A contest without losers – The value of extracurricular simulation competition in undergraduate medical education

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Abstract

Introduction
Simulation-based learning is an essential part of physician training, enabling acquisition of knowledge and skills in a safe, educationally-orientated manner. Simulation technology has been integrated into undergraduate medical training programs, however, the effect of a simulation-based competition on undergraduate medical students' performance in both technical and communication skills is unknown.

Methods
Undergraduate medical students enrolled in an extracurricular simulation competition were recruited for this study. Participants completed a questionnaire that included self-perceived levels of confidence in technical skills, communication and teamwork-based skills, before and after their training and assessed their confidence in internal medicine competencies.

Results
This study revealed a significant increase in confidence assuming a leadership role (p=0.027) engaging in closed-loop communication (p<0.01), and communicating mistakes (p<0.01). Additionally, there was an increase in confidence managing an airway (p<0.01), performing CPR (p<0.01), and completing a primary assessment (p<0.01). Following their training, participants did not report confidence in internal medicine competencies.

Conclusion
Exposure to simulation during undergraduate medical education can increase technical and non-technical skill development in acute medical scenarios while the utility of extracurricular competition motivates students to learn separate from their medical school evaluation. Additionally, there is interest in simulation competitions in other
medical specialties, such as internal medicine.

**Keywords:** Simulation; Simulation Competition; Medical Education; Emergency Medicine; Internal Medicine

### Introduction

Simulation-based learning is an essential aspect of a physician's training, enabling acquisition of knowledge and skills in an educationally orientated and efficient manner. Controlled, simulated environments bridge the gap between the theoretical knowledge that students acquire in their pre-clerkship years and its translation to the clinical skills required to succeed during post-graduate residency training.

In Ireland, several medical schools have high-fidelity training centres; however, their presence has not heralded increased simulation-based learning opportunities in undergraduate medical education. Like many medical education centres across the world, simulation-based training is commonly reserved for interns, residents and consultant level physicians. Recently, simulation technology has been slowly integrated into undergraduate medical training programs to help teach cardiac and respiratory management (Fraser et al., 2009), trauma management (Ali et al., 2007), and laparoscopy skills (Kanumuri et al., 2008). This high-fidelity simulation training has been shown superior to problem-based learning in the acquisition of critical assessment, communication and management skills and reducing the rate of medical error, thus minimizing patient harm (Steadman et al., 2006; Hunt et al., 2007). To our knowledge, no study has looked at the effect of a simulation-based competition on undergraduate medical students performance in both technical and communication skills.

This study assessed skill development in an undergraduate medical student cohort following the introduction of an acute medicine simulation competition in medical students who do not receive significant simulation-based training as part of their standard curriculum. The use of a competitive environment was predicated on the idea that the imposed stressful situation would mimic the pressure of a hospital environment, thus serving as a proxy for hospital preparedness.

### Methods

#### Participants

Participants for this study included undergraduate medical students who were enrolled in an extracurricular simulation competition (SimWars) at University College Cork. The students ranged from first year to final year of their medical training. The students had not received any high-fidelity simulation-based training as part of their medical school curriculum prior to the event.

A second group of medical students who were competing in the All-Ireland National SimWars competition were additionally recruited for a secondary survey to assess their confidence in internal medicine specific competencies, following their acute medicine simulation training.

#### Surveys

On day 1, participants were asked to fill out a paper questionnaire that included previous simulation training, previous education and self-perceived levels of confidence in both technical and non-technical, communication and teamwork-based skills. Specifically, the technical skills assessed were airway management, completing a primary
assessment, performing CPR, providing fluid resuscitation, and intubating a patient. An additional measure of ‘treating a pediatric patient’ was included as a control measure as the students received no previous training in pediatric scenarios. The non-technical skills assessed were assuming a leadership role, working within a team, communicating mistakes, discussing cases and closed-loop communication. Perceived confidence was ranked on a Likert confidence scale from 1 to 5, with 1 being "not at all confident" and 5 being "very confident". Following 3 months of training, each team competed in the simulation competition and surveys were retaken by all participants following the completion of each team’s simulation in the high-fidelity ASSERT centre.

A second survey was then distributed following the All-Ireland National SimWars competition. This survey was aimed at collecting information regarding participants interest in simulation training in more subspecialties, such as internal medicine. Questions focused on whether students believed that the skills gained during their emergency medicine simulation training could translate to internal medicine specific competencies. Ethical approval for this study was obtained by the Social Research Ethics Committee (SREC), University College Cork.

**Statistical analysis**

Statistical analyses were performed using Statistical Package for Social Sciences (SPSS) version 25 (IBM Corporation, Armonk, NY, USA) and GraphPad Prism 6 (GraphPad Software Inc., La Jolla, California, USA). Repeated measures ANOVA was used for the primary analysis to assess differences following simulation training. Values are displayed as mean ± standard deviation with a significance of $a=0.05$.

**Results/Analysis**

A total of 32 individuals participated in the first half of the study completing surveys at the beginning and end of their training.

Student confidence in non-technical and technical skills are displayed in Figure 1. Following 3-months of simulation training there was a significant improvement in confidence assuming a leadership role (2.72 vs. 3.22, $F[1, 31]=5.39$, $p=0.027$) engaging in closed-loop communication (3.05 vs. 4.06, $F[1,31]=19.97$, $p<0.01$), and communicating mistakes to a team member (3.33 vs. 4.25, $F[1,31]=16.51$, $p<0.01$).

