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ORIGINAL CONTRIBUTION

Development of an Emergency Medicine Simulation Fellowship Consensus Curriculum: Initiative of the Society for Academic Emergency Medicine Simulation Academy

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Abstract

Objectives: There is currently no consolidated list of existing simulation fellowship programs in emergency medicine (EM). In addition, there are no universally accepted or expected standards for core curricular content. The objective of this project is to develop consensus-based core content for EM simulation fellowships to help frame the critical components of such training programs.

Methods: This paper delineates the process used to develop consensus curriculum content for EM simulation fellowships. EM simulation fellowship curricula were collected. Curricular content was reviewed and compiled by simulation experts and validated utilizing survey methodology, and consensus was obtained using a modified Delphi methodology.

Results: Fifteen EM simulation fellowship curricula were obtained and analyzed. Two rounds of a modified Delphi survey were conducted. The final proposed core curriculum content contains 47 elements in nine domains with 14 optional elements.

Conclusion: The proposed consensus content will provide current and future fellowships a foundation on which to build their own specific and detailed fellowship curricula. Such standardization will ultimately increase the transparency of training programs for future trainees and potential employers.

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As patient safety concerns continue to move to the top of the international healthcare agenda, simulation-based training has emerged at the forefront of medical education across many high-risk specialties, including emergency medicine (EM).[1–11] The progressive sophistication of high-fidelity mannequin-based simulation, and the increasing uses for standardized patients and task trainers in all facets of medical education, underscore the need for fellowship-trained simulation faculty.[1–3,5,12–21] To close this gap, several EM programs throughout the United States have created their own simulation fellowship

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programs to train the future generation of simulation educators.[22]

At present, 29 EM simulation fellowships are referenced in the Society for Academic Emergency Medicine (SAEM) directory.[23] However, existing in a non-ACGME accredited status, there is neither a standard curriculum for these simulation fellowships nor a central repository where information can be obtained about each fellowship program. A survey of medical simulation fellowship directors highlighted the need for national consensus program guidelines.[24] In their current state, wide variability in duration, core curriculum, and graduation requirements poses significant obstacles to establishing a consensus statement on the core competencies required at the completion of all simulation fellowships. The value of such a document would among other things standardize critical curricular components, increase program transparency and consistency, and enhance transferability of the educational experience across fellowships. Other EM-based fellowships, such as education scholarship, ultrasound, and pediatric EM, have successfully defined core curricular content through varying consensus methodologies.[25–29]

With support of the SAEM simulation academy, a group of EM simulation experts sought to create a comprehensive list of EM simulation fellowship programs in North America and to define the core content for standard EM simulation curricula. Thus, the objective of this project is to develop consensus based core content for EM simulation fellowship programs.

METHODS

Study Design

This initiative is a cross-sectional analysis of existing EM simulation fellowship curricula utilizing a discrete stepwise process for content validation. This study protocol was reviewed and categorized as "not human subject research" by the Institutional Review Board at Hartford Hospital in Hartford, Connecticut.

Study Setting and Population

The project was led by medical simulation experts from the SAEM Simulation Academy. The study group was composed of volunteer academy members who were simulation fellowship directors (eight) and current and former simulation fellows (six). In May 2015, a comprehensive list of current EM simulation fellowships and fellowship directors was compiled by reviewing the SAEM fellowship directory, the Council of Residency Directors in EM (CORD) listserv, the Society for Simulation in Healthcare listserv. The group of fellowship programs and directors identified in this query, along with the study group, served as the basis for obtaining current simulation fellowship curricula. EM simulation fellowships were those defined as accepting EM residency–trained physicians as fellows. This included fellowships in the United States and Canada.

Study Protocol

A literature search was conducted to identify any preexisting core curricular content for EM simulation fellowship curricula and validated frameworks used to develop other consensus curricula in medical education. This search confirmed a lack of previously published EM simulation fellowship core curricular content and identified the work of Cumyn and Harris[30] as a guiding framework. Cumyn and Harris's methodology for content validation of curricular guidelines was used to ensure appropriate curricular content. This entailed a three-step process: 1) initial delineation of curricular content; 2) validation of curricular content using survey methodology; and 3) obtaining consensus on curricular modifications using the Delphi method.[30]

Initial Delineation of Curricular Content. Current fellowship curriculum objectives and guidelines were requested from all identified programs. Data were collected from all participating fellowships. Collected curricula were analyzed by a committee of simulation experts. Through an inductive qualitative analysis approach, in which all individual curricular subtopics were identified and condensed, specific subcurricular themes or domains were identified. These thematic domains were then used to further categorize individual elements identified within each curriculum. Each curriculum was reviewed and analyzed by two independent reviewers. Disagreement between reviewers was resolved by discussion and a third reviewer if necessary. The individual curricular reviews were then compiled together by four separate simulation experts to combine elements with similar wording or content.

