Review of Surgical Education Research Trends in North America

Emily Palmquist, MD, Caroline Ricard, MD, and Lilian Chen, MD

Department of Surgery, Tufts Medical Center, Boston, Massachusetts

OBJECTIVE: The purpose of this study was to synthesize surgical education research literature over the last decade and to address the following questions: (1) What are the most common subjects studied? (2) What research designs and data-gathering strategies are commonly employed? (3) Where are these papers being published? (4) What subject and research design trends have emerged in the last decade?

DESIGN: A literature review was conducted on surgical education publications from January 2008 to July 2018, using the search terms, "Graduate Medical Education," and "General Surgery." Inclusion criteria included articles published in the United States and Canada specific to general surgery and graduate medical education.

RESULTS: A total of 1043 articles met inclusion criteria and were categorized according to year published, journal type, journal of publication, subject of research, research design, and data collection method. The following observations were noted: (1) curriculum/teaching remains the most common subject of surgical education research, with growing emphasis on program evaluation, well-being, duty hours, and case exposure. (2) Descriptive research is the most common, although qualitative and mixed methods research is becoming more common. (3) Online surveys are the most common data collection method as they are the quickest way to gather data but there is an increasing use of interviews as support for qualitative research grows. and (4) Surgical education papers are largely published in journals specifically designed for education, and have slowly grown in popularity in generalized surgical journals.

CONCLUSIONS: As surgical education continues to develop as a field, we anticipate further acceptance of qualitative research in major peer-reviewed surgical journals, increased emphasis on resident well-being, and more effective use of interviews and mixed methods including online resources for data collection. (J Surg Ed 76:1476–1483. © 2019 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: Graduate Medical Education, Surgical Education, Duty Hours, Surgical Curriculum, Quality Research, General Surgery Residency

COMPETENCIES: Practice-Based Learning and Improvement, Systems-Based Practice, Interpersonal and Communication Skills, Professionalism

INTRODUCTION

The scope and volume of surgical education research has expanded over the last decade. The increase in publications may be related to changes in the structure of general surgical residency training, broader acceptance of qualitative research, or recent modifications in healthcare policy and delivery.[1-3]

In 2000, Derossis et al.[4] conducted a review of surgical education papers published between 1988 and 1998 aiming to highlight common subjects, research designs, and statistical methods used in this research arena. They found curriculum and teaching to be the most common subjects studied.[4] Descriptive methodology was the most common research design, although there was an increasing trend in experimental research. Papers were increasingly published in surgical journals rather than medical education journals over the course of the decade.

Since 1998, numerous changes have reshaped the surgical education landscape, from duty hours to the implementation of the Accreditation Council for Graduate Medical Education core competencies.[5] Furthermore, qualitative research design has been increasingly valued in medical education literature as a means of describing individual or group experiences as they occur in natural, rather than experimental, contexts.[6,7]

As surgical education continues to become a growing field of interest and research, there continues to be an increasing amount of resources and opportunities for both

Correspondence: Inquiries to Emily Palmquist, MD, Department of Surgery, Tufts Medical Center, 800 Washington St., Boston, MA 0211; e-mail: palmquie@gmail.com

  1931-7204/$30.00 https://doi.org/10.1016/j.jsurg.2019.06.014

trainees and academic surgeons. In 2014, the American College of Surgeons developed the Academy of Master Surgeon Educators with goals to assemble a group to advance surgical education and training.[8] The American College of Surgeons and the Association of Surgical Education have developed courses and fellowships to educated those interested in the field of surgical education.[9,10] These changes highlight the growing awareness of graduate medical education and the importance of continued understanding and research in the field of surgical education.

In light of these changes, an analysis of recent surgical education publications was conducted. The purpose of this study was to synthesize surgical education research literature over the last decade, and to address the following questions: (1) What are the most common subjects studied? (2) What research designs and data-gathering strategies are commonly employed? (3) Where are these papers being published? (4) What subject and research design trends have emerged in the last decade?

METHODS

A literature review was conducted on surgical education publications from January 2008 to July 2018 following PRISMA guidelines.[11] PubMed, Medline, and ERIC database were queried using the search terms, "Graduate Medical Education," and "General Surgery." Inclusion criteria included articles published in the United States and Canada specific to general surgery and graduate medical education. Exclusion criteria included research in other surgical specialties including neurosurgery, orthopedics, obstetrics, and otolaryngology. Additional exclusion criteria included articles published outside of the United States and Canada, review articles, letters, editorials, addresses, historical perspectives, and patient education handouts. A total of 1043 articles met inclusion criteria (Fig. 1).

