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Assessing the effort associated with teaching residents[☆]

Kelli R. Aibel^a, Tracy Truong^b, Ronnie L. Shammass^a,
Eugenia H. Cho^a, Kate J. Burette^a, Gina-Maria Pomann^b,
Scott T. Hollenbeck^{a,*}

^a Division of Plastic, Maxillofacial & Oral Surgery, Duke University Hospital, Durham, NC, USA

^b Department of Biostatistics and Bioinformatics, Duke University Hospital, Durham, NC, USA

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Summary *Background:* Intraoperative resident education is an integral mission of academic medical centers and serves as the basis for training the next generation of surgeons. The actual effort associated with teaching residents is unknown as it pertains to additional operative time. Using a large validated multi-institutional dataset, this study aims to quantify the effect of having a resident present in common plastic surgery procedures on operative time. Future directions for developing standardized methods to record and report teaching time are proposed, which can help inform prospective studies.

Study design: The 2006–2012 American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database was queried to identify seven isolated plastic surgical procedures that were categorized based on resident involvement and supervision. Linear regression models were used to calculate the difference in operative time with respect to resident participation while controlling for patient and operative factors.

Results: Resident involvement was associated with longer operative times for muscle flap trunk procedures (53 min, 95% CI = [25, 80], p-value = 0.0002) and breast reconstruction procedures with a latissimus dorsi flap (55 min, 95% CI = [22, 88], p-value = 0.001). For six of the seven surgeries evaluated, resident involvement was associated with longer operative times, as compared to no resident involvement.

Conclusion: Resident involvement is associated with an increase in operative time for certain plastic surgery procedures. This finding underscores the need for a mechanism to quantify the

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* Corresponding author. 200 Trent Drive, Duke University Medical Center, Box 3945, Durham, NC 27710, USA. Fax: +1 (919) 681 2670. E-mail address: scott.hollenbeck@duke.edu (S.T. Hollenbeck).

time and effort that the attending surgeons allocate toward intraoperative resident education. Further study is also necessary to determine the causal impact on patient care.

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Introduction

Large academic medical centers are under increasing pressure to improve healthcare efficiency and patient outcomes. Hospitals, owing to this pressure, have started using lower risk educational technologies and methods, although actual operating room experience remains the most effective way to teach surgical residents.¹ For attending physicians to be able to provide quality education to surgical residents while promoting the highest level of patient care, it is important for physicians and academic institutions to accurately understand and value the effort dedicated to teaching them.

The American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database provides reliable, risk-adjusted data based on 30-day post-operative surgical outcomes in both inpatient and outpatient settings.² While many NSQIP studies investigating trainee association with outcomes report on operative time and resident involvement,^{3–18} the majority of them do not focus their primary analysis on this association for specific procedures of interest. Additionally, these studies do not define resident participation using the data acquisition techniques that we have proposed for the NSQIP database.

Currently, there is a paucity of studies in the NSQIP plastic surgery literature that examine the effect of resident participation on surgical outcomes. In this study, we utilized NSQIP to isolate each surgery of interest in order to ensure proper analysis of operation time for plastic surgery cases spanning reconstructive, cosmetic, and hand surgery. Furthermore, this study aimed to capture both resident and attending physician presence to identify whether certain surgical procedures have longer operating times with resident involvement. Insights derived from this study indicate a need to develop more robust models and interventions in order to more accurately quantify the effort dedicated to resident education.

Methods

Study population

Patients over the age of 18 who underwent a single plastic surgery procedure in the 2006–2012 NSQIP dataset were identified. The plastic surgery procedures examined in this study are shown in [Table 1](#). These procedures were chosen to represent a variety of common plastic surgery procedures of varying complexity. Cases were included only if patients underwent a single plastic surgery procedure with only one primary current procedural terminology (CPT)

code listed. Cases where a plastic surgery procedure was performed in addition to other or concurrent procedures (multiple CPT codes) were excluded from the analysis.

Definition of resident participation in plastic surgery

Resident participation in surgery was defined using two NSQIP variables: 1) the presence of an attending physician and the level of his/her involvement and 2) the presence and level of a resident involved. In NSQIP, the ATTEND or “level of residency supervision” variable has six levels (“Attending Alone,” “Attending & Resident in OR,” “Attending in OR,” “Attending in OR Suite,” “Attending Not Present, but Available,” or “Not entered”), while the PGY or “highest level of resident surgeon” variable has 11 levels ranging from 0 to 11, with 0 corresponding to no resident present during a surgery and >0 corresponding to at least one resident present during a surgery (increasing values from 1 to 11 correspond to increase in resident training levels). As this was an associational study and the definition of PGY varies across institutions and within surgical specialties, the variable was dichotomized into 0 or 1.

First, a primary analysis was performed using our definition of resident participation, which incorporated both resident (PGY) and attending (ATTEND) involvement variables. If a resident was present during surgery, then resident participation equaled 1. In this case, an ATTEND variable that equaled “Attending & Resident in OR,” “Attending in OR,” “Attending in OR Suite,” “Attending Not Present, but Available,” or “Not entered” had to be concordant with a PGY variable between 1 and 11. If a resident was not present during a surgery, then resident participation equaled 0. In this case, the ATTEND variable that equaled “Attending Alone,” “Attending in OR,” or “Not entered” had to be concordant with a PGY variable that equaled 0. Cases for which the PGY and ATTEND variables were discordant were excluded from the analysis. For comparison, a sensitivity analysis was performed using only

Table 1 Examined CPT codes.

CPT	Procedure
19364	Unilateral breast free flap reconstruction (UBrFF)
19357	Unilateral breast tissue expander (UTE)
15830	Abdominoplasty (AbP)
15734	Muscle flap trunk (MFT)
19361	Breast reconstruction with lat dorsi flap (BrLD)
25111	Excision of ganglion cyst (Gang)
26615	Open treatment of metacarpal fracture (MtcFx)

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