Based on triangulation from these sources, an initial blueprint of the important curricular elements of a EM simulation fellowship was created. Subject matter experts, specifically current fellowship directors and senior members of the SAEM Simulation Academy with significant simulation experience, provided an overall evaluation of the blueprint, with attention to comprehensiveness and clarity. This blueprint contained 64 elements within nine domains.

Validation of Curricular Content Using Survey Methodology. Thirty selected content experts consisting of mostly simulation fellowship directors and simulation educational experts were surveyed via online survey software, and demographic information was collected. Individuals were asked to indicate whether each element in the survey should be included, modified, or deleted. If a modification or deletion was recommended, the individual was asked to provide justification. Any additional curricular content that was felt to be missing was also solicited. A free marginal kappa was calculated for each element. A free-marginal kappa with a cutoff of greater than 0.7 may be used to indicate sufficient interrater agreement, so only items with greater than 0.7 free marginal kappa were included in the final draft curricular content.[31–33] Qualitative analysis was conducted by the initial reviewers for any additional content proposed.

Obtaining Consensus on Modifications Using Modified Delphi Methodology. The identified elements that did not show agreement with a free marginal kappa of 0.7 or above were compiled into a second survey. Content experts were asked to rank each of the elements based on importance to an EM simulation

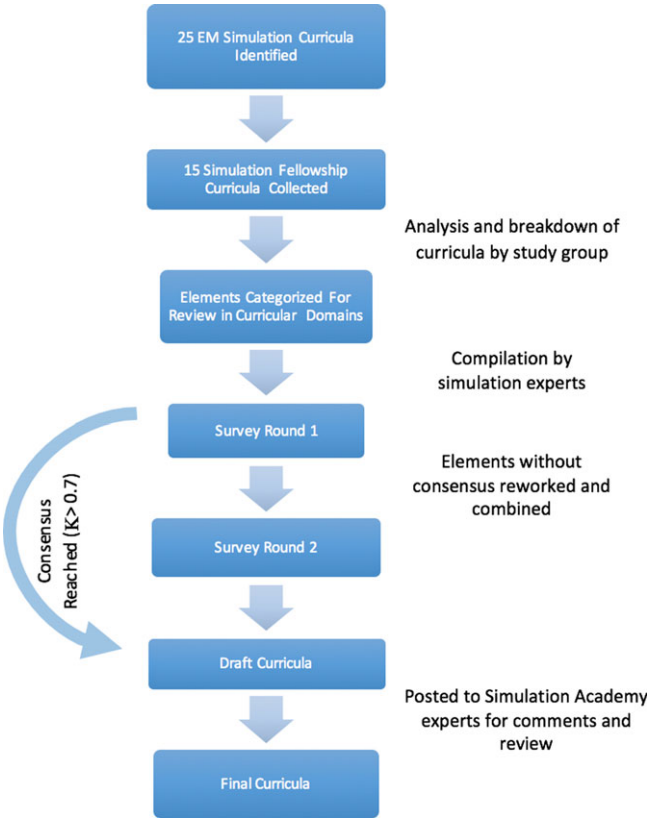

Figure 1. Graphical depiction of methods.

fellowship curriculum using a 10-point rating scale with unipolar adjectival anchors: 1–3 representing "not important to include"; 4–7 representing "moderately important to include"; and 8–10 representing "extremely important to include." Only elements that fell into the 8- to 10-point category on 80% or more of the survey responses were considered essential to an EM simulation fellowship curriculum. Those elements that did not make the cutoff were included as optional components.

As a final step, the proposed general curriculum was posted on a secure website for comments from 10 selected Simulation Academy experts including the Simulation Academy Executive Board. These comments were reviewed for any other necessary revisions. Figure 1 summarizes the methods as described.

