

# The State of Plastic Surgery Education Outside of the Operating Room

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**Background:** Plastic surgery education consists of technical skills, surgical decision-making, and the knowledge necessary to provide safe patient care. Competency in these modalities is ensured by requiring case minimums and oral and written examinations. However, there is a paucity of information detailing what teaching modalities residency programs use outside of the operating room.

**Methods:** A 16-question survey was sent to all integrated and independent program directors. Information regarding nonsurgical resident education was collected and analyzed.

**Results:** There were 44 responses (46 percent). Most programs had six to 10 faculty (43 percent), and a majority (85 percent) required faculty to participate in resident education outside of the operating room. Residents most commonly had 3 to 4 hours (43 percent) of protected educational time 1 day per week (53 percent). Nonsurgical education consisted of weekly lectures by attending physicians (44 percent) and residents (54 percent), in addition to weekly CoreQuest (48 percent), teaching rounds (38 percent), and Plastic Surgery Education Network lectures (55 percent). Monthly activities included morbidity and mortality conference (81 percent) and journal club (86 percent). Indications conference was either monthly (41 percent) or weekly (39 percent). Cadaver laboratories, visiting professors, board preparation, in-service review, and meetings with the program director occurred yearly or several times per year. Forty-nine percent of programs sponsor one educational course per resident. In addition, most programs (65 percent) do not receive outside funding for education.

**Conclusions:** These findings improve understanding of the current state of nonsurgical resident education in plastic surgery. They illustrate that residents participate in a diverse number of nonsurgical educational activities without any significant standardization. (*Plast. Reconstr. Surg.* 146: 1189, 2020.)

Postgraduate medical education, and specifically postgraduate surgical education, encompasses three unique domains: fund of knowledge, technical skills, and judgment. Competency in all three of these modalities is required to deliver safe and consistent patient

care. Education takes place both inside and outside of the operating room. Within the operating room, residents learn technical skills and surgical decision-making, and outside of the operating room, residents learn clinical diagnosis, bedside manner, the ability to navigate health care delivery systems, and the required fund of knowledge to diagnose and safely treat patients. To achieve comprehensive resident education, both intraoperative and extraoperative components must be present and are required by the American Council for Graduate Medical Education.

To maintain a high standard of care, the American Council for Graduate Medical Education

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requires residents to log their surgical cases and sets specific minimal case requirements that must be met before graduation to ensure that graduating residents have gained prerequisite surgical exposure to fundamentals of plastic surgery. In addition, a published set of Plastic Surgery Milestones are available as guidelines for the progression that residents are expected to take through their training. However, no standards exist for education outside of the operating room, although the Plastic Surgery In-Service examination does function as a standardized assessment tool for knowledge, scored against their level- and track-appropriate peer group nationally.<sup>1,2</sup>

With the current limitations in resident work hours and the need to maximize time spent in the operating room, time spent learning outside of the operating room must be used effectively and efficiently. However, there are no data to identify what works and what does not in terms of resident education outside of the operating room. The aim of this study is to characterize how plastic surgery residents nationwide are educated outside of the operating room, and to make evidence-based recommendations for resident education.

## METHODS

A link to a 16-question survey was sent to all integrated and independent plastic surgery program directors using SurveyMonkey (SurveyMonkey, Inc., Palo Alto, Calif.). Responses were recorded and compared. Solicited responses were focused on:

- Basic information such as number of residents and faculty.
- Amount of protected educational time for residents.
- Type and frequency of educational activities within the program.
- Type and frequency of educational activities outside the program.
- Funding for education activities.
- Microsurgery training.

Results were compared to the published American Council for Graduate Medical Education program requirements. Data are presented as percentages, means, or medians with standard deviations where appropriate. The Mann-Whitney *U* test was used to compare frequency of various educational activities and protected educational time between integrated and independent plastic surgery residency programs. Associations between

program size and frequency of education activities were evaluated with Pearson's correlation coefficient (*r*) for scale data and Spearman's rank-order correlation coefficient (*r<sub>s</sub>*) for ordinal data.