Figure 1: Undergraduate medical student confidence in non-technical and technical skills following 3-months of simulation training for an acute medical simulation competition. *$p<0.05$. 

There was a significant increase in confidence managing a patient’s airway (1.78 vs. 3.56, \(F[1, 31]=69.2, p<0.01\)), performing CPR (3.16 vs. 4.09, \(F[1, 31]=27.59, p<0.01\)), and completing a primary assessment (2.10 vs. 3.74, \(F[1,31]=58.4, p<0.01\)). These differences remained present when adjusting for year of medical school. There was no significant change in the control of confidence treating pediatric patients (1.78 vs. 1.84, \(F[1, 31]=0.122, p=0.73\)).

Following the competition there was a total of 64 individuals who completed the second survey. Of these participants 62 (97%) expressed interest in pursuing simulation training specific to internal medicine, with only 34 (54%) believing that their emergency medicine training would translate to internal medicine specific scenarios.

Regarding internal medicine specific competencies (Figure 2) following the competition, students lacked confidence in managing patients with multiple comorbidities (2.27±0.98), acute kidney injury (2.42±1.1), heart failure (2.56±1.0), respiratory failure (2.62±0.94), GI bleed (2.69±1.0), and inflammatory conditions (1.89±1.0).

Figure 2: Student self-perceived confidence in internal medicine competencies following simulation training in emergency medicine.
Discussion

The introduction of a competitive environment emulates the high-stress environment common to medical emergencies, providing an impetus for extracurricular training and self-learning. Our study is the first to demonstrate the positive impact of an extracurricular simulation competition and associated training on student confidence in both technical and non-technical skills. These data suggest the potential benefit of competitive atmospheres in undergraduate medical education in combination with the well-documented skill development inherent to simulation training (Fraser et al., 2009; Datta, Upadhyay and Jaideep, 2012).

How this improved confidence translates into a clinical environment is yet to be determined. The post-training improvement in closed-loop communication and communication of mistakes suggests that the competition develops skills critical for success both as a physician and as a learner in any medical specialty. The increased confidence in technical skills may be due to lack of exposure to the procedural elements of acute medicine. These improvements are undoubtedly associated with increased contact time during training, which should motivate the expanded use of simulation training in undergraduate medical education.

The lack of definitive improvement in terms of paediatric patient management can be explained by the lack of emphasis on paediatric-specific scenarios in the simulation competition. The competition format largely eliminates acute medical scenarios in obstetrics, gynaecology, and paediatrics in effort to reduce the breadth of knowledge that would cater to students farther along in their medical training. Further evidenced by the lack of crossover with internal medicine-specific competencies, successful training in acute medicine does not effectively translate into other specialties. Our data suggests that the introduction of an explicit, subspecialty-focussed competition and training environment would best support the development of skills in other areas of medicine.
This study provides insight into the value of extracurricular simulation competition, and areas of improvement for future competition studies should act to strengthen our findings. Though it is intrinsically variable, we did not account for the specificities of each in-hospital rotation undertaken by the students during the 3-month training window. It is possible that students gained meaningful exposure to topics in acute medicine via in-hospital rotations, which could have contributed to increased confidence. We stratified our data based on year of study in attempt to address these differences as closely as possible; however, a more in-depth analysis of specific exposures is warranted. Similarly, the surveys conducted at the culmination of the competition consisted of respondents from medical schools throughout Ireland. While little is known about the specificities surrounding the training regimen undertaken by each school, the competition rule book provided to each school suggests the types of cases that competitors may encounter. It is expected that some competitors received more hours of training than others, likely contributing to an increase in confidence, and is an area that should be further explored.

While our study involved a national competition only a small cohort of individuals was considered for the pre- and post-training surveys, which limited our repeated measures analysis. Our measure of student confidence using the Likert scale is also innately subjective and complimentary studies aimed at assessing improvements in student skills should be developed. For example, obtaining student performance metrics on objective structured clinical examinations or individual performance scores during simulated competition scenarios may demonstrate quantitative improvements in overall aptitude.

Conclusion

The use of simulation in emergency medicine and anaesthetics have been well described and continues to be incorporated into these post-graduate training schemes (Lorello et al., 2014; Jong et al., 2019; Kester-Greene, Hall and Walsh, 2019). Exposure to simulation during undergraduate medical education is demonstrably variable and we have presented a potential solution to increase technical and non-technical skill development in acute medical scenarios. The utility of extracurricular competition is clear; students are motivated to learn while, importantly, separate from medical school evaluation. There is a clear advantage and interest in the development of competitions in other medical specialties, such as internal medicine. Increased exposure should eventuate in to the emergence of more highly-skilled trainees with improved preparedness for residency.

Take Home Messages

- The utility of extracurricular competition is clear; students are motivated to learn while, importantly, separate from medical school evaluation.
- There is a clear advantage and interest in the development of competitions in other medical specialties, such as internal medicine.
- Increased exposure should eventuate in to the emergence of more highly-skilled trainees with improved preparedness for residency.

Notes On Contributors

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**Appendices**

None.

**Declarations**

The author has declared that there are no conflicts of interest.

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**Ethics Statement**

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