. Also, assessments need to be completed and collected promptly. Delays in collection are associated with less detailed and less informative evaluations.²⁸

The current structure of plastic surgery residency, with two discrete pathways (i.e., integrated and independent), creates an additional layer of complexity in designing the ideal assessment system. Independent pathway residents, by definition, have completed more years of training and are expected to have developed a deeper skill set. However, despite this expectation, it should be considered with caution because the prior categorical training may not necessarily be congruent with plastic surgery principles. Previous investigators have evaluated performance between the two pathways and not shown superiority.^{39,40} Nevertheless, the progress of independent pathway residents should be scrutinized and assessed according to the milestones to the same degree as their integrated peers who may have been assessed from a plastic surgery perspective at a more junior level.

The investigation of assessment strategies and the idea of using an evidence-based models is a developing field. Related disciplines such as general surgery have made significant strides in development and implementation. As we transition to the milestone evaluation system and begin to use newer assessment tools, there will be a plethora

of data to evaluate and help us identify superior tools that are supported with reliability and validity. This was the intention of the Plastic Surgery Milestones Working Group.

THE ROLE OF CERTIFICATION

Most of the preceding material in this article has focused on assessment of the student or trainee during his or her formal education. In the United States and most other developed nations, after the completion of formal medical education, residency training, and fellowship (if taken), the ultimate assessment process usually follows: board certification. Certification by one of the component boards of the American Board of Medical Specialties in the United States or by the Royal College of Physicians and Surgeons in Canada has become the gold standard by which most hospitals, other physicians and groups, practice plans, payers, and most importantly the public are assured that certain specified standards are met. These include education, training, licensure, and competence—in the six competencies adopted by the Accreditation Council for Graduate Medical Education and the American Board of Medical Specialties, and meeting standards of ethics, professionalism, and safety. To achieve certification by the American Board of Plastic Surgery, one must complete a multistep process (Fig. 1).⁴¹

American Board of Plastic Surgery board certification is thus the culmination of multiple stages of assessment. Diplomates must achieve

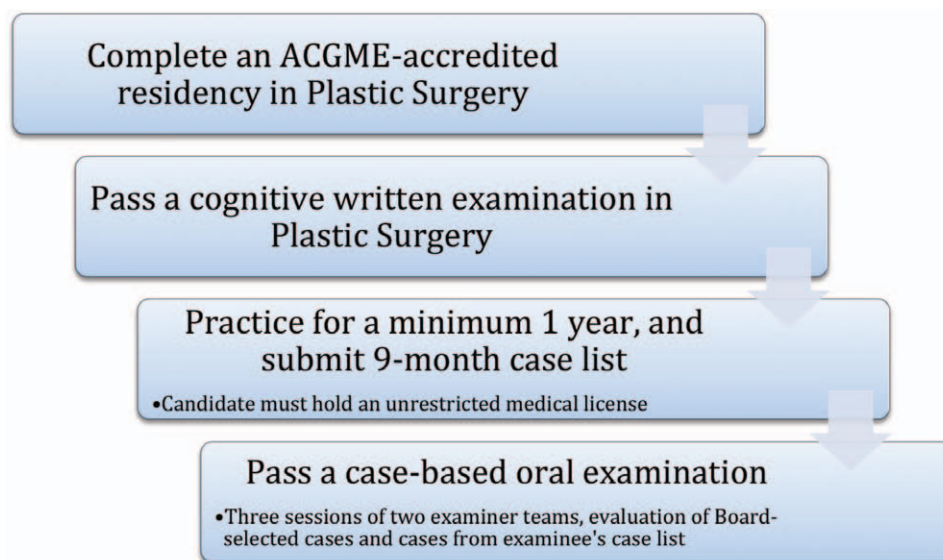


Fig. 1. Process of certification by the American Board of Plastic Surgery. Depicted is the sequence of steps to become eligible and complete board certification in plastic surgery. ACGME, Accreditation Council for Graduate Medical Education.