RESULTS

The curricula for all EM simulation fellowship programs in existence at the time of the study (n = 27) were eligible for inclusion (Table 1). Fifteen curricula (55%) were obtained for analysis. Demographic information from the curricula was noted but not included in the Delphi surveys as the focus was the educational content of the curricula (Table 2). Simulation fellowship curricula varied in length from 1 to 2 years. Seven (46%) programs offered the opportunity for a master's degree in health professions education during a second year of fellowship. Five (33%) fellowships offered alternative workshops or certificates (e.g., The Center for Medical Simulation Instructor Certificate Series, Harvard Macy Institute's Program for Educators in the Health Professions).

Table 1
Simulation Fellowships Identified and Queried*

Akron City Hospital Summa Health
Alberta Children's Hospital
Alpert Medical School of Brown University
Brigham and Women's Hospital/Harvard Medical School
Dayton VA Hospital
Drexel University
Durham VA Hospital
Hartford Hospital
Hennepin County Medical Center
JUMP Simulation/University of Illinois Peoria
Maimonides Hospital
Massachusetts General Hospital
New York University Langone/The City University of New York
North Florida VA Hospital
Northshore Hospital
Palmetto Health University
Pittsburgh VA Hospital
Providence VA Hospital
San Francisco VA Hospital
Stanford University
St. Luke Roosevelt Hospital
Stroger Cook County Hospital
SUNY Downstate/Institute for Medical Simulation and Advanced Learning (IMSAL)
University of California Davis
University of California Irvine
University of Illinois Chicago
Yale University

*Fellowships were identified through querying the Society for Academic Emergency Medicine's (SAEM) fellowship directory, Council of Residency Directors, SAEM, and Society for Simulation in Healthcare listservs August 2015.

Table 2
Simulation Fellowship Program Characteristics

Program Curricula (N = 15)	Length	Advanced Degree (e.g., MHPE)	Educational Certificates
1 y	7 (46%)	0 (0%)	5 (33%)
1–2 y	7 (46%)	7 (46%)	
2 y	1 (6%)		

MHPE = master's degree in health professions education.

There were 20 of 30 (66%) respondents to the initial modified Delphi survey and consensus was reached with a free marginal kappa of 0.7 to retain 37 of 64 elements for the final curriculum. Twenty-seven elements were reworked by the study group and combined according to survey comments. These were distributed in survey round two as 16 survey items. Nine of those curricular elements were deemed essential. The final proposed core curriculum content contains 47 elements in nine domains with 14 optional elements (Table 3).

DISCUSSION

To our knowledge, this is the first published consensus on the suggested core curricular content for EM simulation fellowships. A prior survey study of simulation fellowship directors identified several common broad

