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An Anaesthesiology and Emergency Medicine Multidisciplinary Simulation-Based Bootcamp

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Abstract

Aim

The fundamental concept of multidisciplinary education is a shared mental model that leads to better interdependent collaboration. The aim of this bootcamp was to create a sustainable induction curriculum for Anaesthesiology and Emergency Medicine trainees and nurses through training in a simulated multidisciplinary environment.

Methods

The two-day bootcamp consisted of lectures, equipment demonstration, workshops, and high-fidelity simulated scenarios. A pre- and post-course MCQ test was used for assessment of knowledge acquisition. Pre and post confidence scores were used to evaluate procedural skill confidence level. A 5-point Likert scale was used to evaluate qualitative feedback from participants.

Results

Seven anaesthesiology trainees, two anaesthetic nurses, six emergency medicine trainees and three emergency medicine nurses were enrolled. There was a statistically significant increase (p-value<0.01) in post-MCQ scores, portraying significant knowledge acquisition. The total procedural confidence scores increased from 375 (±9.15) to 550 (±8.43), ($p < 0.01$). All participants agreed that the stated educational objectives were met and relevant to their clinical practice, and strongly commended team training exercises.

Conclusion

Multidisciplinary simulation-based training improves team performance as well as transfer of knowledge across two or more disciplines. Overlapped training between Anaesthesiology and Emergency Medicine created an opportunity for sharing of educational resources in the current time-based speciality training system.

Introduction

With the ever-increasing complexity and expansion of the healthcare system, there is growing recognition of the role of simulation technology in medical education.[1] Simulation-based education is a useful tool in maintaining healthcare professional training up-to-date, which is a key component in patient safety.[2] A simulation-based curriculum standardises learning outcomes by integrating both technical and non-technical learning strategies for day-to-day and rare, potentially life-threatening emergencies.[3]

Simulation-based introductory bootcamps in Anaesthesiology for newcomers to the speciality have been instituted by several departments in Ireland since its introduction in St Vincent's University Hospital in 2018.[4] Speciality-specific bootcamps are a growing trend in medical education as they provide a safe training environment for learners entering new clinical roles and a framework on which further clinical knowledge and skills can be built.[5] The learning curve when commencing a career in Anaesthesiology or Emergency Medicine can be quite steep, with new procedures to master, new environments to work in, and new cognitive and non-technical skills to assimilate. This can have an impact on patient safety.[6] This is particularly important in critical clinical situations, where multiple health professionals frequently face and interact with each other for the first time and in many cases, unaware of each other's roles and skill sets.

Effective team dynamics is key in the delivery of high-quality patient care.[7] Team training is an established part of training in high-stake industries such as commercial aviation and the nuclear power industry. Its use in healthcare is becoming more widespread, particularly in high-risk specialities, targeting communication, situational awareness, and role clarity.[8] Interprofessional education promotes a shared mental model that leads to better interdependent collaboration.[9] Educational materials that cross between disciplines enable sharing of data, techniques and tools, optimising use of resources and creating stronger team dynamics within the hospital system for better patient and organisational outcomes.[10]

The Pillar Centre for Transformative Healthcare provides an interdisciplinary educational space in the Mater Misericordiae University Hospital. Using this educational platform, the Department of Anaesthesiology and Emergency Medicine launched a simulation-based bootcamp for trainees and nurses from both disciplines in July 2021, which to the best of our knowledge, was the first cross-disciplinary bootcamp in Ireland.

Methods

The design of the course was tailored to meet the educational needs of both Anaesthesiology and Emergency Medicine participants, addressing topics relevant to doctors and nurses from both disciplines. The goal was to provide exposure to the core skills and knowledge that are crucial in the management of a patient undergoing general anaesthesia, or in resuscitation attempts of a critically ill patient. The objectives were classified into technical and non-technical skills categories.

The first set of technical objectives were based on the use of specific task trainers to teach procedural skills. Instructor-led workshops were designed to facilitate active engagement by participants, hands-on practice, and collaborative learning experiences. The aims were to demonstrate and teach the following procedures: (1) The use of appropriate airway devices and techniques in advanced airway management and recognition of airway emergencies; (2) Arterial and central line placement, including complication recognition and management; (3) Planar blocks; (4) Neuraxial blocks; and (5) Chest drain insertion techniques.