Three investigators reviewed selected abstracts and were categorized according to year published, journal type, journal of publication, subject of research, research design, and data collection method. If the information was not referenced in the abstract, the investigators obtained the full article for review. Using Derossis et al.'s[4] paper as a resource as well as discussion with the investigators, predefined categories for the subjects of research were determined.

The journal type was classified as either medical or surgical. The "surgical" journal category included journals discussing surgical and procedure-based practices. The "medical" journal category included medical journals and excluded journals that discussed any procedures. The subject categories were defined by approximating the major topics highlighted in Derossis et al.: curriculum/teaching, assessment (both technical and educational), program evaluation, new technology, resident well-being,

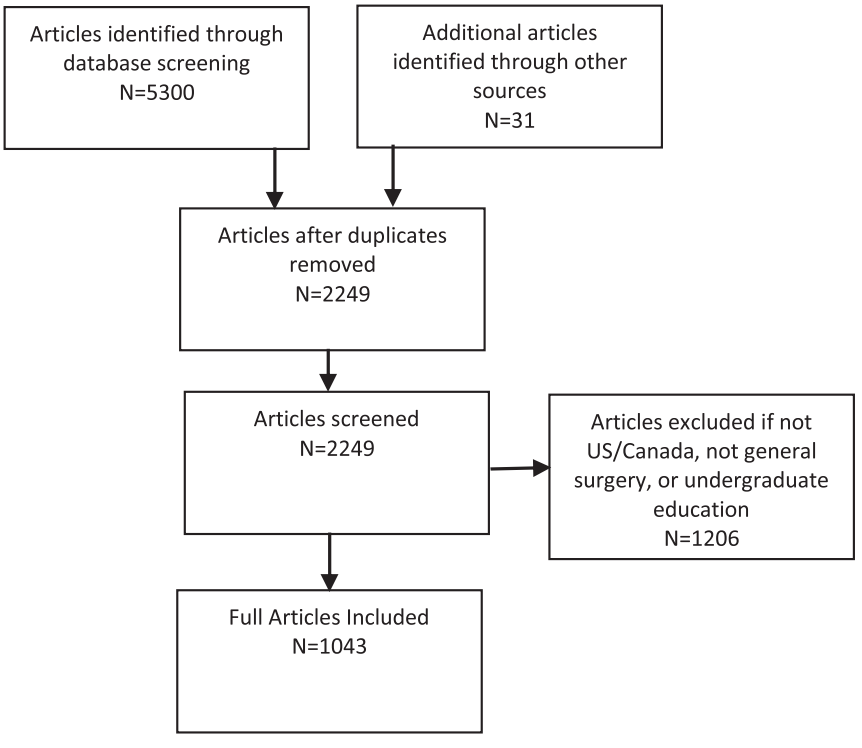

FIGURE 1. PRISMA DIAGRAM demonstrating initial search and inclusion and exclusion criteria for surgical education publications.[11]

and other. New technology was defined as the development of new tools, but not novel ways to use existing tools. The major subjects were curriculum/teaching, assessment (both technical and educational), program evaluation, new technology, resident well-being, and other. The "other" category was later subclassified into case exposure/volume, duty hours/call schedule, autonomy/operative confidence, application/match process, effect of resident involvement on case outcome, research during residency, and learning styles/personalities of surgical residents. Research design categories included descriptive, comparative, and experimental, qualitative, and mixed-methods utilizing previously described methodologies by Turner et al.[12]

Descriptive design included studies that described existing characteristics of a group or individuals. Comparative or correlational research included studies looking at relationships between variables both dependent and independent. Experimental design included studies that looked at effects of interventions including both randomized and nonrandomized experiments. Qualitative studies described methods using common themes to explain an educational phenomenon, and mixed-methods included studies that used qualitative research in addition to another category of quantitative research. Data collection methods included observation or testing, survey or questionnaire, data available, and interview. For each article, only 1 subject and research design was selected, but multiple data collection methods could be coded separately.