satisfactory performance on multiple assessments throughout medical school, residency, and fellowship, in addition to the attestation by one's program director that he or she is "safe and competent in the independent practice of plastic surgery." Diplomates must also fulfill the requirements and assessments for state medical licensure and hospital privileges. Candidates undergo assessment for eligibility for American Board of Plastic Surgery board certification through practice assessment, ethics and professionalism assessment, and cognitive assessment (written examination), and finally the comprehensive oral examination assessment of diagnosis and planning, treatment, management of complications, judgment, and safety to provide the certification that one is a safe and effective plastic surgeon. Although different in some respects, certification by the Royal College of Physicians and Surgeons of Canada is very similar in purpose, structure, and outcome.

What purpose does board certification serve? Clearly, the primary purpose of certification by an American Board of Medical Specialties board is to provide the public (i.e., the consumer) with a rigorous and reliable way of identifying physicians who are safe and competent in a specific specialty. This is evident in the mission statement of the American Board of Medical Specialties: "...to serve the public and the medical profession by improving the quality of health care through setting professional standards for lifelong certification in partnership with Member Boards." The American Board of Medical Specialties boards are self-regulated independent bodies, purposefully separate from membership organizations, whose purpose instead is to serve their members. Although board certification is a voluntary process, because of its importance in identifying and highlighting the competence of a diplomate in a specialty, practically speaking, nearly all residency graduates pursue board certification.⁴²

A key component of American Board of Medical Specialties certification is the confirmation and attestation of a diplomate's professionalism. Establishing and enforcing professional standards is a constant challenge for any profession, none more so than medicine, the practitioners of whom the public assume to have the very highest professional standards, as they trust their lives and well-being to physicians. Too often, assessment of professionalism is reduced to lists of behavioral expectations, such as competence, expertise, respectability, dedication, reliability, and so forth, which, some argue, risk losing the foundation of "professionalism." The American Board of

Medical Specialties has realized that professionalism is not simply an accounting of what physicians promise to patients, but rather it is a belief system that leads physicians to create and keep shared promises. Therefore, in 2012, the American Board of Medical Specialties defined medical professionalism as "... a belief system about how best to organize and deliver health care, which calls on group members to jointly declare ('profess') what the public and individual patients can expect regarding shared competency standards and ethical values and to implement trustworthy means to ensure that all medical professionals live up to these promises." This definition highlights the primary function of professionalism in health care: ensuring that physicians are worthy of patient and public trust.⁴³

MAINTENANCE OF CERTIFICATION

In the 1990s, a number of external studies and reports raised concerns about the rates of medical errors and the cost of care, challenging the validity of a lifetime certificate.⁴⁴ In response, the American Board of Medical Specialties in 2000 introduced maintenance of certification programs, which limit the duration of a certificate and also offer physicians a continuous professional development program with the goal of ensuring public accountability and transparency about physician competence and performance. Several findings supported the need for this type of lifelong certification program, no different than a career-long recertification process that other professions accountable for the lives of the public follow (e.g., commercial airline pilots). Studies have shown that physicians are poor at accurately independently assessing themselves.⁴⁵ In addition, more clinical experience does not necessarily lead to better clinical outcomes. A systematic review of 62 studies showed that, typically, a physician's knowledge, skills, adherence to evidence-based process of care, and patient outcomes decline as a function of time from initial training.⁴⁶ The goal of maintenance of certification was to ensure the public that physicians maintain competence over their career. The American Board of Medical Specialties maintenance of certification program is based on the six Accreditation Council for Graduate Medical Education/American Board of Medical Specialties competencies and composed of four parts, each assessed over a 10-year cycle: professionalism, lifelong learning and self-assessment, evaluation of knowledge, and performance in practice.

