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Assessing quality and resources during campus-wide simulation integration

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ABSTRACT

Introduction: Our simulation center, supported by four departments (Surgery, OB/GYN, Urology, and Anesthesiology), is accredited as a comprehensive Accredited Educational Institute (AEI) and is now expanding to accommodate all departments on campus.
Methods: A 61-point questionnaire was administered to 44 stakeholders, representing all of UME and GME. Data were compared for AEI vs. non-AEI activities.
Results: Responses were collected from all 44 groups (100% response rate). Overall, 43 simulation activities were hosted within the AEI and 40 were hosted by non-AEI stakeholders. AEI activities were more likely to be mandatory (93% vs. 75%, $p = 0.02$), have written learning objectives (79% vs 43%, $p < 0.001$), and use validated assessment metrics (33% vs. 13%, $p = 0.03$).
Conclusion: These data suggest that the AEI courses are more robust in terms of structured learning and assessment compared to non-AEI courses. Campus-wide application of uniform quality standards is anticipated to require significant faculty, course, and program development.

Introduction

In 2005, the American College of Surgeons (ACS) launched its Accredited Educational Institute (AEI) program, which offers accreditation for surgical simulation centers that meet objective quality standards.[1–3] These centers offer courses for practicing surgeons, surgical trainees, medical students, and other members of the surgical team. The surgical community has embraced the AEI program, and 94 simulation centers across 10 countries have achieved AEI status.

Our simulation center at University of Texas Southwestern has been accredited as a comprehensive AEI since 2006.[4] This institute has been historically supported by four departments—Anesthesiology, Obstetrics & Gynecology, Surgery, and Urology. These departments are responsible for approximately 300 residents and fellows and host 80–100 rotating medical students at any given time. However, many other campus departments host non-AEI-accredited simulations.

In 2015, UT Southwestern leadership unveiled plans to build a new 49,000 ft^2 simulation facility that would centralize all simulation activities on campus.[4] This planned integration would expand the AEI quality standards to as many as 44 clinical departments, divisions, and other educational groups, representing approximately 1400 residents and fellows as well as nearly 1000 medical students.

We recognized very early that it would take substantial effort to transform the simulation-based educational experience on campus from a fragmented, heterogeneous milieu to a centralized environment with uniform quality standards. In preparation for this major initiative, we aimed to collect detailed, baseline data on all AEI and non-AEI simulation activities occurring on campus prior to integration. We also performed a campus-wide needs assessment of simulation-based education to better understand the expectations of our stakeholders. This study represents an analysis of the quality and resource data gathered to satisfy these aims.

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Methods

Data for this study were gathered via two separate surveys. A "Course Description" (CD) survey gathered data on existing simulation activities that stakeholder groups were actively offering. The "Needs Assessment" (NA) survey gathered data on simulation activities that groups hoped to offer if they could secure financial and logistical support from the simulation center.

Survey development

The surveys were developed with input from a committee of 13 simulation experts within the institution.[4] The committee members represented eight different medical specialties (Anesthesiology, Cardiology, Emergency Medicine, Gastroenterology, Internal Medicine, Obstetrics & Gynecology, Pediatrics, and Surgery), and seven committee members held appointments as dean within the School of Medicine or School of Health Professions. The CD survey contained 61 items and the NA survey contained 13 items. One item in the CD survey allowed respondents to indicate that their stakeholder group was not currently hosting any simulation activities, and this response terminated the survey. Full versions of both surveys are available in the Supplementary Materials.

Survey distribution

Through a process of iterative discussions, a list of key stakeholder groups across campus was compiled representing the entirety of undergraduate medical education (UME) and graduate medical education (GME). Stakeholder groups were maximally aligned with clinical departments, divisions, and other existing administrative frameworks, such that a single individual (group leader) could be held responsible for submission of the requested data. The final list represented 44 stakeholder groups across UME and GME.