The second set of technical objectives were based on a combination of interactive lectures and instructor-led roleplay using experiential learning strategies. Participants were encouraged to use critical thinking within a challenging environment. The aims were: (1) To perform a comprehensive preoperative anaesthetic assessment; (2) To understand the safety features of the anaesthetic machine; to perform an anaesthetic machine check as per recommended guidelines; and to understand the set up and use of the High-Flow Nasal Oxygen device; (3) To learn about commonly used medications in anaesthesia and emergencies, their preparation and administration, as well as promoting drug safety and prevention of drug errors; (4) To assess and respond to emergencies in the Post-Anaesthetic Care Unit.

In relation to non-technical skills, there was significant emphasis laid on the importance of human factors, such as leadership, task management, situational awareness, and communication. These factors are known to be pivotal in promoting good teamwork and key decision-making processes. Using full-scale high-fidelity simulation, the concept of crisis resource management was taught through management of critical incidents. Participants were expected to understand the collaborative role of team members and team dynamics in delivering high quality patient care.

In advance of the bootcamp, participants were sent a pre-course learning material pack. Candidates were expected to have read the contents prior to attending the course. The pack included the following: AAGBI Safety Guidelines: Checklist for Anaesthetic Equipment 2012, AAGBI Safe Vascular Access Guidelines 2016, AAGBI Quick Reference Handbook (QRH) Guidelines for Crises in Anaesthesia, a pre-recorded PowerPoint Presentation on Arterial Line Insertion, a pre-recorded PowerPoint Presentation on Endotracheal Intubation, a pre-recorded presentation and video on Central Line Insertion and a pre-recorded video on the Hamilton ventilator.

The Bootcamp was an intensive two-day simulation-based course. Each day comprised of interactive lectures, equipment demonstration, workshops, and full-scale high-fidelity simulated scenarios. Day one was specifically designed to teach airway manoeuvres, techniques and devices used in advanced airway management using a variety of airway task trainers. Relevant Guidelines from the Difficult Airway Society (DAS) and the Association of Anaesthetists of Great Britain and Ireland (AAGBI) were used.[11, 12]

Day two incorporated a lecture on human factors and crisis resource management, with examples of real-life incidents and comparison to high-stakes industries. Using advanced ultrasound-guided task trainers, two vascular access workshops were set up for central and arterial line insertion. For the third workshop, we merged a hybrid model to teach planar blocks. Anatomical landmarks were demonstrated on a volunteer, followed by live hands-on ultrasound practice, prior to using ultrasoundable and injectable nerve block models. The fourth workshop was divided into two parallel sessions whereby Emergency Medicine trainees and nurses attended the chest drain station while Anaesthesiology trainees and nurses attended the neuraxial block station, in line with our local clinical practice. Both stations used highly realistic models for practice. The neuraxial block station included the use of epidural and spinal task trainers that allowed demonstration of both landmark and ultrasound techniques, and injection of simulated drugs.

Each day ended with faculty-led simulated scenarios using a full-size high-fidelity patient simulator. Participants were expected to showcase technical and non-technical skills and knowledge gained from the lectures and workshops into management of critical incidents in a multidisciplinary simulated environment.

Data and metrics from the course were used to conduct a quantitative and qualitative course evaluation. A pre- and post-course MCQ test was used for immediate post-training assessment of knowledge acquisition. Pre and post confidence scores were used to evaluate procedural skill confidence level for procedures and tasks, taught at eight workshops over the two days. Confidence level was rated from 1 to 5 as follows: 1 = No confidence and 5 = Strongly confident. Strongly confident referred to being able to perform all necessary steps, understand indications and contraindications for the procedure, and able to recognise and manage any inadvertent complications. Where the participant did not perform the procedure themself in their clinical practice but assisted an operator, they were asked to rate their level of confidence as above but with an A (Assisted score); For example, Arterial Line = 5A meant strongly confident in assisting an operator inserting an arterial line, knew all the steps the operator was expected to perform, would inform the operator if they noticed an error, and were able to manage all adjuvant equipment such as transducer, line, and pressure bag. A post-evaluation form captured participants satisfaction in different aspects of the bootcamp, particularly addressing the multidisciplinary element. We reviewed if the objectives we set were met and if our methods of delivery were adequate and relevant to the participants' practice.

Results

Participants on this collaborated project included seven anaesthesiology trainees, two anaesthetic nurses, six Emergency Medicine trainees and three Emergency Medicine nurses. The attendees worked at The Mater Misericordiae Hospital, The Rotunda Hospital and Cappagh Hospital in Dublin, Ireland. The faculty consisted of consultants from both disciplines, a Simulation Fellow, the Head of Clinical Engineering, the Perioperative Clinical Nurse Facilitator and the Simulation Programme Nurse Lead.