Although often criticized by diplomates as being onerous and lacking evidence of efficacy, there is actually good evidence to the contrary, in support of maintenance of certification. For plastic surgeons, part III of maintenance of certification, the 10-year examination of medical knowledge, is actually composed 100 percent of questions in the public domain and available to all, so it is actually just a 10-year mandated review of current medical knowledge in the specialty. Perhaps the most contentious is part IV, the 3-year evaluation of performance in practice that is fulfilled by completing one of 22 self-assessment modules based on an operative procedure performed frequently in one's practice, and tailored to an individual plastic surgeon's practice. This then creates a benchmarking report review with evidence-based medicine pearls added so that surgeons can assess their practice against their peers, and most importantly against the evidence for best care. This is then followed by a maintenance of certification–approved educational activity aligned with the tracer procedure to complete the educational and self-improvement process. Evidence that maintenance of certification part IV is effective can be found in the survey completed by plastic surgeons at the end of this activity wherein the overwhelming majority note that they plan to change something to improve the way that they practice as a result of the process. A wealth of evidence supporting the efficacy and value of board certification and maintenance of certification exists for numerous other American Board of Medical Specialties certification processes.^{42,43} In the end, board certification and maintenance of certification are central to protecting the public and ensuring the public trust.

CONCLUSIONS

The movement to competency-based assessment should allow plastic surgery programs to more efficiently and effectively train residents. A significant effort has gone into creation of the plastic surgery milestones and suggested methods of assessment. Although research on assessment tools has been burgeoning in medical education over the past two decades, it is a new and developing field that has not been thoroughly evaluated in plastic surgery but that has seen growth in other surgical specialties. The assessment methods available for plastic surgery training programs are new and will require continued research and refinement. Furthermore, they will not show reliability or validity until

initial research on outcomes can be conducted. The Plastic Surgery Milestones Working Group intends to interrogate the milestones and the assessment tools programs use as residency programs transition to the Next Accreditation System. This will provide an abundance of data to inform in addition to ample opportunities to further investigate and refine plastic surgery education. The result will be a step toward progress in plastic surgery education.

There is little room for argument that board certification and maintenance of certification are integral requirements to ensure that plastic surgeons continue to function safely and effectively. Although these requirements provide additional burden for the surgeon, they are justified by intent and the results created.

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REFERENCES

1. Sachdeva AK, Flynn TC, Brigham TP, et al.; American College of Surgeons (ACS) Division of Education; Accreditation Council for Graduate Medical Education (ACGME). Interventions to address challenges associated with the transition from residency training to independent surgical practice. *Surgery* 2014;155:867–882.
2. Bell RH Jr. Graduate education in general surgery and its related specialties and subspecialties in the United States. *World J Surg*. 2008;32:2178–2184.
3. Sachdeva AK, Bell RH Jr, Britt LD, Tarpley JL, Blair PG, Tarpley MJ. National efforts to reform residency education in surgery. *Acad Med*. 2007;82:1200–1210.
4. Sudan R, Lynch TG, Risucci DA, Blair PG, Sachdeva AK. American College of Surgeons Resident Objective Structured Clinical Examination: A national program to assess clinical readiness of entering postgraduate year 1 surgery residents. *Ann Surg*. 2014;260:65–71.
5. Willis RE, Peterson RM, Dent DL. Usefulness of the American College of Surgeons' Fundamentals of Surgery Curriculum as a knowledge preparatory tool for incoming surgery interns. *Am J Surg*. 2013;205:131–136.
6. Reznick RK, MacRae H. Teaching surgical skills: Changes in the wind. *N Engl J Med*. 2006;355:2664–2669.
7. Vassiliou MC, Feldman LS, Andrew CG, et al. A global assessment tool for evaluation of intraoperative laparoscopic skills. *Am J Surg*. 2005;190:107–113.
8. MacRae HM, Cohen R, Regehr G, Reznick R, Burnstein M. A new assessment tool: The patient assessment and management examination. *Surgery* 1997;122:335–343; discussion 343.
9. Sachdeva AK, Loiacono LA, Amiel GE, Blair PG, Friedman M, Roslyn JJ. Variability in the clinical skills of residents entering training programs in surgery. *Surgery* 1995;118:300–308; discussion 308.

