2019

Changing the Surgical Residency: A Mixed-Methods Study of Residents' and Faculty Experiences One Year After Implementation

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ORIGINAL RESEARCH

Changing the Surgical Residency: A Mixed-Methods Study of Resident and Faculty Experience One Year After Implementation

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Introduction:	We evaluated a reformed surgical residency curriculum aimed at addressing emerging practice models, enhancing residents' educational experience, and improving the quality of patient care by reducing service size and enhancing attending-resident interactions.
Methods:	A mixed-methods study of a surgical training program following curriculum reform, including focus groups and individual qualitative interviews with residents, attendings, nurses, and advanced practice providers to explore perspectives on curriculum reform; time study of resident activities; and quantitative assessment of surgical case logs.
Results:	Interviews demonstrated disparate knowledge and attitudes regarding the goals of the curriculum. Several themes emerged during transcript analysis, including goals of the change, learning and educational value, communication, teamwork, service, and quality of life. Both positive (e.g., improved focus on resident education, balance between educational and service activities, communication, opportunity for direct feedback and observation) and negative aspects (e.g., lack of role clarity, insufficient workforce) of curriculum reform were identified. The time study revealed variability in resident activities by postgraduate year, with more time spent on indirect patient care in the early years and with attendings in the operating room and one-on-one with attendings later. Surgical case logs showed no significant decrease in the number of cases for residents by either training level or role.
Discussion:	This single-institution mixed-methods study suggests that a reformed surgical residency curriculum improved residents' educational experiences and the balance between educational and service activities without affecting operative volume. Multiple assessment methods are essential to identify the positive and negative aspects of an educational intervention.
Keywords:	surgical education, curriculum, residency reform, general surgery, mixed-methods, qualitative assessment, time study

Increased demands on surgical trainees have called for innovation and reform in the century-old methods of surgical education. These demands include, but are not limited to, mandated work hours, limitations in resident autonomy, increasing trends towards specialization, increased patient complexity, and a distinct evolution of the role of the learner in care delivery.[1–3] Large-scale structural changes, such as the "Flexibility in Surgical Training" and "Early Specialization" pathways, were designed in response to the increasing demands on trainees and barriers introduced by work hours (Supplemental Table 1).[4,5] The American College of Surgeons (ACS) has gone so far as to create a working group dedicated to this cause called "Fix the Five."[6] In parallel with these efforts, we addressed some of these challenges internally

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through curricular reform with a focus on deliberate changes to the service/delivery model.

In July 2015, we implemented a new surgical residency training curriculum designed to address emerging practice models, enhance residents' educational experience, and improve the quality and continuity of patient care. As a guide, we used curriculum from the Surgical Council of Resident Education (SCORE), a consortium of seven US-based surgical organizations. SCORE was established in 2004 to standardize competency-based education for general surgery residencies and to develop a web portal to deliver content to surgical residents.[7] We first mapped the learning objectives of each rotation with those represented on the American Board of Surgery In-service Examination (ABSITE) and the minimum case numbers required for graduation. The result of this mapping exercise was to rebalance the clinical rotations and prioritize education over service activities. Surgical service teams were decreased in size and an apprenticeship-type experience was introduced to increase longitudinal exposure between attendings and residents.[8]

While case logs and other quantitative methods have been used previously to evaluate changes in residency design, many of these studies fail to address the multifactorial nature of a training program.[9] Specifically, we know that the number of cases alone does not equate to surgical competency or reflect the quality of the residency experience.[10,11] Nevertheless, case volume is an important metric. When a training model changes emphasis from service and case coverage to education, there is understandable concern about a potential decline in case volume.

In this study, we used a mixed-methods approach that combined 1) qualitative analysis of stakeholder perceptions post-implementation and 2) quantitative analysis of both residents' time demands and their case mix and volume before and after implementation of the curricular change. We previously published the latter case-log data but have incorporated selected data here to inform the interpretation of the qualitative and time-study data.[9] We hypothesized that despite significant changes to the current training model and introduction of smaller, experience-based rotations, the curriculum would improve learning opportunities without a significant decline in surgical case numbers.

METHODS

Setting

This study was conducted at a university-affiliated community institution with a 5-year general surgery residency program that admits four categorical residents per year. This number was stable for the duration of the study. Residents operate within a single institution, including the only ACS-verified level 1 trauma center and pediatric emergency department in the state and an ambulatory surgery center. The study was reviewed by the local Institutional Review Board and approved as part of a program-wide evaluation and quality improvement initiative (IRB # 4793NR).