Each investigator initially coded the same 20 articles to assess inter-rater reliability. Discrepancies were evaluated and category definitions were further refined to improve inter-rater reliability. Descriptive statistics were employed to evaluate trends in journal of publication, subject, research design, and data collection methods over time.

RESULTS

A total of 1043 articles were included in the final review dating from January 2008 to July 2018. These articles were coded by the 3 investigators based on the standard coding key. A full list of the articles included can be provided upon request.

The initial trial of 20 articles showed moderate inter-rater reliability with agreement in 87% of coding options. Discrepancies were evaluated at that time, and subject definitions were further refined to insure inter-rater reliability. A subsequent 20-article trial on new articles had excellent inter-rater reliability with agreement in 97.5% of coding options (Table 1).

TABLE 1. Characteristics of 1043 Articles Published Between 2008 and 2018 by Subject, Design, Data Collection

Journal			
	Journal of Surgical Education	364	35%
	American Journal of Surgery	159	15%
	Journal of Surgical Research	60	6%
	Journal of the American College of Surgeons	60	6%
	American Surgeon	43	4%
	Surgical Endoscopy	37	4%
	Annals of Surgery	30	3%
	JAMA	30	3%
Subject			
	Curriculum/Teaching	266	26%
	Assessment	146	14%
	Program Evaluation	64	6%
	New Technology	30	3%
	Well-being	41	4%
	Other	496	48%
Design			
	Descriptive	565	54%
	Comparative	272	26%
	Experimental	123	12%
	Qualitative	50	5%
	Mixed Methods	33	3%
Data collection			
	Observation	333	32%
	Survey/questionnaire	470	45%
	Data available	342	33%
	Interview	44	4%

Journal of Publication

The majority of surgical education articles were published in surgical journals (94%) as compared to medical journals (6%). The most common journals for publication were the *Journal of Surgical Education* (35%) and the *American Journal of Surgery* (15%). Other prevalent journals included the *Journal of Surgical Research* (6%), *Journal of the American College of Surgeons (JACS)* (6%), *American Surgeon* (4%), *Surgical Endoscopy* (4%), *Annals of Surgery* (3%), and *Journal of the American Medical Association (JAMA)* (3%) (Table 1).

Subject of Research

Excluding the "other" category, the most common research subject was curriculum/teaching (26%). Curriculum/teaching remained the most prevalent subject throughout the time interval, except when superseded by assessment in 2009. Well-being and program evaluation were discussed with increasing frequency as time progressed (see Table 2 and Fig. 2a).

When further subdividing the "other" category, the most common subcategories were reports of case exposure for residents, duty hours and call schedules, and the effect of resident involvement on case outcomes (see Fig. 3). Cost of living, international graduates, global surgery rotations, diversity in surgical residency, pregnancy during residency, mentorship, and interdisciplinary collaboration were other categories that were studied but are less frequent in numbers than the above.

Research Design

The most common research designs were descriptive, comparative, and experimental (54%, 26%, 12%, respectively). Qualitative research including mixed method designs remained in the minority (5% and 3%, respectively). Descriptive design remained the most common throughout the 10-year time interval but decreased in prevalence (88% in 2008 to 36% in 2018). Accordingly, the other research designs became more prevalent as time progressed (Table 2 and Fig. 2b). For example, comparative studies constituted only 10% of the articles in 2008, but constituted between 27% and 33% of the articles from 2011 to 2017. Additionally, only 1% of studies in 2008 were experimental, while they made up 18% to 24% of articles from 2014 to 2017. Qualitative and mixed methods studies collectively accounted for 1% of the articles in 2008, but grew to 19% by 2017.

When specifically examining qualitative and mixed methods papers, medical journals were more likely to publish papers with these research designs than surgical journals. When looking specifically at qualitative studies 19% were published in medical journals and 81% were published in surgical journals. This is in contrast to the

TABLE 2. Characteristics of 1043 Articles Published Between 2008 and 2018 by Subject, Study Design, Data Collection, and Journal Type Summarized by Publication Year