Fifteen participants completed both the pre- and post-MCQ test. Each candidate was assigned a number. Candidates 3, 5 and 10 only completed either the pre- or post-test, hence their scores were not included for comparison. Further data analysis with a paired t-test showed a p-value of 0.00007 and 0.0001 with a one-tail and a two-tail test respectively (Table 1). Our findings hence demonstrated a statistically significant increase in MCQ scores, portraying a significant knowledge acquisition during the bootcamp.

Pearson Correlation	0.828580792
t Stat	-5.118400121
P(T<=t) one-tail	7.81552E-05
t Critical one-tail	1.761310136
P(T<=t) two-tail	0.00015631
t Critical two-tail	2.144786688

Table 1: *t-Test: Paired Two Sample for Means between the pre and post MCQ scores.*

Confidence scores for procedures and tasks taught at the workshops increased across all eight domains for each candidate (Figure 1), with the total skill confidence score including assisted scores, rising from 375 (±9.15) to 550 (±8.43) after the simulation-based education (p-value<0.01). No participants reported a reduction in confidence.

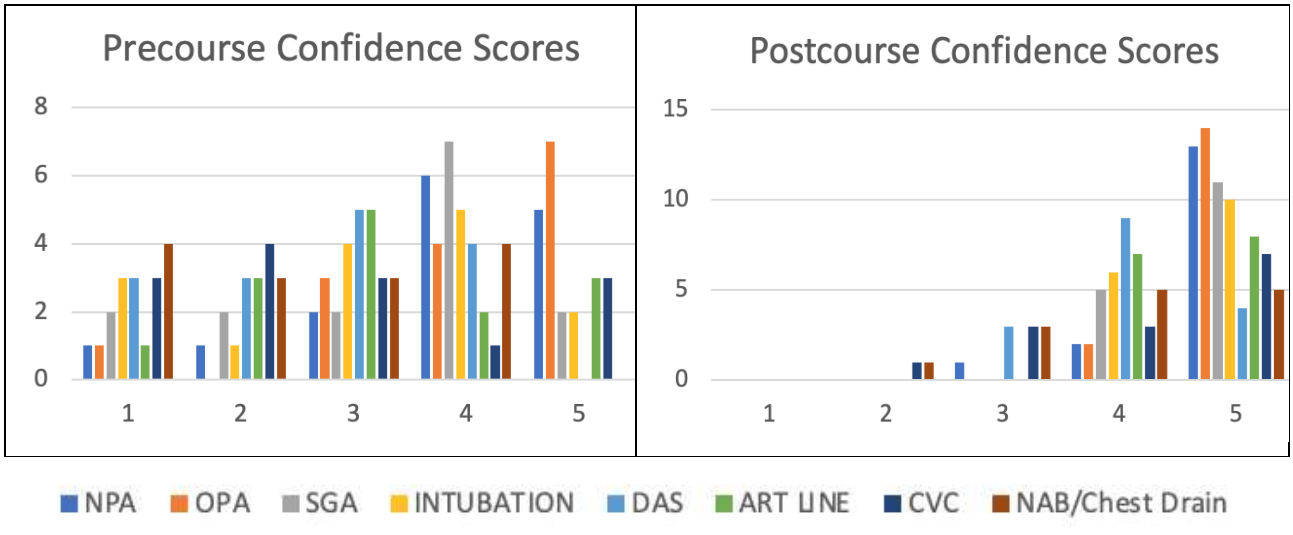

Figure 1: *Direct comparison between pre and post course confidence scores using raw data. Confidence scores on the x-axis rated from 1 to 5 and the number of candidates who gave that rating on the y-axis. NPA, Nasopharyngeal Airway. OPA, Oropharyngeal airway. SGA, Supraglottic Airway Device. DAS, Followed Difficult Airway Society Guidelines to Front of Neck Access. ART LINE, Arterial Line. CVC, Central Venous Catheter. NAB, Neuraxial Block.*

	Pre-course mean (±SD)	Post-course mean (±SD)	Diff.	P-value
NPA	3.87 (±1.19)	4.73 (±0.59)	0.86	p<0.01
OPA	4.07 (±1.16)	4.86 (±0.35)	0.79	p<0.01
SGA	3.33 (±1.29)	4.73 (±0.46)	1.40	p<0.01
INTUBATION	3.13 (±1.36)	4.60 (±0.51)	1.47	p<0.01
DAS	2.67 (±1.11)	4.06 (±0.70)	1.39	p<0.01
ART LINE	3.21 (±1.25)	4.50 (±0.52)	1.29	p<0.01
CVC	2.79 (±1.48)	4.14 (±1.03)	1.35	p<0.01
NAB/CD	2.50 (±1.22)	4.00 (±0.96)	1.50	p<0.01

CD - Chest Drain. SD - Standard Deviation. Diff. – Difference

Table 2: *Comparison between weighted average scores for each procedure pre and post course.*

Table 2 shows the weighted average scores for each procedure pre- and post-bootcamp. This table clearly demonstrates a statistically significant (p-value<0.01) increase in confidence scores for all eight procedures after the simulation-based education. Further analysis using a paired t-test shows a significant difference between the pre- and post-bootcamp variables with a mean score of 3.19 and 4.45 respectively (p-value<0.01).