Curriculum reform

The surgical residency has long consisted of service groups organized by attending surgeons and major categories of clinical care. In 2015, a team of surgical trainees and attending surgeons reviewed the American Board of Surgery (ABS) map for the ABSITE and SCORE curriculum. The modules within the ABS map, which are designed to specifically and proportionally reflect the content of the ABSITE, were divided into categories relating to operative experiences. These categories were then translated into proposed surgical teams. In contrast to the original model of larger service groups that incorporate a range of surgical specialties, the new surgical teams were organized by targeted educational experience within a more narrowed anatomic and/or clinical approach, as demonstrated in the example shown in Figure 1.[9] Service groups that were affected by this reorganization include surgical oncology (divided into breast, endocrine, and hepatobiliary/oncology surgery), general surgery (divided into elective general surgery and acute care surgery), vascular surgery (divided into two teams), and creation of two new teams for colorectal surgery and bariatric/advanced minimally invasive surgery. One proposed benefit of the curriculum reform was increased face-to-face time between residents and attending surgeons. This was expected to have the added benefit of facilitating more accurate and detailed competency-based evaluations. The Accreditation Council for Graduate Medical Education (ACGME) competencies for general surgery residents include interpersonal and communication skills, patient care, medical knowledge, systems-based practice, and practice-based learning and improvement. These competencies seemed more

thoroughly addressed when an attending has had a longitudinal working relationship with a resident on a small team.[12] To date, we are unaware of any similar systematic approaches to changing surgical services to address educational issues on a large scale.

Qualitative evaluation

We conducted a qualitative study employing semi-structured focus groups and individual interviews from May to July 2016, approximately one year after the new curriculum was implemented. These semi-structured interviews/focus groups used an interview guide designed to explore perceptions of the value and impact of the new curriculum (Supplemental Table 2). Two investigators (CG, KH) , who were not involved in the clinical service or training program conducted the focus groups (4–6 participants) or individual interviews with personnel most closely involved in the care of surgical patients. Separate focus groups were conducted with 1) residents, 2) advanced practice professionals (APPs; including nurse practitioners and physician assistants), 3) nursing staff, and 4) attending physicians. All residents, APPs, and attendings were invited to participate, as were nursing supervisors or representatives from the areas of the hospital with

the highest volume of surgical patients. Nursing supervisors used brief questionnaires and open-forum discussion at staff meetings to review the changes. Staff were recruited to participate through email and announcements at department meetings, such as grand rounds. Individual interviews were conducted when participants were unable to attend the scheduled focus-group meetings. The focus groups and interviews were audio recorded, and these recordings were transcribed immediately after the focus group or interview.

Two members of the qualitative research team (LM, KH) developed the coding framework around the interview questions using line-by-line reading of the transcribed interview text in multiple meetings. The initial coding categories were developed, and further refined categories were applied to all transcripts. Main categories and sub-categories were systematically identified and compared through review of data within and across codes. Inconsistencies were solved through consensus among coders. MaxQDA software package was used by the team to ensure the consistency of the coding and create an audit trail. This software package was further used to create memos documenting the data-analysis process.
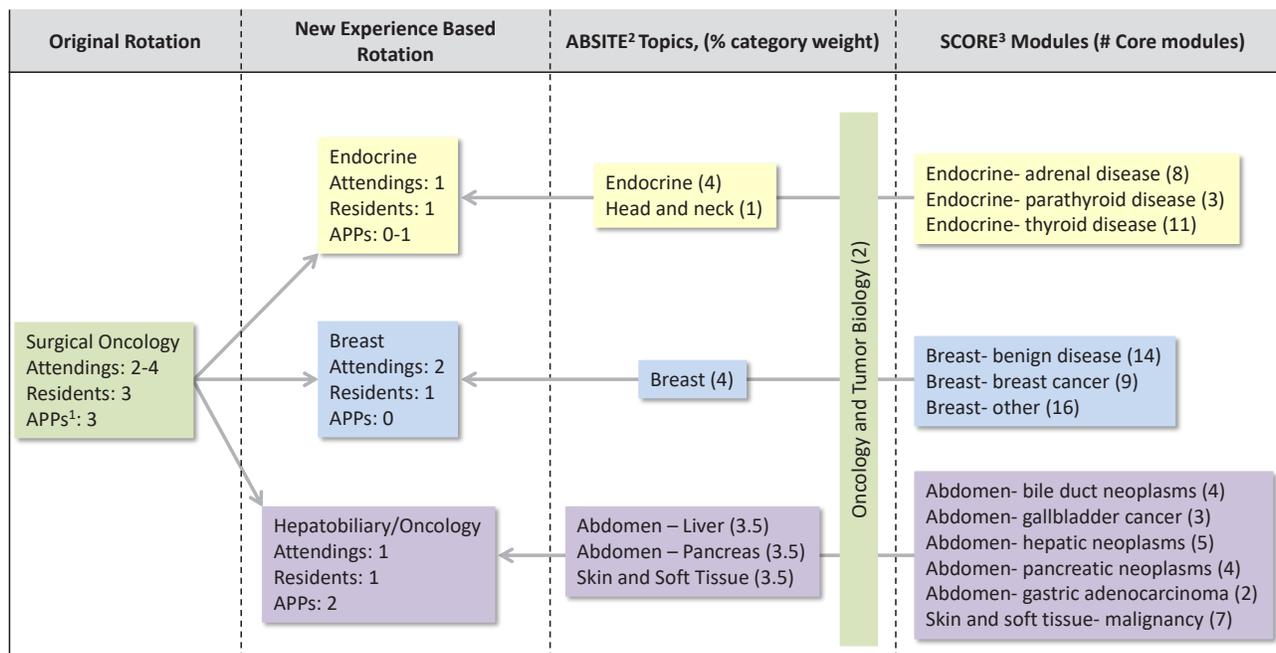