Requests for survey completion were distributed to each stakeholder group leader (e.g. department chair, division chief, UME Dean, etc.) along with the group's key educators (e.g. Program Directors, Clerkship Directors, Simulation Experts, etc.) Stakeholders received an email with an explanation of the plans for campus-wide simulation integration and an instructions for completing both surveys. Each stakeholder group was asked to fill out a separate CD survey for each simulation activity they were actively hosting and also to fill out a separate NA survey for each activity they wished to host if resources were available. Study data were collected and managed using REDCap electronic data capture tools hosted at UT Southwestern.[5] REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies. If a stakeholder group did not submit a response in a timely fashion, a member of the study team arranged for a face-to-face meeting to administer the surveys.

Data analysis

Data from CD surveys were analyzed according to quality of simulation activities (e.g. course structure, methods of assessment, methods of course evaluation, etc.) and resources required to host the activities (e.g. cost of materials, hours of faculty time, hours of support staff members' time, etc.) The cohort of AEI-accredited simulation activities were compared to non-AEI-accredited simulation activities using chi-square and Mann-Whitney U tests with $p < 0.05$ being considered significant. Data from NA surveys were summarized based on number of requests made per stakeholder group, types of learners targeted, and estimated resources required to initiate the proposed activity.

Results

Course Description (CD) survey

At least one survey was completed by all 44 stakeholder groups (100% response rate). Twenty-two groups (50%) indicated that they were not actively hosting simulation activities. The remaining 22 groups (50%) submitted 83 CD surveys. The stakeholders reported several different types of learners (median 16 per course (IQR 9–22)), including residents/fellows (82% of courses), students (20%), faculty (13%), and nursing and allied health (7%), with multiple inter-professional education courses (13%). Overall, we received 43 CD surveys (52%) from AEI groups and 40 from non-AEI groups. The distribution of CD surveys submitted is shown in Table 1.

Simulation activity development/structure

AEI-accredited simulation activities were significantly more likely than non-AEI activities to enforce mandatory participation (93% vs. 75% respectively, $p = 0.02$) and mandatory completion (87% vs. 65% respectively, $p = 0.03$) of the entire simulation. AEI activities were also more likely to provide learners with written learning objectives (79% vs. 43%, respectively, $p < 0.001$); however, both groups were equally likely to incorporate written/didactic components and self-practice/self-study components (Table 2). A formal needs assessment was infrequently reported as being performed by AEI groups or non-AEI groups in the development of their activities (33% vs. 40% respectively, p = non-significant).

Assessment

The two cohorts were equally likely to provide learners with feedback on performance; however, AEI activities used debriefing sessions significantly less frequently than non-AEI activities to achieve this objective (30% vs. 63% respectively, $p = 0.003$). In contrast, although AEI and non-AEI activities were equally likely to formally assess learners performance, AEI simulations used validated metrics for assessment more frequently than non-AEI simulations (33% vs. 13% respectively, $p = 0.03$).[6–11] The cohorts did not

Table 1
Simulation activities hosted by each group.

	Stakeholder Group	# of CD surveys
AEI Group	Surgery	16
	Anesthesiology and Pain Management	15
	Obstetrics and Gynecology	9
	Urology	3
	Subtotal	**43**
Non-AEI Group	Emergency Medicine	7
	Pediatric Critical Care	7
	Gastroenterology	4
	UME Preclerkship Courses	3
	Family and Community Medicine	2
	Nephrology	2
	Neurological Surgery	2
	Pulmonary & Critical Care Medicine	2
	Radiology	2
	Cardiovascular and Thoracic Surgery	1
	Cardiovascular Diseases	1
	Endocrinology	1
	Internal Medicine	1
	Neurology and Neurotherapeutics	1
	Otolaryngology	1
	Pediatric Emergency Medicine	1
	Pediatric Neonatal & Perinatal Care	1
	Radiation Oncology	1
	Subtotal	**40**
	Total	**83**

Table 2
Comparisons of AEI and non-AEI Simulation Activities.