## RESULTS

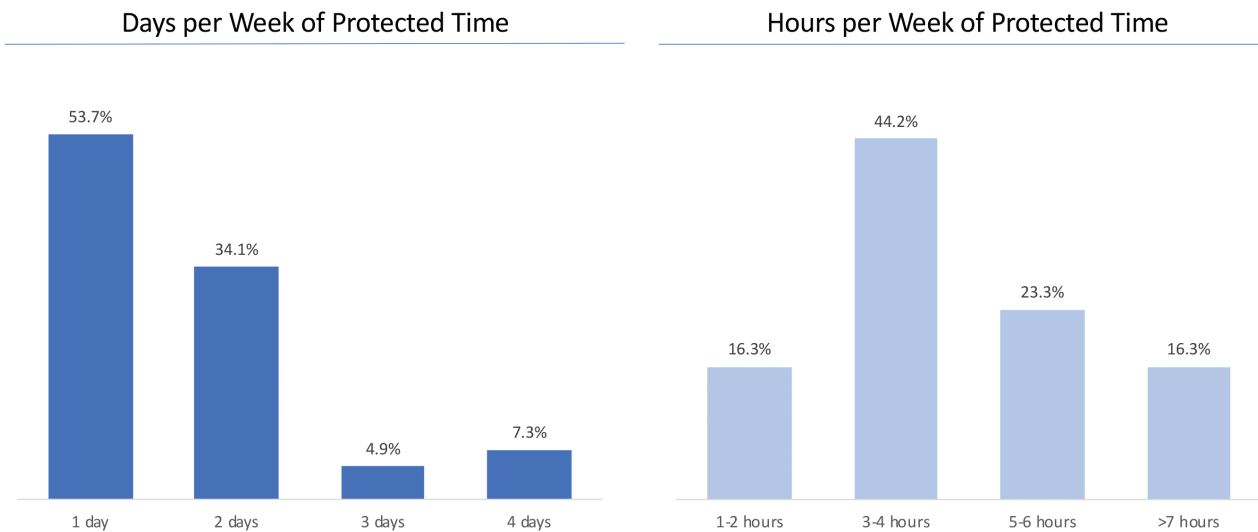
Forty-four of 96 program directors completed the survey, yielding a 46 percent response rate. Of those, 19 (43 percent) were responsible for integrated programs, 12 (27 percent) for independent programs, and 13 (30 percent) for both. Integrated programs accepted an average of  $2.6 \pm 1.22$  residents per year and independent programs accepted an average of  $2.1 \pm 1$  residents each year. Most programs (44 percent) had six to 10 faculty members, and a majority (86 percent) required faculty to participate in resident education outside of the operating room.

### Protected Educational Time

The American Council for Graduate Medical Education program requirements state that "residents must be provided with protected time to participate in core didactic activities."<sup>3</sup> Program directors were asked about the amount of time that residents dedicate to education outside of the operating room (distinct from allocated research time) (Fig. 1). Fifty-four percent of program directors grant their residents protected education time 1 day per week, whereas 34 percent grant their residents 2 days with protected time. In total, 44 percent of programs directors responded that their residents have 3 to 4 hours of protected education time every week, 23 percent granted residents 5 to 6 hours, and 16 percent granted either 1 to 2 hours or more than 7 hours. There was no statistical difference detected in the amount of protected time between respondents that identified their programs as integrated versus independent.

### Educational Activities within the Program

American Council for Graduate Medical Education program requirements state that "the curriculum must contain ... a broad range of structured didactic activities."<sup>3</sup> The type and frequency of various educational activities within the program were solicited from residency directors. Program directors were asked to select the frequency of participation of a list of common educational activities and were also given the opportunity to add any activities and their frequency that were not on the list. Listed activities included the following: attending surgeon lectures, lectures given by