	2008 n = 91	2009 n = 78	2010 n = 98	2011 n = 93	2012 n = 98	2013 n = 101	2014 n = 103	2015 n = 134	2016 n = 125	2017 n = 99
Subject										
Curriculum/Teaching	42%	13%	21%	24%	28%	17%	32%	29%	27%	27%
Assessment	9%	20%	5%	11%	9%	8%	6%	17%	23%	15%
Program Evaluation	0%	1%	5%	5%	6%	5%	9%	6%	11%	9%
New Technology	1%	3%	3%	5%	5%	5%	2%	1%	2%	1%
Well-being	3%	0%	0%	3%	5%	8%	6%	0%	2%	12%
Other	44%	63%	65%	52%	46%	57%	46%	47%	36%	36%
Design										
Descriptive	88%	85%	75%	52%	58%	48%	36%	43%	37%	36%
Comparative	10%	10%	19%	27%	33%	33%	31%	29%	27%	27%
Experimental	1%	4%	1%	7%	4%	5%	21%	18%	24%	18%
Qualitative	1%	1%	4%	9%	4%	11%	9%	7%	8%	12%
Mixed methods	0%	0%	1%	6%	0%	3%	3%	3%	4%	7%
Data collection										
Observation	25%	23%	22%	37%	24%	23%	32%	31%	38%	25%
Survey/questionnaire	43%	41%	43%	39%	46%	39%	38%	36%	34%	46%
Data available	30%	35%	33%	21%	25%	36%	27%	27%	26%	23%
Interview	2%	1%	2%	3%	6%	2%	3%	6%	3%	7%