	AEI Activities (n = 43)	Non-AEI Activities (n = 40)	p value
Participation in the activity is mandatory	93%	75%	0.02[a]
Completion of the entire activity is mandatory	87%	65%	0.03[a]
Activity has written learning objectives	79%	43%	<0.001[a]
Activity contains written/didactic component	53%	60%	0.55
Activity contains self-study/practice component	49%	35%	0.20
A formal needs assessment was performed	33%	40%	0.48
Learners receive feedback on performance	81%	88%	0.44
Learners participate in a debriefing session	30%	63%	0.003[a]
Learners' performance is formally assessed	72%	60%	0.24
Validated metrics are used for assessment	33%	13%	0.03[a]
Learners evaluate the activity	70%	60%	0.35
Faculty evaluate the activity	40%	25%	0.15
Learners evaluate the faculty	53%	30%	0.03[a]
Median cost of activity (in thousands of dollars)	15.5 (IQR 2.8–103)	8.3 (IQR 0.4–61)	0.21
Median total personnel hours per activity	22 (IQR 8.5–50.5)	25 (IQR 7.5–46.5)	0.87

[a] Statistically significant ($p < 0.05$).

differ regarding how frequently they required learners and faculty to submit evaluations of the simulation activity; however, the AEI cohort was significantly more likely than the non-AEI cohort to require that learners submit formal evaluations of faculty members (53% vs. 30% respectively, $p = 0.03$).

Resources

Both cohorts dedicated significant financial and personnel resources to their simulation activities. Including initial capital costs for simulation equipment, AEI groups spent a median of $15,500 (IQR $2800–103,000) whereas non-AEI groups spent a median of $8300 (IQR $400–61,000) to host a simulation activity. Individual AEI activities required a median commitment of 22 man-hours (IQR 8.5–50.5) from faculty and support staff whereas individual non-AEI activities required 25 man-hours (IQR 7.5–46.5). These differences in costs and personnel hours were not statistically significant.

Needs assessment (NA) survey

In addition to the 83 CD surveys, stakeholders submitted 33 NA surveys. Overall, 21 surveys (64%) were submitted by 13 groups that were currently hosting simulation activities and hoped to expand their offerings. The remaining 12 NA surveys (36%) were submitted by 5 groups who were not actively hosting simulation activities but had a desire to do so if the resources were available. Only two surveys (6%) were submitted by an AEI–accredited stakeholders while the other 31 (94%) came from non-AEI stakeholders. Table 3 lists the number of NA surveys received from each group.

Of the 33 simulation activities proposed by NA surveys, 15 (45%) were intended exclusively for residents, ten (30%) for fellows, one (3%) for medical students, one (3%) for advanced practice providers, and six (18%) were planned to be multi-disciplinary. Overall, 22 proposed activities (66%) involved task training, four (12%) taught medical interviewing skills, four (12%) incorporated team training, and three (9%) had both team training and task training elements. Median estimated cost to host the proposed activities was $40,000 (IQR $5000–100,000).

Discussion

Our analysis uncovered an extensive catalogue of simulation activities hosted by both AEI and non-AEI stakeholder groups and a similarly impressive wish-list for future activities. Direct comparison of AEI- and non-AEI-accredited simulation activities revealed that activities hosted by AEI-accredited groups were more robust in terms of structure and assessment, while activities from both cohorts involved significant investments of financial capital and human resources.

Several findings of our analysis deserve more detailed discussion. First, some readers may be surprised to see that a much higher proportion of simulation activities at our institution were offered to GME learners as opposed to UME learners. Although the numbers of UME and GME learners on our campus are comparable (1000 vs. 1400 respectively), our UME population is generally divided into two cohorts (pre-clerkship students and clerkship students) whereas our GME population is divided among 100 ACGME residency and fellowship programs and an additional 65 non-ACGME fellowships.[12] Thus, it makes sense that more individual simulation activities are needed to satisfy the more heterogeneous needs of all cohorts in the GME community. However, it may also be true that simulation is under-represented in our UME curriculum.