Figure 1. Example of changes to surgical services with curriculum reform
[1]Advanced Practice Providers: nurse practitioners, physician assistants
[2]American Board of Surgery In-service Examination
[3]Surgical Council on Resident Education

Quantitative evaluation

Case-log evaluation

Data for categorical residents and faculty from 2014 to 2016 were collected retrospectively from the ACGME case log and stratified by study period (2014–2015 and 2015–2016, pre- and post-intervention, respectively) for analysis. Data were summarized as mean case number per resident overall and after stratification by postgraduate year (PGY) to assess variability in case numbers within a PGY. Further details on the methods of this study have been published.[9]

Time study

In 2015, we performed a cross-sectional, observational, two-part study of the activities of general surgery residents across various rotations and PGYs before the curriculum change. Rotations included were those most susceptible to change with the new curriculum and that had relatively stable daily schedules (i.e., fairly predictable distribution of clinic and operative time) irrespective of team members (e.g., surgical oncology, vascular surgery). Actions observed were categorized into eight mutually exclusive activities: verbal team communication (e.g., sign out, running the list), direct patient care (e.g., rounding, seeing consults), indirect patient care (e.g., discharge planning, writing notes), academic or in-house study time, administrative duties (e.g., logging cases), clinic time, transition time (e.g., physical movement within the hospital), and time in the operating room. The first part of the study (pre-implementation) involved capture of resident activities by an independent observer using an electronic time–study application (nuVizz Timestudy, Atlanta, GA). The second part (post-implementation) involved self-capture of activities by five residents, using the same application. The data categories varied slightly between the two phases to decrease the amount of disruption caused by self-logging activities in the second phase of the study (Supplemental Table 3).

Data analysis

Data were summarized as mean (standard deviation) or frequency (n, %), either overall or stratified by category. Categorical data were compared between subgroups by chi-square test or by Fisher's exact test as appropriate, and continuous data were compared between subgroups by t-tests. Pairwise post-hoc analyses of categorical data were interpreted after Bonferroni's correction for multiple comparisons. All analyses were performed using Microsoft Excel and SPSS Statistical Software (IBM SPSS Inc, Armonk, NY).

RESULTS

Qualitative Findings

Nine focus groups (2–9 participants per group) and 2 individual interviews were conducted with a total of 18 residents (90.0% of categorical residents), 6 attending surgeons (37.5% of invited attendings), 8 APPs (53.3% of invited APPs), and 15 nurses. The audio recordings were transcribed immediately after the focus group interviews with three groups of residents (PGY 1–2, PGY 3, and PGY 4–5), one group of attendings, one group of APPs, and three groups of nurses. Individual interviews were conducted with two attendings, one APP, and one nurse. Figure 2 summarizes the code matrix, and Table 1 summarizes the major themes identified together with key findings and selected quotes for each theme. Six major themes emerged: goals of the change, learning and educational value, communication, teamwork, service, and quality of life. The specific findings include:

1. Goals of the change: Participants perceived several main goals of the curriculum change, including to reduce service size, focus learning, and support an apprenticeship model.

2. Learning and educational value: Attending surgeons and residents perceived improvement in the educational experience, which they attributed to smaller services, apprenticeship-type learning, greater specialty–specific learning opportunities, and greater time for education/studying.

3. Communication: While there appeared to be increased opportunities for junior- and senior-level residents to communicate directly with attending surgeons, there was a decrease in resident-to-resident interaction and education perceived by both attending surgeons and residents.

4. Teamwork: Both residents and APPs expressed a lack of role clarity with regards to expectations and responsibilities for covering the services (e.g., APPs working on teams with only junior residents) and a potential increased workload for the APPs. With smaller services,

there was a decreased emphasis on teamwork and concern for future loss of leadership opportunities for chief residents due to less time on teams with junior residents.