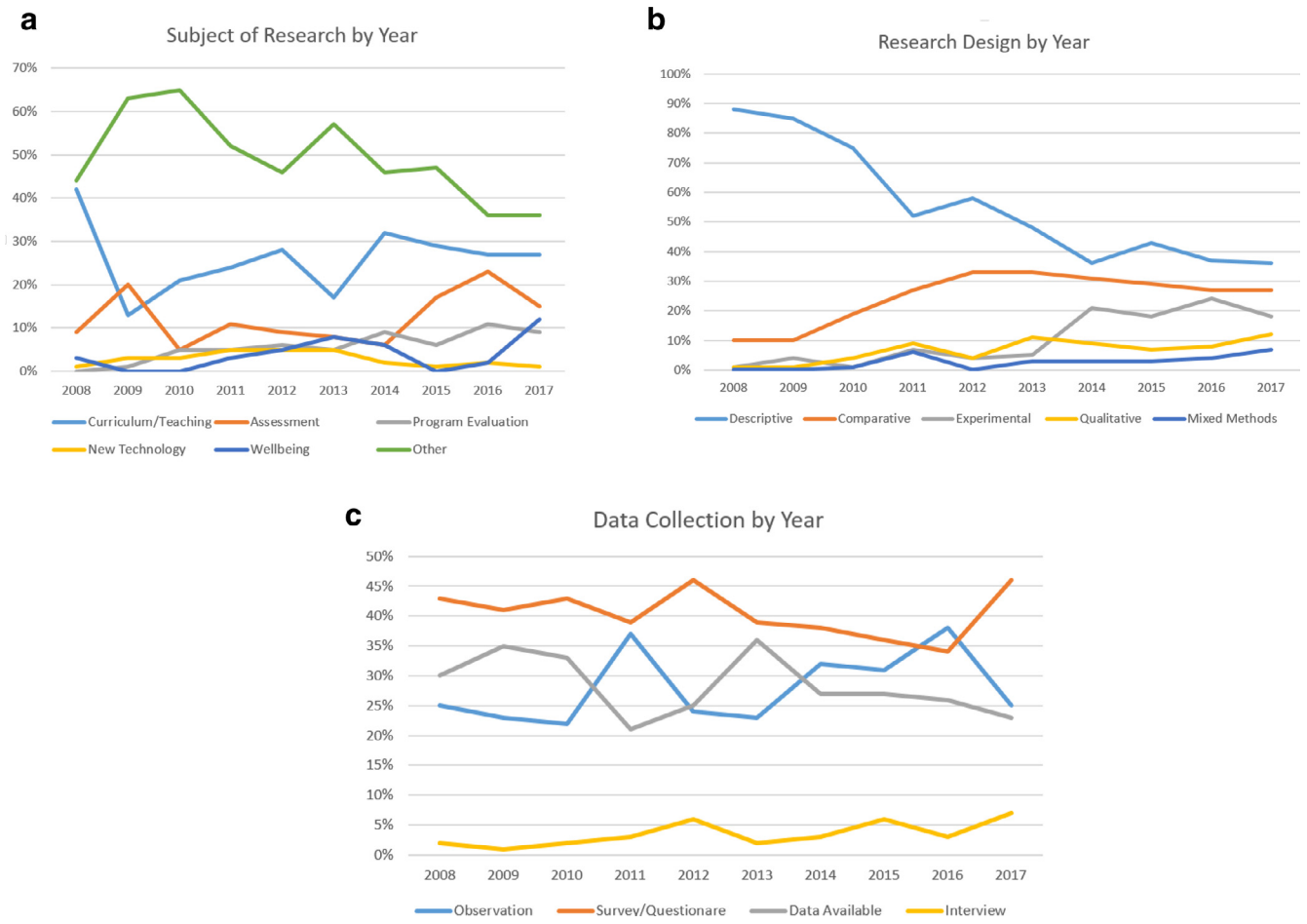

FIGURE 2. (a) Subject of research trends by year. (b) Research design trends by year. (c) Data collection trends by year.

breakdown of publications for all the articles studied with an overwhelming majority being published in surgical journals (94%) as compared to medical journals (6%). Qualitative and mixed methods papers were more likely to focus on curriculum/teaching compared to other study designs. Utilization of interviews for data collection was much more common in qualitative studies, whereas observation and survey/questionnaire are more common with other study designs.

Data Collection

Survey/questionnaires were the most prevalent data collection method throughout the study period. Observation and available data remained the next 2 most commonly used methods. Examples of available data included case logs, previous resident surveys, and demographic data. The minority of papers employed interviews for data collection throughout the time interval, although their prevalence did marginally increase over time (Table 2 and Fig. 2c).

DISCUSSION

This analysis of surgical education publications from the last decade provides insight into the changes to this field of research. Content, research methods, data collection strategies, and journals dedicated to publishing surgical education literature were critically evaluated.

Subject themes often reflect changes in the surgical education climate, such as the introduction of duty hour regulations, institution of core competencies, expansion of endoscopic surgery, and high rates of resident burnout and attrition. Although curriculum and teaching remained the most common topic over the last decade, program evaluation, well-being, duty hours, and case exposure increased with time. Curriculum and teaching may have remained most prevalent as the scope of general surgery expands to include endoscopic and robotic surgery modalities. As highlighted in Derossis et al.,[4] the steady increase in program evaluation publications may reflect a growing need for program accountability. With recent publications illustrating poor health outcomes (substance abuse, mental health issues, poor sleep, poor home life, and increased

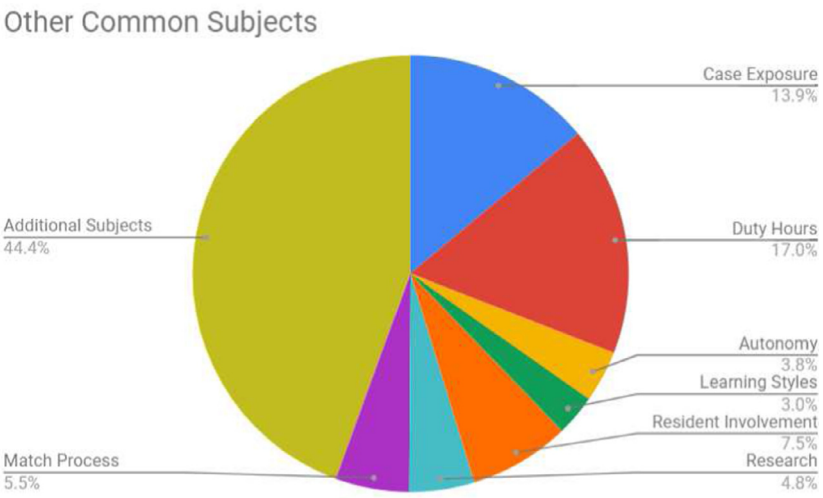

FIGURE 3. Distribution of common "other" subjects.

burnout) in surgical residents,[13-15] many surgical education papers have emphasized the effects of the duty hours, the night float system, and formalized programs on resident well-being.[16-18] Finally, the increasing number of papers focusing on case exposure during residency likely reflects the general concern of surgical residents not being adequately trained given the duty hour restrictions.[19-22]