**Fig. 1.** Protected education time. (Left) days per week and (right) total hours.

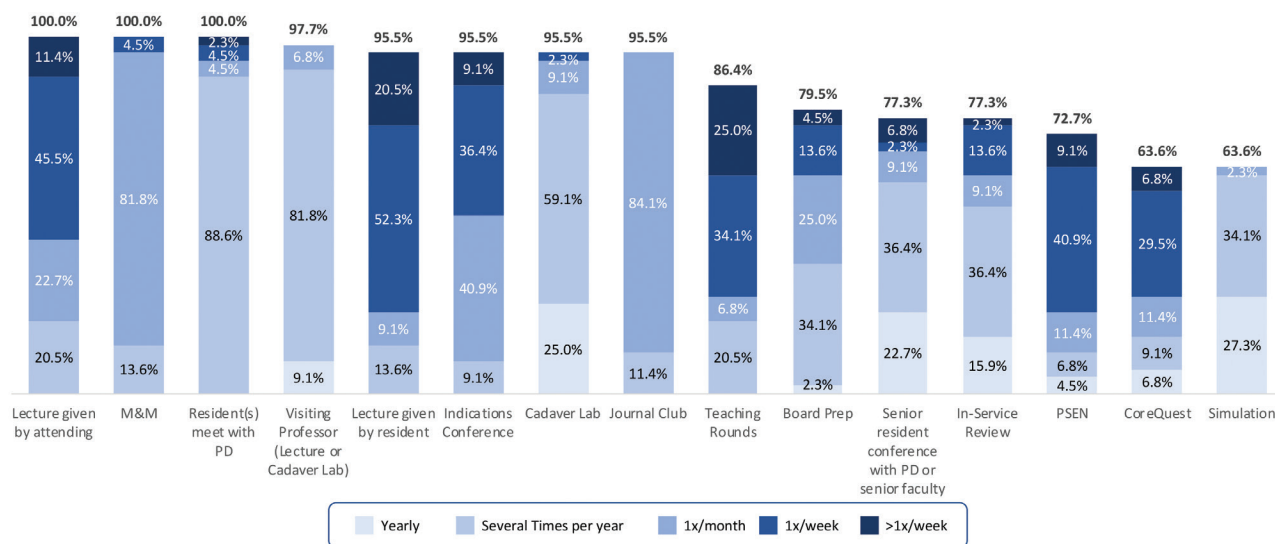
a resident, indications conference, morbidity and mortality conference, CoreQuest (open-ended topic-based questions provided by the American Council of Academic Plastic Surgeons), cadaver laboratory, simulation, journal club, educational modules provided through the Plastic Surgery Education Network, board preparation, teaching rounds, resident meetings with program directors, senior residents meeting with the program director, in-service review, and visiting professor (including lecture or cadaver laboratory).

All program directors responded that their residents participate in lectures by faculty, morbidity and mortality conference, and meetings with the program director. Almost all program directors (95 to 98 percent) responded that their residents participate in lectures given by co-residents, journal club, visiting professor lectures or cadaver laboratories, indications conferences, and cadaver laboratories. Eighty-six percent of program directors responded that residents participate in attending physician teaching rounds, and 80 percent responded that residents participate in structured board preparation. In-service review and senior resident meetings with program directors were included in 77 percent of program director responses. Plastic Surgery Education Network was included in 73 percent of program director responses, and CoreQuest and simulation were included by 64 percent of responding program directors.

Program directors were also asked how frequently residents participate in these activities (Fig. 2). Options were greater than once a week, weekly, monthly, several times a year, and yearly. Activities that were most often weekly were lectures by residents and faculty (55 percent and 45 percent

weekly, respectively), Plastic Surgery Education Network (56 percent weekly), and CoreQuest (46 percent weekly). Teaching rounds showed high variability, with 39 percent responding that they occurred weekly, 29 percent responding greater than once a week, and 24 percent responding several times a year. Activities that were most often monthly included morbidity and mortality conferences (82 percent monthly) and journal club (86 percent monthly). Indications conference was either monthly (43 percent) or weekly (38 percent). Cadaver laboratories (62 percent several times per year), visiting professors (84 percent several times per year), board preparation (43 percent several times per year), in-service review (47 percent several times per year), simulation (54 percent several times a year), and meetings with the program director (89 percent several times per year) occurred several times per year.