5. Service: Residents perceived that the new curriculum improved the balance between educational and service activities, and it encouraged shared responsibilities among residents and APPs. For example, when a resident was on vacation while rotating on a busy service, participants reported reverting back to the old model and combining services to compensate for the increased workload and lack of coverage.

6. Quality of life: Residents acknowledged the stress inherent to residency training and reported that the new curriculum change allowed greater time for self-directed study and preparation, which contributed to some improvement in quality of life. Confusion regarding expectations and responsibilities, however, were associated with worsening quality of life for APPs (e.g., fewer residents on a given service with whom to split the workload, services with just an APP and a junior resident in which the APP was placed in a leadership or teaching role).

Quantitative Findings

Case logs

We identified 11,365 cases for inclusion, including 6111 in 2014–2015 (pre-implementation, 21 residents) and 5,255 in 2015–2016 (post-implementation, 20 residents), excluding "first-assistant" and "endoscopic" cases. As we described in more detail in our previous publication, average case volumes increased significantly for PGY 3 residents [from 262 (SD 16) cases per resident to 353 (SD 39) cases per resident, p = 0.005] and decreased for PGY 4 residents [from 367 (SD 41) cases per resident to 283 (SD 48) cases per resident, p = 0.04]. There was also a significant change in distribution of cases by resident role (surgeon chief, surgeon junior, or teaching assistant) within the PGY 2, 4, and 5 years when comparing total cases pre- and post-curriculum reform (p < 0.001). Variability was observed among residents at the same PGY level both pre- and post-intervention.[9]

Time study

During the pre-implementation stage of the time study, 8 residents (36.4% of the residency program) rotating on the surgical oncology/endocrinology and vascular surgery services were observed on 13 different occasions for a total of 81 hours and 42 minutes. Ninety-five percent of activity could be categorized as described in the Methods and Supplemental Table 3. The remaining 5% of activity was recorded as "other" (Figure 3A). Overall, residents spent the largest proportion of their time in the operating room, with senior residents [PGY 4 and 5; average 58.8% (SD 4.4)] spending twofold more time there when compared with junior residents [PGY 1, 2, or 3; 29.3% (SD 23.6)] (p = 0.03). In contrast, while residents overall spent 13.3% (SD 11.7) of time communicating with nursing and ancillary services, this task accounted for an average of 16.7% (SD 12.9) of time for junior residents and 6.5% (SD 5.0) for senior residents (p = 0.13). Both groups spent large proportions of their time working in the electronic health record (EHR) or on indirect patient care [15.0% (SD 7.0) versus 20.7% (SD 14.9) for senior and junior residents, respectively; p = 0.46)]. Time spent in direct education, outside of scheduled conference time accounted for only 2.5% (SD 4.3) and 0.03% (SD 0.08) of total observed activity for seniors and juniors, respectively (p = 0.43).

In the second (post-implementation) stage of the time study, 5 residents (62.5% of invited participants, 22.7% of all residents) collected data about their own activities over 7 weeks, for a total of 1131 hours and 54 minutes (Figure 3B). The study group included 3 (60%) senior residents (PGY 4 and 5) and 2 (40%) junior residents (PGY 1, 2, and 3). On average, 11.5% of the time was spent on direct patient care compared to 31.4% on indirect patient care or EHR-related activities. Overall, residents spent an average of 24% of their time in the operating room, which was significantly variable between residents. For example, the PGY 1 residents who were on the newly created breast, skin, and soft tissue rotation spent 42% of their time in the operating room compared to approximately 15% of the time among PGY 3 residents.

Our study contained potential confounding factors, such as other changes in curriculum, variability between rotations, and differences in data-collection methods in the two time periods. Here we show descriptive data, but we have not performed

a formal statistical comparison of time-study data pre- and post-implementation. However, we did observe trends for the services evaluated. After implementation of the revised curriculum, residents reported more time in face-to-face interactions with attendings and in the clinic, and only slightly less time in the operating room.

DISCUSSION

Despite the many changes facing surgical education, such as increased sub-specialization, rapid innovations in technology and surgical technique, and restrictions in duty hours, the evaluation of the resident experience among these changes is limited.[2,6,13] We redesigned the residency curriculum to proportionally address the educational demands of trainees and used a multifaceted approach to evaluate our training program.[14] Through the various phases of this analysis, we identified several strengths and weaknesses of the surgical curriculum. These study findings have already helped shape the ongoing evolution of our training program and have the potential to serve as a guide for modifying surgical training programs and providing a set of tools to assess their impact on meaningful outcomes.