Although descriptive research remained the most common research design, its prevalence decreased over time as comparative, experimental, qualitative, and mixed methods increased. Descriptive research can be simple, fast, and inexpensive; it is the easiest way to illustrate current characteristics or patterns without having to perform retrospective or prospective analysis. However, more complex methods such as comparative or experimental study designs are often required to draw quantitative comparisons and/or causal relationships.[23] Over the last 20 years, there has been very limited qualitative or mixed method study design published in surgical journals. Qualitative research is relatively new in the field of medical education. The limited utilization of this method may reflect an adaptation period with the need to learn and master a new set of methodologies. In order to close this gap, those interested in graduate medical education may seek out additional training including resources from education academies, Masters of Education, or educations research fellowships.[8,9] The recent increase in published qualitative research indicates that new emphasis is being placed on underlying reasons, opinions, and motivations related to surgical education.

Survey and questionnaires remained the most commonly utilized data collection methods which may be related to the ease of creating, distributing, completing, and evaluating online survey results. As the value placed on qualitative research slowly increases, interviews and other qualitative data collection will likely rise over time.

This review has several key limitations. First, the initial literature search was limited to publications from the United States and Canada, which does not capture the entire body of surgical education research outside of North America. Secondly, although the initial 50 articles were coded together among the investigators there could still be some inter-rater variability with subsequent analysis. Although discrepancies between coders were addressed at the beginning of the coding process, coding styles may have deviated as time progressed given the large number of articles. Finally, this study was designed to qualitatively describe surgical education trends over the last decade, and exhaustive statistical analyses were not employed to quantify the observed changes.

CONCLUSIONS

The purpose of this paper was to define those research subjects, journals, designs, and data collection methods used in surgical education research and observe how they have evolved over the last decade. A thorough review of the surgical education literature from 2008 to 2018 yielded the following observations: (1) curriculum/teaching remains the most common subject of surgical education research, with growing emphasis on program evaluation, well-being, duty hours, and case exposure. (2) Descriptive research is the most common but slowly declining while qualitative and mixed methods research is becoming more common. (3) Online surveys are the most common data collection method however there is an increasing use of interviews as support for qualitative research grows. and (4) Surgical education papers are largely published in journals specifically designed for

education, and have slowly grown in popularity in generalized surgical journals.

As surgical education continues to develop as a field, we anticipate further acceptance of qualitative research in major peer-reviewed surgical journals, increased emphasis on resident well-being, and more effective use of interviews and mixed methods including online resources for data collection. In the future, conducting multi-institutional surgical education research may help coordinate research priorities and improve funding.[24] Furthermore, North American surgical education literature should be compared to other areas, most notably the United Kingdom, to compare trends in subject, research design, and data-gathering strategy.

REFERENCES

1. Giacomini MK, Cook DJ, Group for the E-BMW. Users' guides to the medical literature: XXIII. Qualitative Research in Health Care A. Are the results of the study valid? *JAMA*. 2000;284:357–362. https://doi.org/10.1001/jama.284.3.357.

2. Dunnington GL, DaRosa DA. Changing surgical education strategies in an environment of changing health care delivery systems. *World J Surg*. 1994;18:734–737. https://doi.org/10.1007/BF00298919.

3. Health care quality, access, cost, workforce, and surgical education: the ultimate perfect storm - ScienceDirect. https://www-sciencedirect-com.ezproxy.library.tufts.edu/science/article/pii/S0022346811008815?via%3Dihub. Accessed February 12, 2019.

4. A ten-year analysis of surgical education research - ScienceDirect. https://www-sciencedirect-com.ezproxy.library.tufts.edu/science/article/pii/S0002961000004207?via%3Dihub. Accessed February 12, 2019.

5. Harsha V. Polavarapu, Afif N. Kulaylat, Susie Sun, and Osama Hamed. 100 years of surgical education: the past, present, and future. The Bulletin. http://bulletin.facs.org/2013/07/100-years-of-surgical-education/. Published July 1, 2013. Accessed February 12, 2019.

6. Lingard LK. Qualitative research in medical education. Understanding Medical Education: Evidence, Theory and Practice. John Wiley & Sons, Ltd.; 2010. p. 323–335.