A 5-point Likert scale was used to evaluate qualitative feedback after the bootcamp. All participants strongly agree/agree that the stated educational objectives were met, the course was relevant to their current clinical practice and the methods of delivery were adequate. 93.8% strongly agree/agree that the course matched their own learning needs, was relevant to their stage of training and would impact on their future practice. All participants and faculty were overall satisfied with the course and strongly recommended further courses that integrates multiple disciplines.

Discussion

With increased emphasis on patient-centred care and improved patient outcomes in a complex healthcare environment, the importance of multidisciplinary teamwork is becoming increasingly important. Multidisciplinary in-hospital teamwork that is cohesive, is associated with improved patient outcomes.[13] Teams consist of staff from different levels on a treatment pyramid. There is a critical need to keep multidisciplinary teams functioning effectively together as it optimizes performance and maximises patient safety.[14] With better patient outcomes, the added benefits are better patient and staff satisfaction, reduced complications and hence hospital costs.[15, 16] Simulation provides a safe educational environment that allows professional growth without compromising patient safety and aims for transferability of educational outcomes to the clinical setting. Multidisciplinary training in a simulated environment helps bridge the gap amongst disciplines.[17] Consistent with our results, multiple studies have shown that multidisciplinary simulation-based training is associated with improved performance.[18 19]

A study by Riley et al. which delivered a comprehensive interdisciplinary team training program using in-situ simulation demonstrated improved perinatal safety in the hospital setting.[20] One key element of patient safety is effective interprofessional communication. Human rather than technical failures now present the greatest threat to complex systems such as healthcare.[21] Communication failings in interactions between health professionals have been linked to patient harm as well as contributing to professional silos and medical tribalism.[22] The argument to institute a team training program to improve team-based competencies is quite compelling. Team training interventions have been shown to improve cognitive, affective, and performance outcomes.[23] Healthcare facilities which implemented team training programmes have improved both clinical processes and patient outcomes, including morbidity and mortality.[24]

While our results showed an improvement in knowledge acquisition and procedural confidence scores, it also highlighted that multidisciplinary team training is more challenging, requiring a multifaceted approach when compared to a uni-disciplinary educational platform. It is known that setting up multidisciplinary training sessions can be costly while also require more time to facilitate. However these challenges are offset by the overall increases in patient safety.[25] Based on the feedback from participants and faculty post-bootcamp, the faculty agreed by consensus that the time allocated to workshops and high-fidelity simulation scenarios on future courses would be longer. Although multidisciplinary training has been used among student healthcare professionals with outcome effects primarily relating to changes in knowledge, skills, attitudes, and beliefs,[23] to the best of our knowledge, this is the first instance of a simulation-based bootcamp involving doctors and nurses from two disciplines, being undertaken in Ireland.

As modern medicine in hospital settings is practiced by interdisciplinary and multidisciplinary teams, it would follow that our postgraduate medical training should follow the same pattern. We believe therefore that there is much scope for further expansion of this model of teaching to more experienced clinicians in addition to including other medical specialities, or other allied health professionals.

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Declaration of Conflicts of Interest:
The authors declare that they have no competing interests.

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References:

1. Higham H, Baxendale B. To err is human: use of simulation to enhance training and patient safety in anaesthesia. British Journal of Anaesthesia. 2017;119:i106-i114.
2. Aggarwal R, Mytton O, Derbrew M, Hananel D, Heydenburg M, Issenberg B et al. Training and simulation for patient safety. Quality and Safety in Health Care. 2010;19(Suppl 2):i34-i43.
3. Patterson M, Geis G, LeMaster T, Wears R. Impact of multidisciplinary simulation-based training on patient safety in a paediatric emergency department. BMJ Quality & Safety. 2012;22(5):383-393.
4. Duffy, C., Nawoor-Quinn, Z. and Burlacu, C., 2019. "Rapid sequence induction"—an anaesthesiology boot camp. *Irish Journal of Medical Science (1971 -)*, 189(3), pp.1047-1051
5. Blackmore C, Austin J, Lopushinsky S, Donnon T. Effects of Postgraduate Medical Education "Boot Camps" on Clinical Skills, Knowledge, and Confidence: A Meta-Analysis. Journal of Graduate Medical Education. 2014;6(4):643-652.
6. Berk W, Welch R, Levy P, Jones J, Arthur C, Kuhn G et al. The Effect of Clinical Experience on the Error Rate of Emergency Physicians. Annals of Emergency Medicine. 2008;52(5):497-501.
7. Buljac-Samardzic M, Doekhie K, van Wijngaarden J. Interventions to improve team effectiveness within health care: a systematic review of the past decade. Human Resources for Health. 2020;18(1).
8. Weaver S, Lyons R, DiazGranados D, Rosen M, Salas E, Oglesby J et al. The Anatomy of Health Care Team Training and the State of Practice: A Critical Review. Academic Medicine. 2010;85(11):1746-1760.
9. Liaw S, Wu L, Wong L, Soh S, Chow Y, Ringsted C et al. "Getting Everyone on the Same Page": Interprofessional Team Training to Develop Shared Mental Models on Interprofessional Rounds. Journal of General Internal Medicine. 2019;34(12):2912-2917.
10. Zajac S, Woods A, Tannenbaum S, Salas E, Holladay C. Overcoming Challenges to Teamwork in Healthcare: A Team Effectiveness Framework and Evidence-Based Guidance. Frontiers in Communication. 2021;6.
11. Henderson J, Popat M, Latto I, Pearce A. Difficult Airway Society guidelines for management of the unanticipated difficult intubation. Anaesthesia. 2012;67(4):452-452.
12. Anderson E, Bythell V, Gemmell L, Jones H, McIvor D, Pattinson A et al. Checking Anaesthetic Equipment 2012. Anaesthesia. 2012;67(6):660-668.

13. Hickman L, Phillips J, Newton P, Halcomb E, Al Abed N, Davidson P. Multidisciplinary team interventions to optimise health outcomes for older people in acute care settings: A systematic review. Archives of Gerontology and Geriatrics. 2015;61(3):322-329.
14. Cooper J. Critical Role of the Surgeon–Anesthesiologist Relationship for Patient Safety. Anesthesiology. 2018;129(3):402-405.
15. Grogan E, Stiles R, France D, Speroff T, Morris J, Nixon B et al. The impact of aviation-based teamwork training on the attitudes of health-care professionals. Journal of the American College of Surgeons. 2004;199(6):843-848.
16. Zwarenstein M, Goldman J, Reeves S. Interprofessional collaboration: effects of practice-based interventions on professional practice and healthcare outcomes. Cochrane Database of Systematic Reviews. 2009;.
17. Robertson J, Bandali K. Bridging the gap: Enhancing interprofessional education using simulation. Journal of Interprofessional Care. 2008;22(5):499-508.
18. Frengley R, Weller J, Torrie J, Dzendrowskyj P, Yee B, Paul A et al. The effect of a simulation-based training intervention on the performance of established critical care unit teams*. Critical Care Medicine. 2011;39(12):2605-2611.
19. Steinemann S, Berg B, Skinner A, DiTulio A, Anzelon K, Terada K et al. In Situ, Multidisciplinary, Simulation-Based Teamwork Training Improves Early Trauma Care. Journal of Surgical Education. 2011;68(6):472-477.
20. Riley W, Davis S, Miller K, Hansen H, Sainfort F, Sweet R. Didactic and Simulation Nontechnical Skills Team Training to Improve Perinatal Patient Outcomes in a Community Hospital. The Joint Commission Journal on Quality and Patient Safety. 2011;37(8):357-364.
21. Reason J. Understanding adverse events: human factors. Quality and Safety in Health Care. 1995;4(2):80-89.
22. Weller J, Boyd M, Cumin D. Teams, tribes, and patient safety: overcoming barriers to effective teamwork in healthcare. Postgraduate Medical Journal. 2014;90(1061):149-154.
23. Salas E, DiazGranados D, Klein C, Burke C, Stagl K, Goodwin G et al. Does Team Training Improve Team Performance? A Meta-Analysis. Human Factors: The Journal of the Human Factors and Ergonomics Society. 2008;50(6):903-933.
24. Cooper H, Carlisle C, Gibbs T, Watkins C. Developing an evidence base for interdisciplinary learning: a systematic review. Journal of Advanced Nursing. 2001;35(2):228-237.
25. Hibberson M, Lawton J, Whitehead D. Multidisciplinary simulation training for perioperative teams: An integrative review. Journal of Perioperative Nursing. 2021;34(2).