10. Peters JH, Fried GM, Swanson LL, et al.; SAGES FLS Committee. Development and validation of a comprehensive program of education and assessment of the basic fundamentals of laparoscopic surgery. *Surgery* 2004;135:21–27.
11. Carmont MR. The Advanced Trauma Life Support course: A history of its development and review of related literature. *Postgrad Med J*. 2005;81:87–91.
12. Jacobs LM, Burns KJ, Kaban JM, et al. Development and evaluation of the advanced trauma operative management course. *J Trauma* 2003;55:471–479; discussion 479.
13. Kuhls DA, Risucci DA, Bowyer MW, Luchette FA. Advanced surgical skills for exposure in trauma: A new surgical skills cadaver course for surgery residents and fellows. *J Trauma Acute Care Surg*. 2013;74:664–670.
14. Sanfey H, Ketchum J, Bartlett J, et al. Verification of proficiency in basic skills for postgraduate year 1 residents. *Surgery* 2010;148:759–766; discussion 766.
15. Sanfey H, Williams R, Dunnington G. Recognizing residents with a deficiency in operative performance as a step closer to effective remediation. *J Am Coll Surg*. 2013;216:114–122.
16. Memon MA, Brigden D, Subramanya MS, Memon B. Assessing the surgeon's technical skills: Analysis of the available tools. *Acad Med*. 2010;85:869–880.
17. Accreditation Council for Graduate Medical Education; American Board of Plastic Surgery, Inc. The Plastic Surgery Milestone Project. Available at: <http://www.acaplasticsurgeons.org/multimedia/files/ACGME/Milestones/Plastic-Surgery.pdf>. Accessed June 20, 2014.
18. Accreditation Council for Graduate Medical Education; American Board of Plastic Surgery, Inc. The Plastic Surgery Milestone Project: Assessment tools. Available at: <http://www.acaplasticsurgeons.org/multimedia/files/ACGME/Milestone-Assessment-Tools.pdf>. Accessed June 20, 2014.
19. McGrath MH. The plastic surgery milestone project. *J Grad Med Educ*. 2014;6(Suppl 1):222–224.
20. Swing SR, Clyman SG, Holmboe ES, Williams RG. Advancing resident assessment in graduate medical education. *J Grad Med Educ*. 2009;1:278–286.
21. Norcini JJ, Blank LL, Arnold GK, Kimball HR. The mini-CEX (clinical evaluation exercise): A preliminary investigation. *Ann Intern Med*. 1995;123:795–799.
22. Veloski J, Boex JR, Grasberger MJ, Evans A, Wolfson DB. Systematic review of the literature on assessment, feedback and physicians' clinical performance: BEME Guide No. 7. *Med Teach*. 2006;28:117–128.
23. Boonyasai RT, Windish DM, Chakraborti C, Feldman LS, Rubin HR, Bass EB. Effectiveness of teaching quality improvement to clinicians: A systematic review. *JAMA* 2007;298:1023–1037.
24. Martin JA, Regehr G, Reznick R, et al. Objective structured assessment of technical skill (OSATS) for surgical residents. *Br J Surg*. 1997;84:273–278.
25. Reznick R, Regehr G, MacRae H, Martin J, McCulloch W. Testing technical skill via an innovative "bench station" examination. *Am J Surg*. 1997;173:226–230.
26. Szalay D, MacRae H, Regehr G, Reznick R. Using operative outcome to assess technical skill. *Am J Surg*. 2000;180:234–237.
27. Ault G, Reznick R, MacRae H, et al. Exporting a technical skills evaluation technology to other sites. *Am J Surg*. 2001;182:254–256.
28. Williams RG, Klamen DA, McGaghie WC. Cognitive, social and environmental sources of bias in clinical performance ratings. *Teach Learn Med*. 2003;15:270–292.
29. Williams RG, Verhulst S, Colliver JA, Sanfey H, Chen X, Dunnington GL. A template for reliable assessment of resident operative performance: Assessment intervals, numbers of cases and raters. *Surgery* 2012;152:517–524; discussion 524.