While a variety of tools have been used to assess surgical training curricula over the years, most are limited to evaluation of a specific component, such as a new rotation or a simulation program, especially in the setting of competency-based training. In the qualitative assessment of our study, focus groups were used to enhance participation and allow ideas to be exchanged between participants based on role in the surgical care team and training level. As noted in the results, most participants appeared to understand the intended goals of smaller services to enhance the educational experience and allow for more focused education. There was, however, significant variability in resident and APP perceptions and attitudes regarding the curriculum reform, depending on the rotation or service. Specifically, comments on quality of life and job satisfaction were found to reflect poor communication on the roles of residents and APPs and the principals of participating in a teaching hospital service team. While this prompted internal development and redefining of provider roles, these findings are not unique to our residency. In one study regarding the dynamic between residents and APPs, 42.4% of survey respondents (residents) reported that the role of the APP is not well defined in their

hospital.[15] In another study highlighting the role of APPs on surgical services, there was variability in the perception of the "chain of command" between residents and APPs, role definition, and contribution of APPs to resident clinical education.[16] Both of these studies collected valuable information from surveys but were limited by the heterogeneity and small sample sizes.

When compared to standard feedback obtained via brief surveys administered through an electronic portal at the end of each rotation, this method provided much richer and more constructive information. In response to similar restructuring and abbreviation of surgical training in the UK, Parsons et al administered a questionnaire to assess the experience of surgical trainees.[17] While that study successfully described the experience of trainees in the setting of reduced work hours and limited training opportunities, it was limited in the evaluation of other stakeholder opinions.

Qualitative evaluations may be limited to evaluation of a single component of a curriculum. Similarly, quantitative tactics, such as the use of case logs, have been shown to tell a potentially incomplete story of the resident experience.[18] Plainly stated, experience, though essential to becoming an expert, does not necessarily ensure expertise. Therefore, the number of surgical procedures or periods of deliberate practice may not be a useful indicator of clinical competence as once proposed.[19–21] Regardless of the questionable validity of using procedure numbers as a proxy for surgical experience or expertise, our previous publication demonstrates that despite concerns that a change in rotation structure and increase in clinic time would result in decreased case volume, no practically significant change in case volume was observed following curriculum change. Resident role, an adjunct measure to evaluate resident autonomy, did not appear to change significantly with the curriculum change.[9]

The time study we performed pre-and post-implementation of the revised curriculum was limited due to differences in the data-collection strategy pre- and post-implementation. Nonetheless, it represents one of the largest time and motion studies performed among general surgery residents.[22–25] With more than 80 hours recorded by the independent observer and more than 1000 hours self-reported by residents, this study identified

variability in how residents spend their time and deficits in educational efforts. Quantification of time spent in the EHR and away from the operating room and bedside, for example, is a valuable adjunct to anecdotal reports of staffing deficits.[26] Since our time study was first conducted, more sophisticated studies using time-motion technology and randomly assigned observers have recorded activity real time using a tablet.[27] Uniform methodology in the pre- and post-intervention time periods, as described in published studies, would facilitate the interpretation of results.[23,27,28]

Additionally, further analysis at the multi-institutional level using time-motion studies may guide efforts to more effectively use ancillary staff and APPs.

Limitations

While the various parts of this study successfully evaluated a surgical curriculum, there are some limitations that, if addressed, would enhance the use of these methods for future program assessments. This study was conducted at a single institution with a small number of residents and limited pre- and post-implementation data. The small sample size not only limits generalizability of specific results, but it also increases the risk of statistical error. Another limitation of this study is that concurrent implementation of several changes in a training program limits the ability to determine the specific causes of the observed outcomes. In addition to restructuring the surgical teams, the resident experience may have been influenced by faculty and other structural changes, such as the simultaneous introduction of an integrated vascular training program, as well as changes to weekend staffing by APPs.

In the time study, standardized methods between the two parts of the study and validation between observer obtained and self-reported data would enhance the findings. While definitions of categories were reviewed with the residents and observers prior to initiation, some nuances of resident activity may have been lost in the first phase while some details or changes in activity were missed due to resident pre-occupation with clinical tasks. With increased resources and well-trained observers, we would ideally eliminate the bias introduced by self-reporting activities and improve the quality and completeness of data recorded. This would have supported a more reliable comparison between pre- and post-intervention data. The qualitative portion of this study, while enhanced by the use of unbiased and professional research team members, is inherently subject to bias through group mentality. Responses may also be influenced by factors external to the study that affect the participants' ability to articulate their experience from an earlier and possibly differently challenging rotation.