Table 3
Simulation Fellowship Curriculum Domains and Content

Domain	Curricular Content
1. *Curriculum Development*—With respect to simulation curriculum development, simulation fellows should:	1. Demonstrate an understanding of and the ability to implement the principles of curriculum design such as Kern's six steps of curriculum design.[34] 2. Describe the conceptual frameworks necessary to conceive, develop, implement, and evaluate educational medical simulation curricula (such as Bloom's Taxonomy, KSAs, deliberate practice, directed feedback). 3. Implement the aforementioned conceptual frameworks in practice. 4. Demonstrate the ability to implement and integrate formal simulation-based curriculum into existing training programs. 5. Analyze and critique the effectiveness of existing evaluation tools used to evaluate participants. 6. Demonstrate an understanding of and the ability to implement assessment strategies for simulation-based education.
2. *Technical Operations and Techniques*—With respect to simulation technical operations, simulation fellows should:	1. Demonstrate understanding of the operation, programming, and maintenance of a wide variety of medical simulation technology such as human patient simulators, partial task simulators, computerized simulation technologies, virtual reality simulators, simulation audiovisuals, learning management systems, and data management systems. 2. Demonstrate proficiency in the application of a variety of simulation techniques, such as human patient simulators, partial task trainers, standardized patients, in situ or portable simulation, computerized simulation technologies, virtual reality simulators. 3. Demonstrate the ability to appropriately pair different types of simulation equipment with session objectives. 4. Become familiar with hybrid simulations (coordinated application of simulation manikins, SPs, and other technologies in collaborative multipatient scenarios to achieve session objectives). 5. Develop simulation-based training scenarios for special populations. 6. Conduct team training using crisis resource management. 7. Demonstrate the ability to apply medical simulation for patient safety training initiatives. 8. Demonstrate proficiency in the utilization of simulation from various perspectives such as scenario design, curricular development, case programming, scenario operation/implementation, debriefing, and program assessment. *Optional Elements* • Demonstrate familiarity with equipment maintenance; • Acquire skills in simulation activity setup, breakdown, and delivery; • Acquire skills in moulage and prop development; • Become cognizant of or have exposure to novel and innovative simulation devices/technology.
3. *Simulation Directorship/ Administrative*—With respect to simulation directorship and administrative tasks simulation fellows should:	1. Describe the administrative duties of a simulation medical director/administrator. 2. Recognize some of the issues around the creation and evaluation of new simulation centers. 3. Demonstrate the management skills to lead a simulation program. 4. Develop skills in the financial aspects of operating budgets and funding of a simulation center. 5. Demonstrate familiarity with the recruitment and training of simulation staff. 6. Demonstrate familiarity with simulation advocacy at an institutional and departmental level. *Optional Elements* • Develop familiarity with the various equipment and supply needs of a simulation center including inventory control, maintenance, and ordering equipment and supplies; • Develop familiarity with interactions and negotiations with simulation equipment vendors.
4. *Simulation Research*—With respect to simulation research fellows are expected to:	1. Complete a clearly defined scholarly project. 2. Develop skills in research methodology. 3. Attend national and local academic simulation meetings. *Optional Elements* • Present at a national/international meeting; • Peer review simulation-related research; • Publish a research manuscript; • Develop skills in grant writing; • Develop skills in simulation policy writing.

(Continued)

Table 3 (continued)

Domain	Curricular Content
5. Simulation Fellowship Teaching and Education—With respect to simulation fellowship teaching and education the simulation fellow should:	1. Develop expertise in concepts of interprofessional teamwork education/training, crisis resource management, and communication skills. 2. Apply a variety of debriefing methods. 3. Discuss the important characteristics of strong leadership and role clarity to interdisciplinary teams and crisis management. 4. Differentiate between formative and summative feedback and develop skills to provide both. 5. Set learner expectations for simulation sessions. 6. Demonstrate the ability to teach to a variety of learner levels. 7. Demonstrate understanding of the role of simulation in faculty and staff development. 8. Develop the ability to clearly convey medical knowledge in a concise manner and promote critical thinking by the trainees. 9. Develop skills in networking and career advancement in education and simulation.
6. Simulation Theory (familiarity best practice, evidence-based simulation literature, landmark articles)—With respect to simulation history and theory, simulation fellows should:	1. Describe the conceptual framework/foundations of simulation-based medical education. 2. Demonstrate knowledge of key issues in simulation-based education relevant to both the learner and the educator. 3. Describe the theoretical basis of simulation in team based interprofessional health education, patient safety, and systems improvement. 4. Describe and implement best practices in simulation and related instructional methods. 5. Demonstrate familiarity with evidence-based simulation literature and landmark simulation articles, for both individuals and interdisciplinary groups.
7. Other Common Topics—The following specific topics may be found in a general fellowship curriculum:	1. Crisis resource management. 2. Interdisciplinary team training. 3. Medical education. *Optional Elements* • Surgical simulation; • Disaster simulation.
Program Administration	
8. Assessment of the Fellow—During the simulation fellowship the simulation fellow will:	1. Be assessed through preparation of his/her teaching or simulation portfolio containing research, projects, lectures, and other didactic activities. 2. Receive formative feedback (such as postsession debriefing analysis and review of feedback obtained from the learners after each session). 3. Receive critical feedback on their debriefing skills. 4. Receive assessments from the fellowship director at least twice a year. 5. Be assessed through tracking of fellowship accomplishments to assess progress, i.e., publications, successful educational programs, master's degree, or certificate. *Optional Element:* • Be assessed by the fellowship leadership through a recognized or internally developed assessment model (such as ACGME milestones or an entrustment scale).
9. Evaluation of the Fellowship Program by the Fellow—during the simulation fellowship the fellow will:	1. Evaluate the fellowship at its completion through an exit interview with the fellowship director. 2. Have an opportunity to give summative feedback to the fellowship director with the goal of improving future iterations of the fellowship.