Independent programs participated in lectures given by attending physicians more frequently (median, once per month versus once per week;  $p = 0.035$ ), whereas integrated programs held simulation laboratories more frequently (median, several times per year versus do not participate;  $p = 0.012$ ). The frequency of other educational activities and protected educational time was statistically similar between program type. Some survey respondents ( $n = 13$ ) had both an integrated and an independent program at their institution, and their survey answers reflect the educational activities of both types of programs; these respondents were ultimately excluded from this statistical analysis, as their responses could not be solely assigned to either the integrated or independent groups.



**Fig. 2.** Frequency of resident involvement in educational activities. *M&M*, morbidity and mortality conferences; *PD*, program director; *PSEN*, Plastic Surgery Education Network.

Eighty-six percent of respondents require their faculty to participate in resident education outside of the operating room, and a majority (66 percent) do not receive outside funding for resident education in the form of industry support or grants. Lastly, 48 percent of programs sponsor one outside educational course per resident, whereas 18 percent sponsor one per year.

### Educational Activities outside the Program

The American Council for Graduate Medical Education requires that “Residents must participate and present educational material at conferences.”<sup>3</sup> Program directors were also asked what, if any, additional educational activities their residents participate in. Responses included “national meetings,” “courses,” “microsurgical lab,” and “art courses/sessions.”

The final portion of the survey asked about microsurgical education. It showed that 72 percent of program directors have residents participate in a formal microsurgical curriculum at their institution, whereas 7 percent send residents to an outside institution. Twenty-one percent do not have their residents participate in a formal microsurgical curriculum. Of those program directors who send their residents to a course (either at their own institution or outside), there was high variability in what year of training residents participated in such a course.

### Correlation between Program Size and Educational Activities

Statistical analysis was performed to determine whether any correlation between program size and

frequency of education activities existed. Among integrated residency programs, both number of residents and number of faculty were found to correlate significantly with frequency of simulations ( $r = -0.431, p < 0.014$ ; and  $r_s = 0.366, p = 0.043$ , respectively). The number of faculty was also found to significantly correlate with frequency of visiting professor lectures/laboratories ( $r_s = 0.407, p = 0.023$ ).

## DISCUSSION

Adults learn differently from children, and as such, unique approaches must be used in teaching the adult learner. Unlike pedagogy, or the teaching of children,<sup>4</sup> andragogy was introduced in the 1980s to differentiate adult learning from childhood learning. Adult learners were hypothesized to differ from child learners in several respects—namely, that the adult learner:

- Moves from dependency to increasing self-directedness as he or she matures and can direct his or her own learning.
- Draws on his or her accumulated reservoir of life experiences to aid learning.
- Is ready to learn when he or she assumes new social or life roles.
- Is problem-centered and wants to apply new learning immediately.
- Is motivated to learn by internal, rather than external, factors.

Attending and resident physicians alike must be aware of these basic concepts to optimize the educational experience.<sup>5-7</sup>

In addition, adults can have different styles of learning.<sup>8</sup> Although most students will learn regardless of the teaching style, many will have a preferred learning style according to the most dominant “sense” the learner prefers to use. The three major learning styles are as follows:

1. **Visual:** Visual learners prefer to see tasks performed and demonstrated step-by-step.
2. **Auditory:** These learners learn best when they listen to a process of concept being explained. They benefit most from traditional lectures and from asking questions.
3. **Kinesthetic:** These learners learn best by performing tasks, even if they must use trial and error. They benefit most from hands-on learning.