CONCLUSIONS

Despite the limitations of this study, it is one of the first to use a multifaceted approach to evaluate an evolving surgical curriculum. It is imperative to the growth of our field to continue modifying how we train surgeons. Without appropriate monitoring and assessment, however, we cannot guarantee that the changes made equate to safer, more competent surgeons. The tools used in this study (time studies, focus groups, and individual interviews) and quantitative analysis of case volume may be used to more accurately assess surgical training models. Further research including the correlation of intraoperative competency tools to assess resident experience during an intensive, immersion-type rotation, and with ABSITE and board examinations should be used to evaluate evolving models for surgical education.
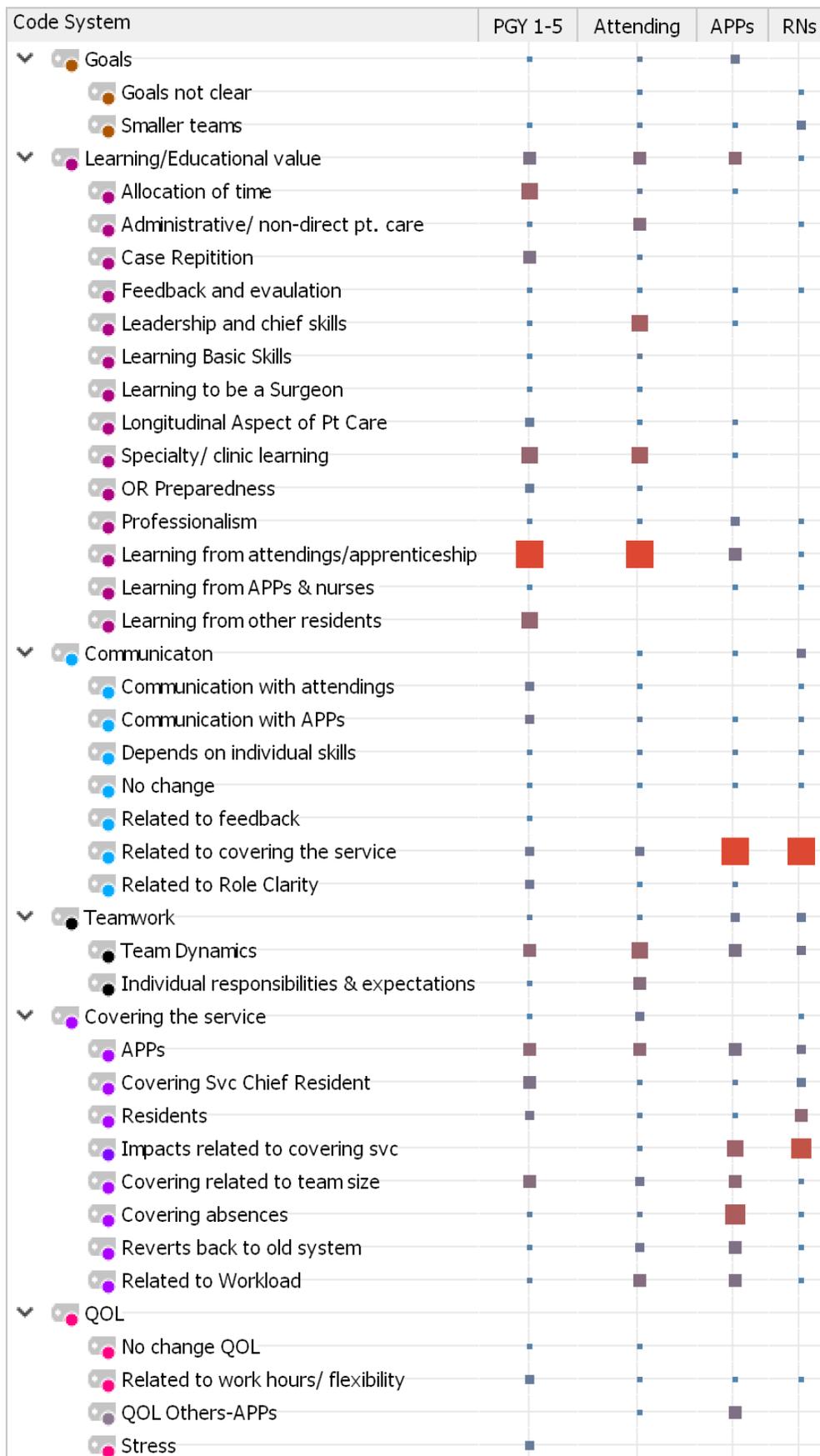
Code System	PGY 1-5	Attending	APPs	RNs
⌄ Goals	▪		▪	
Goals not clear		▪		▪
Smaller teams	▪		▪	▪
⌄ Learning/Educational value	◼	◼	◼	▪
Allocation of time	◼			
Administrative/ non-direct pt. care		◼		
Case Repitition	◼			
Feedback and evaualtion	▪	▪		▪
Leadership and chief skills	▪	◼	▪	
Learning Basic Skills	▪			
Learning to be a Surgeon	▪	▪		
Longitudinal Aspect of Pt Care	◼	▪	▪	
Specialty/ clinic learning	◼	◼	▪	
OR Preparedness	◼	▪		
Professionalism	▪	▪	◼	
Learning from attendings/apprenticeship	🟧	🟧	◼	▪
Learning from APPs & nurses	▪	▪		
Learning from other residents	◼			
⌄ Communicaton		▪		◼
Communication with attendings	◼	▪		
Communication with APPs	◼	▪		
Depends on individual skills	▪	▪	▪	▪
No change	▪	▪	▪	▪
Related to feedback	▪			
Related to covering the service	◼	◼	🟧	🟧
Related to Role Clarity	◼		▪	
⌄ Teamwork		◼	◼	◼
Team Dynamics	◼	◼	◼	◼
Individual responsibilities & expectations	▪	◼		
⌄ Covering the service	▪	▪	▪	▪
APPs	◼	◼	◼	◼
Covering Svc Chief Resident	◼	▪		◼
Residents	◼	▪		◼
Impacts related to covering svc		▪	◼	🟧
Covering related to team size	◼	◼	◼	▪
Covering absences	▪	▪	🟧	
Reverts back to old system	▪	◼	◼	
Related to Workload		◼	◼	
⌄ QOL		◼	◼	▪
No change QOL	▪	▪	▪	▪
Related to work hours/ flexibility	◼	▪	▪	▪
QOL Others-APPs		◼	◼	
Stress	◼			