Second, compared to non-AEI-accredited simulations, the activities hosted by AEI-accredited stakeholders were more likely to adhere to many ACS metrics for quality; however, our data indicated that AEI–accredited simulations were less likely to use debriefing sessions as part of their simulations. Debriefing is an integral part of simulation-based education, and there are many high-quality studies demonstrating its effectiveness when used with high-fidelity simulations.[13–19] Thus, it is potentially concerning that our AEI simulations are using debriefing sessions infrequently. However, the studies cited above focus on debriefing primarily in the setting of medical interviewing and team training scenarios. In our study, AEI groups hosted simulation activities that were primarily oriented toward task training, and only 11 of the 43 AEI activities (26%) incorporated team training elements. In contrast, of the 40 non-AEI simulation activities, 19 (48%) incorporated team training or taught medical interviewing skills. This higher proportion of team training activities hosted by non-AEI simulations likely accounts for much of the difference seen in utilization of debriefing sessions. For both groups, an overall lack of resources available for team training and debriefing in our current facilities may also have prevented more widespread usage.

Additionally, we feel it is important to note that many of the AEI-accredited activities at our institution have been offered for more than 10 years and have been passed down through multiple iterations of core teaching faculty and simulation personnel. Thus, the respondents to our survey may not be completely familiar with some details of their simulation activities' development as this process pre-dated their involvement with the simulation activity. With that in mind, some of our statistics regarding the frequency of performing formal needs assessments or using validated metrics may underestimate the true frequency of these important quality

Table 3
Needs assessment surveys submitted by group.

	Stakeholder Group	# of NA surveys
Actively Hosting Simulations	Emergency Medicine	3
	Endocrinology	3
	Pediatric Neonatal & Perinatal Care	2
	Pulmonary & Critical Care Medicine	2
	Radiology	2
	Urology	2
	Gastroenterology	1
	Internal Medicin	1
	Nephrology	1
	Neurological Surgery	1
	Otolaryngology	1
	Pediatric Emergency Medicine	1
	Radiation Oncology	1
	Subtotal	**21**
Not Actively Hosting Simulations	Ophthalmology	4
	Orthopaedic Surgery	4
	Pediatric Cardiology	2
	Infectious Diseases	1
	Neurology & Neurotherapeutics	1
	Subtotal	**12**
	Total	**33**

measures. These findings suggest that there is an opportunity to increase the awareness of our stakeholders regarding such best practices.

By undertaking this survey before embarking on campus-wide simulation integration, we were able to obtain buy-in from stakeholders on the value of accreditation. Although our results are prone to some of the limitations detailed above, our data clearly suggest that accreditation has had a positive impact on simulation activities on our campus. This is an important finding given that achieving and maintaining certification as a comprehensive AEI is associated with real financial and administrative costs. However, knowing that the accreditation process was associated with measurable improvements in the rigor of simulation based education at our institution, we felt confident that expanded application of AEI standards would be beneficial to the departments whose programming was not actively monitored by any accrediting body.

Data gathered from these surveys not only enabled us to improve our understanding of the existing simulation activities but also allowed us to anticipate the resources required to achieve our institutional goals for all future activities. This information has favorably impacted the design of our new center in multiple ways. Data from the CD and NA surveys were used to guide the design of the physical space (room layout, planned usage, volume of learners) and guide the purchase of new equipment for the center. We formed a strong partnership with our Information Resources Department to design AV integration plans, data collection processes, and methods for competency and milestone mapping; select a suitable learning management system; and hire new full-time employees (e.g. systems administrator, embedded IT specialist).

We also realized the need to organize our curricula for different groups of learners (UME, GME, Health Professions) using standardized activity description templates, which included learning objectives and methods for assessment, and we hired a full-time instructional designer to oversee this project.[20] Our future directions include continued collection of data to monitor whether interventions will foster improvement in the quality of our simulation-based educational programs. Each institution is unique, and the results described here are not necessarily generalizable to all institutions. However, we feel that our process of assessing all activities according to uniform standards is a valuable exercise for any institution considering campus wide integration. Similarly, a needs assessment survey should be offered to all departments to fully inform integration efforts. This will assist other institutions in customizing the integration process to their unique needs.

Conclusion

These data suggest that the AEI courses are more robust in terms of structured learning and assessment compared to non-AEI courses, and both types require significant resources. Campus-wide integration is anticipated to require significant faculty, course, and program development to fully optimize the use of best practices.

Conflict of interest

None of the others have any relevant conflicts of interest related to this manuscript.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amjsurg.2019.03.008.

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