30. Moorthy K, Munz Y, Sarker SK, Darzi A. Objective assessment of technical skills in surgery. *BMJ* 2003;327:1032–1037.
31. Sharma B, Mishra A, Aggarwal R, Grantcharov TP. Non-technical skills assessment in surgery. *Surg Oncol*. 2011;20:169–177.
32. Satterwhite T, Son J, Carey J, et al. The Stanford Microsurgery and Resident Training (SMArT) Scale: Validation of an online global rating scale for technical assessment. *Ann Plast Surg*. 2014;72(Suppl 1):S84–S88.
33. Davis D, Lee G. The use of standardized patients in the plastic surgery residency curriculum: Teaching core competencies with objective structured clinical examinations. *Plast Reconstr Surg*. 2011;128:291–298.
34. Hull L, Arora S, Kassab E, Kneebone R, Sevdalis N. Observational teamwork assessment for surgery: Content validation and tool refinement. *J Am Coll Surg*. 2011;212:234–243.e1.
35. Rosen JM, Long SA, McGrath DM, Greer SE. Simulation in plastic surgery training and education: The path forward. *Plast Reconstr Surg*. 2009;123:729–738; discussion 739.
36. Williams RG, Sanfey H, Chen XP, Dunnington GL. A controlled study to determine measurement conditions necessary for a reliable and valid operative performance assessment: A controlled prospective observational study. *Ann Surg*. 2012;256:177–187.
37. Norcini J, Anderson B, Bollela V, et al. Criteria for good assessment: Consensus statement and recommendations from the Ottawa 2010 Conference. *Med Teach*. 2011;33:206–214.
38. Reid CM, Kim DY, Mandel J, Smith A, Bansal V. Correlating surgical clerkship evaluations with performance on the National Board of Medical Examiners examination. *J Surg Res*. 2014;190:29–35.
39. Guo L, Friend J, Kim E, Lipsitz S, Orgill DP, Pribaz J. Comparison of quantitative educational metrics between integrated and independent plastic surgery residents. *Plast Reconstr Surg*. 2008;122:972–978; discussion 979–981.
40. Roostaeian J, Fan KL, Sorice S, et al. Evaluation of plastic surgery training programs: Integrated/combined versus independent. *Plast Reconstr Surg*. 2012;130:157e–167e.
41. American Board of Plastic Surgery. *Maintenance of Certification in Plastic Surgery (MOC-PS) Booklet of Information for the Application and Examination Process*. Available at: https://www.abplsurg.org/documents/MOC-PS_2014-2015_Booklet_of_Information.pdf. Accessed May 6, 2015.
42. Lipner RS, Hess BJ, Phillips RL Jr. Specialty board certification in the United States: Issues and evidence. *J Contin Educ Health Prof*. 2013;33(Suppl 1):S20–S35.
43. Hawkins RE, Lipner RS, Ham HP, Wagner R, Holmboe ES. American Board of Medical Specialties Maintenance of Certification: Theory and evidence regarding the current framework. *J Contin Educ Health Prof*. 2013;33(Suppl 1):S7–S19.
44. Shaw K, Cassel CK, Black C, Levinson W. Shared medical regulation in a time of increasing calls for accountability and transparency: Comparison of recertification in the United States, Canada, and the United Kingdom. *JAMA* 2009;302:2008–2014.
45. Davis DA, Mazmanian PE, Fordis M, Van Harrison R, Thorpe KE, Perrier L. Accuracy of physician self-assessment compared with observed measures of competence: A systematic review. *JAMA* 2006;296:1094–1102.
46. Choudhry NK, Fletcher RH, Soumerai SB. Systematic review: The relationship between clinical experience and quality of health care. *Ann Intern Med*. 2005;142:260–273.