objectives among simulation fellowships, but highlighted the need for national curricular guidelines.[24] We utilized a consensus-based approach, beginning with initial delineation of curricular content, followed by validation of curricular content using survey methodology, and ultimately obtaining consensus using a modified Delphi methodology. This three-step approach, as described by Cumyn and Harris,[30] gives credibility and strength to consensus-based curricular content for EM fellowship programs. Our process for content delineation and consensus building was derived from those used for other EM-based fellowship programs such as education scholarship and ultrasound and pediatric EM, and combined with the Delphi method, allowing all experts to anonymously appraise and provide feedback on the curricular content.[25–29] This process was successful in delineating core curricular content with a broad range that could potentially be used by EM simulation fellowships around the world with varying resources and capabilities. The consensus core curricular content represents a launching point for standardizing EM simulation fellowship training, an important advancement to ensuring consistency in simulation educator competencies across programs.[18,25]

Through this process, we determined that there are nine major domains representing the essential knowledge, skills, attitudes, behaviors, and components that should be incorporated into EM simulation fellowship

training (Table 3). The seven domains of curricular content included curriculum development, technical operations and techniques, simulation administration, simulation research, simulation fellowship teaching and education, simulation theory, and other common topics. The two remaining program administration domains were determined to be requisite to a simulation fellowship: assessment of the fellowship and evaluation of the fellowship program by the fellow. This final proposed curricular content is meant to provide fellowship programs with a standard framework of core elements that all simulation fellows should have exposure to, regardless of fellowship length or resources.

This consensus curricular content will provide current and future fellowships a foundation on which to build their own specific and detailed fellowship curricula. Such standardization will also promote transparency among training programs (thus benefitting future trainees) and transferability of knowledge, skills, attitudes, and behaviors learned (thus benefitting potential employers of graduates). For example, a program that states that they utilized this curricular content when building their curriculum would allow trainees and future employers to have a common understanding of what fundamental competencies were gained during that period of training. This common curricular content is not meant to be restrictive; rather, it would ensure that all graduates of an EM simulation fellowship demonstrate the knowledge, skills, and attitudes deemed essential for successful careers as simulation educators. Even with this underlying common foundation, programs should and will continue to have areas of unique expertise or specialization that will appeal to subsets of learners and serve to contribute to EM's development of simulation specialists with a diverse array of strengths and focus areas.

Within simulation, as with any field of content subspecialization, it is understood that it takes time to develop mastery. While the purpose of this project was to define common foundational curricular content for EM simulation fellowship programs to provide for their trainees, it is understood that practical experience and a continued review of relevant literature and innovations will aid in achieving mastery in many of these domains. Additionally, content elements listed as "optional" and other elements of the curriculum that were addressed, but not emphasized during the fellowship, may be useful as a guide for continuing education and faculty development throughout the career of a graduating simulation fellow.

Simulation-based health professions education continues to be the focus of ongoing research, and the evidence-based body of knowledge defining the field continues to evolve. We intend to revisit this consensus fellowship curricular core content in the future to ensure that it reflects major innovations and developments in the field over time.

LIMITATIONS

Although we were able to obtain curricula from 15 different programs from various geographic regions within the United States and Canada, other fellowships may have additional curricular elements that were not considered here. Further, we only collected curricula from EM simulation fellowships. While many of the topics and elements identified here should be generalizable regardless of medical specialty and/or profession, there may be certain elements of this curriculum that could vary based on medical specialty or by discipline. Additionally, specific contractual details such as fellowship pay structure, clinical and/or didactic hours, and fellowship financing were not investigated. While we propose a detailed core curriculum content for EM simulation fellowship programs, we did not explore the assessment modalities of the different training programs. For example, proficiency in debriefing was identified as a consensus element, but the means of assessing competency in the various methods of simulation-based debriefing was not formally assessed.[35] Future work to develop and validate simulation educator assessment tools is necessary to advance the quality of training programs.[35–37]

CONCLUSION

This initiative, led by the Society for Academic Emergency Medicine Simulation Academy Fellowship Curriculum Task Force, developed consensus curricular content that outlines and defines the recommended foundational core elements for an emergency medicine simulation fellowship curriculum. This standardized consensus content will promote consistency, transparency, and transferability of the training received by simulation fellows and advance the application of simulation-based education within EM.

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