Figure 2. Qualitative Findings Code Matrix by Group
Symbol size refers to frequency of topic discussion during interview as calculated by MaxQDA software

Table 1. Qualitative Assessment Major Themes and Supporting Quotes

| Major Theme	Key Findings	Quotes
Service goals	• Smaller teams identified as primary difference • APPs* and nurses aware of smaller team size, not necessarily as a curriculum change	" …I think the more focused learning goal is what we're aiming for. So having somebody that just does breast for a month is great... [The] overall goal is so they focus learning on that one thing for a month."
Learning/ educational value	Five most-discussed sub-categories included: • Learning from attendings/apprenticeship model • Specialty/clinic learning • Learning leadership and chief skills • Learning from other residents • Time allocation	"The new curriculum facilitates a lot more clinic time… created some better focus of educational experience..." "You learn a lot in clinic with the new curriculum by just shadowing attendings…you're getting into a groove and allowed to do a lot more."
Communication	• Enhanced communication with attendings, especially for junior residents • Communication dependent on individual skills, not necessarily influenced by curriculum change	"I think their job has to be a little bit easier with the new way of doing things because they have a smaller list of attendings to call." "I think with the new curriculum, it puts more stress on the junior residents to communicate."
Covering the service	• Problems with communication related to covering service, absences, workload reported by all groups	"Maybe we should just be clearer about expectations of the workload for APPs… There may be different responsibilities or expectations and different management of that team."
Teamwork	• Smaller team size associated with culture of "silos" between residents and APPs • Seemed to exacerbate a pre-existing problem with role clarity	"The residents and the APPs are two separate, in theory, equal groups, but we're so siloed…we're very separate" "Decreased resident-resident interaction, education..."
Quality of life	• QOL† unchanged with some variability by service • Worse QOL reported by APPs based on lack of role clarity and communication	"…noticed a surge in our census and to expect any protected time for education is now down to zero for us [APPs]"
Recommendations	• Ensure protected specialty and clinic time for learning • Overall support for apprenticeship model by attending surgeons • Recommend chief-resident experience with increased autonomy	"[In] bigger volume services, it would be valuable to have a bigger complement of residents but also sort of the expectation, and create a true chief resident experience" "Make the focused learning all across the board so they actually have the time and the energy to focus your learning" "Clearer expectations of the workload for APPs… There may be different responsibilities or expectations and different management of that team" "When they have none [residents], I need the ability to slide someone else over… If they're going to be in a variable staffing pattern, I need to be in one too"
Institutional issues	• Heightened variability in resident and APP staffing with increased number of services • General staffing concerns discussed, unrelated to curriculum change	"…the other problem is that we're separate groups of residents and APPs... It's unmasked issues with manpower."