Previous studies have shown that the preferred learning styles of surgical residents tend to be different from those of the general public,<sup>9,10</sup> and that preferred learning style is also significantly associated with scores on standardized medical testing, including the United States Medical Licensing Examination Step 1 and the American Board of Surgery In-Training Examination.<sup>9,10</sup> Knowing these foundations of adult learning, one can hypothesize which learning modalities would most benefit plastic surgery residents. Between the clinical responsibilities of surgical residents and current duty-hour restrictions, program directors must maximize education efficiency in the small amounts of nonoperative time available to surgical residents.<sup>11-16</sup>

Lectures are the classic education modality for resident physicians,<sup>17</sup> but they target mainly auditory learners. However, they are an effective way to deliver a large amount of factual information in a short period. All the program directors who responded to this study’s survey reported their residents participate in lectures given by their program’s faculty. Alternatively, the Plastic Surgery Education Network is a great learning resource for residents that provides short lectures on specific topics given by experts in the field. As technology becomes increasingly important in medical education,<sup>18-20</sup> online resources such as Plastic Surgery Education Network also allow residents to learn on their own time and at their convenience. An alternative to traditional lecture techniques—a professor delivering information to students—is to allow the learners to develop and deliver lecture material to their fellow students. This strategy, used by 95 percent of programs, is unique because it forces the teacher to

understand the topic and be able to present and explain it to his or her peers. This encourages a deeper understanding of the material, albeit by just one person—the rest of the students are passive participants.

Alternatively, CoreQuest, which is created by members of the American Council of Academic Plastic Surgeons, is unique because it involves a majority if not all residents by providing visual, auditory, and kinesthetic learning. Because the CoreQuest questions are open-ended, they require self-directed learning to find the information required to answer the question. In addition, there are often requirements to draw and design reconstructive options, thus enabling residents to try their hand at designing flaps in a sandbox environment surrounded by their peers.

Other educational activities that are more specific to plastic surgery, such as cadaver laboratories, microsurgical skills laboratories, and simulation courses, are more likely to benefit visual or kinesthetic learners. These interactive learning modalities are very hands-on and are highly effective for learners who do not find traditional lecture-style teaching valuable. These learning styles are particularly important in surgical specialties (as surgery is an inherently visual and kinesthetic activity), especially plastic and reconstructive surgery, in which fine coordination and visuospatial awareness are key. The results of this survey showed that 62 percent of plastic surgery programs hosted cadaver laboratories for their residents several times per year, and 54 percent conducted simulation activities.

The results of this study’s survey demonstrate that residents participate in a diverse variety of learning activities with little standardization. This may be a response to the diverse learning styles of surgical residents. Multimodal learning preferences, wherein the learner prefers to use a mix of multiple different learning styles, are significantly more common than single-modality preferences among surgical residents.<sup>9</sup> Thus, providing residents with educational tools that use a variety of visual, auditory, and kinesthetic learning is crucial. However, in juxtaposition, the diversity of educational activities demonstrates that there is little standardization of resident education and little is known about the effectiveness of each modality.

Statistical analysis of survey responses showed that programs with a higher number of residents and faculty participated in simulation activities more frequently. In addition, number of faculty was also correlated to frequency of visiting professor lectures/laboratories. These results

seem intuitive, as larger programs may have the resources to invest in simulation equipment and support more visiting professors.

Program directors across the country should strive to provide their residents with an assortment of educational resources that matches the diversity of learning styles of their residents. The fields of education and medicine are both constantly evolving; as such, we should strive to continue to improve resident training to teach and foster the best physicians possible. In addition, it is our duty to evaluate the different educational activities that are available to determine which are most effective to best use the limited time that residents have.

This study has several weaknesses. We are unable to verify that the responses obtained are in fact valid. In addition, our labeling of the educational activities included in the survey may be open to interpretation. For example, “simulation” or “teaching rounds” may have different meanings to different program directors. Although this study’s survey results represent only 46 percent of plastic surgery programs, they provide great insight into which educational activities program directors believe are most effective. Given the results of this study, the next logical step would be to evaluate the perspectives of the residents themselves. Studies are currently underway to survey plastic surgery residents to gain a better understanding of what activities they find most effective and what improvements they believe can or should be made in resident education. These results, combined with the data presented here, would be extremely useful in optimizing education programs. Further studies could also be conducted to correlate the preferred learning styles and educational activities of plastic surgery residents with various outcomes such as standardized examination scores and fellowship placement.

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