7. O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. Standards for reporting qualitative research: a synthesis of recommendations. *Acad Med J Assoc Am Med Coll*. 2014;89:1245–1251. https://doi.org/10.1097/ACM.0000000000000388.

8. Academy of Master Surgeon Educators. American College of Surgeons. https://www.facs.org/education/academy. Accessed March 11, 2019.

9. Surgical education research fellowship overview. The association for surgical education. https://surgicaleducation.com/surgical-education-research-fellowship-overview/. Accessed March 11, 2019.

10. 26th Annual ACS Surgeons as Educators. American College of Surgeons. https://www.facs.org/education/division-of-education/courses/surgeons-as-educators. Accessed March 18, 2019.

11. PRISMA. http://www.prisma-statement.org/. Accessed March 11, 2019.

12. Turner TL, Balmer DF, Coverdale JH. Methodologies and study designs relevant to medical education research. *Int Rev Psychiatry*. 2013;25:301–310. https://doi.org/10.3109/09540261.2013.790310.

13. Lin DT, Liebert CA, Esquivel MM, et al. Prevalence and predictors of depression among general surgery residents. *Am J Surg*. 2017;213:313–317. https://doi.org/10.1016/j.amjsurg.2016.10.017.

14. Lin DT, Liebert CA, Tran J, Lau JN, Salles A. Emotional intelligence as a predictor of resident well-being. *J Am Coll Surg*. 2016;223:352–358. https://doi.org/10.1016/j.jamcollsurg.2016.04.044.

15. Lebares CC, Guvva EV, Ascher NL, O'Sullivan PS, Harris HW, Epel ES. Burnout and stress among US surgery residents: psychological distress and resilience. *J Am Coll Surg*. 2018;226:80–90. https://doi.org/10.1016/j.jamcollsurg.2017.10.010.

16. Bolster L, Rourke L. The effect of restricting residents' duty hours on patient safety, resident well-being, and resident education: an updated systematic review. *J Grad Med Educ*. 2015;7:349–363. https://doi.org/10.4300/JGME-D-14-00612.1.

17. Keeping residents in the dark: do night-float rotations provide a valuable educational experience? - ScienceDirect. https://www-sciencedirect-com.ezproxy.library.tufts.edu/science/article/pii/S1931720417302453?via%3Dihub. Accessed April 9, 2019.

18. Scally CP, Sandhu G, Magas C, Gauger PG, Minter RM. Investigating the impact of the 2011 ACGME resident duty hour regulations on surgical residency programs: the program director perspective. *J Am*

Coll Surg. 2015;221:883–889.e1. https://doi.org/10.1016/j.jamcollsurg.2015.07.011.

19. Watson DR, Flesher TD, Ruiz O, Chung JS. Impact of the 80-hour workweek on surgical case exposure within a general surgery residency program. *J Surg Educ*. 2010;67:283–289. https://doi.org/10.1016/j.jsurg.2010.07.012.

20. Fairfax LM, Christmas AB, Green JM, Miles WS, Sing RF. Operative experience in the era of duty hour restrictions: is broad-based general surgery training coming to an end? http://www.ingentaconnect.com/content/sesc/tas/2010/00000076/00000006/art00019%3bjsessionid=25eejaboi38fu.x-ic-live-01. Published June 2010. Accessed April 9, 2019.

21. Nakayama DK, Thompson WM, Wynne JL, Dalton ML, Bozeman AT, Innes BJ. The effect of ACGME duty hour restrictions on operative continuity of care. *Am Surg*. 2009;75:1234–1237.

22. Christmas AB, Brintzenhoff RA, Sing RF, et al. Resident work hour restrictions impact chief resident operative experience. *Am Surg*. 2009;75:1065–1068.

23. McCusker K, Gunaydin S. Research using qualitative, quantitative or mixed methods and choice based on the research. *Perfusion*. 2015;30:537–542. https://doi.org/10.1177/0267659114559116.

24. Stefanidis D, Cochran A, Sevdalis N, et al. Research priorities for multi-institutional collaborative research in surgical education. *Am J Surg*. 2015;209:52–58. https://doi.org/10.1016/j.amjsurg.2014.08.032.

SUPPLEMENTARY INFORMATION

Supplementary material associated with this article can be found in the online version at doi: 10.1016/j.jsurg.2019.06.014.