*APP, advanced practice professionals; †QOL, quality of life

A. Before Implementation of New Curriculum (independent observer)
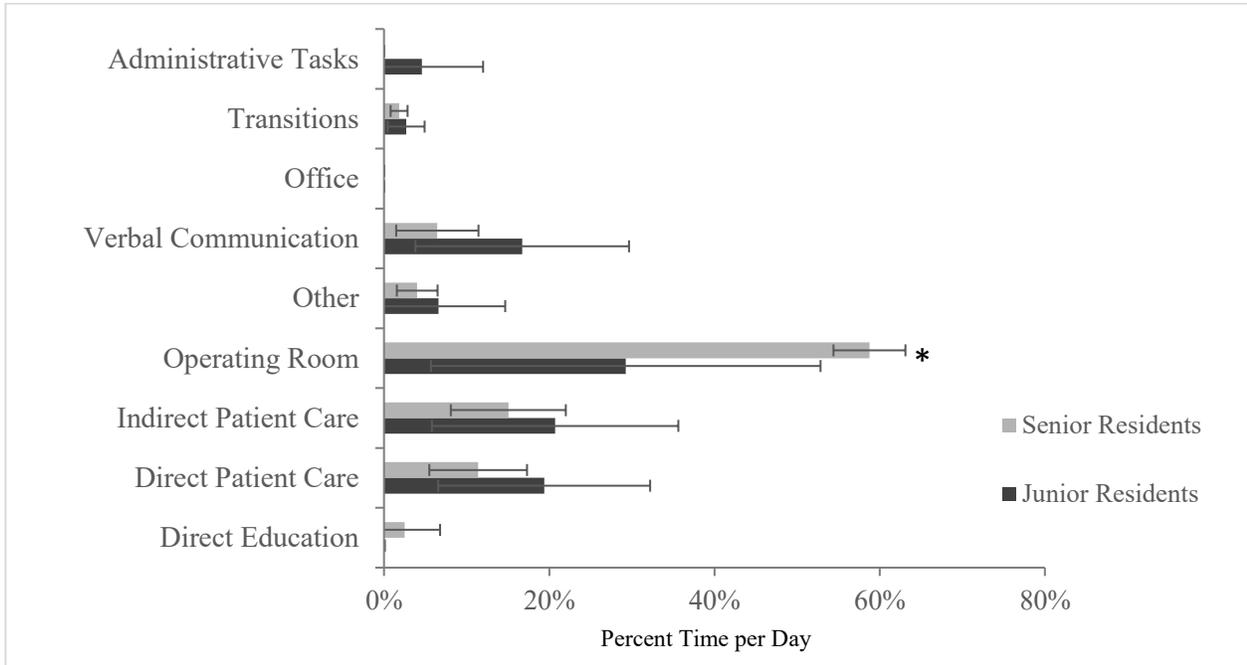
Data expressed as average percentage of total time ± 1 SD. * p ≤ 0.05

B. After Implementation of New Curriculum (self-reported)
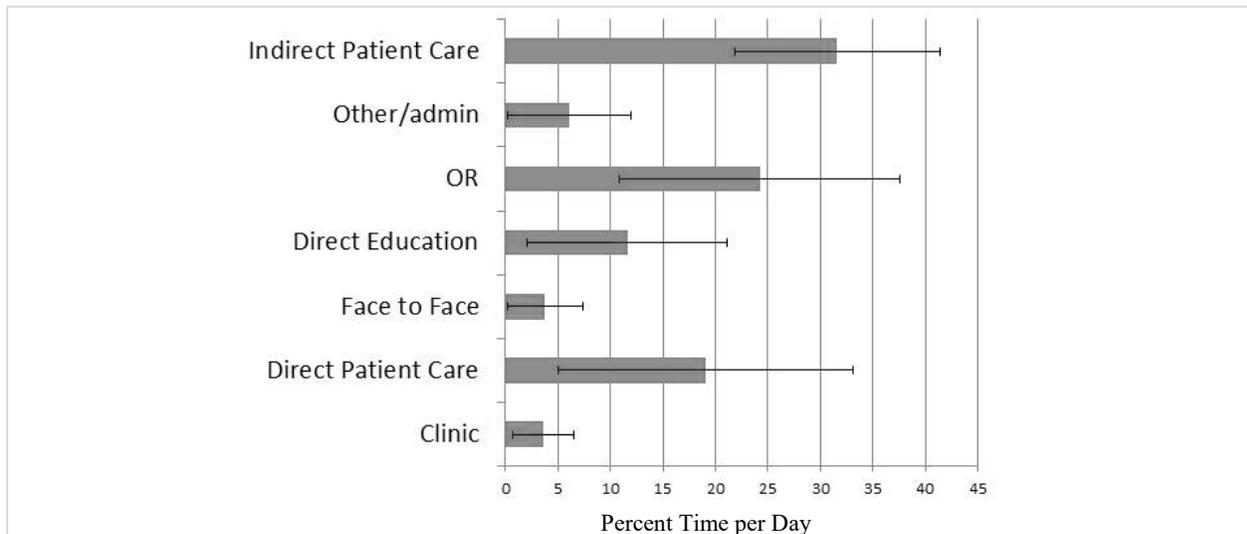
Data expressed as average percentage of total time ± 1 SD.

Figure 3. Time Study of General Surgery Resident Activities

Conflicts of Interest: None

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