ORIGINAL ARTICLE

The community of inquiry framework for virtual team-to-team debriefings during interprofessional trauma simulations

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Abstract

Purpose Psychological safety is key to effective debriefing and learning. The COVID-19 pandemic necessitated rapid adaption of simulation events to virtual/hybrid platforms. We sought to determine the effect of utilizing the Community of Inquiry framework (CoI) for debriefing virtually connecting interprofessional learner teams on the psychological safety experienced during trauma simulations.

Methods General surgery (GSR), emergency medicine (EMR) residents, trauma nurses/nurse practitioners and medical students participated in multiple simulation events designed to improve teamwork and leadership skills. Pre-course materials were provided before the event for learners to prepare. Briefings delineating expectations emphasized importance of and strategies employed to achieve psychological safety. Four unique clinical scenarios were run for each simulation event, with a debrief after each scenario. Virtual team-to-team debriefings were structured using the Community of Inquiry (CoI) conceptual framework. All learners completed pre-/post-assessments utilizing Inter-professional Collaborative Competencies Attainment Survey (ICCAS).

Results Twenty-five learners participated (13 GSR, 5 EMR, 3 medical students, 2 trauma APRNs and 2 trauma RNs). Learner assessment found 88% (22) "agreed"/"strongly agreed" that virtual team-to-team debriefing had social, cognitive and educator presence per the CoI domains. However, one GSR and two nurse learners "strongly disagreed" with these statements. Most learners felt the debriefing was effective and safe. All participants "strongly agreed"/"agreed" the simulation achieved ICCAS competencies.

Conclusions Debriefings utilizing a virtual platform are challenging with multiple barriers to ensuring psychological safety and efficacy. By structuring debriefings using the CoI framework we demonstrate they can be effective for most learners. However, educators should recognize the implications of social identity theory, particularly the effects of hierarchy, on comfort level of learners. Developing strategies to optimize virtual simulation learning environments is essential as this valuable pedagogy persists during and beyond the COVID-19 pandemic.

Keywords Psychological safety · Debrief · Interprofessional · Debriefing · Simulation · Trauma

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Introduction

Debriefing is an essential component of simulation to enable learning. In fact, exposure to simulation without debriefing is of little benefit [1–3]. The process can be stressful for learners; therefore, promoting psychological safety is important [4]. Psychological safety is described as a "team level phenomenon where all team members believe they are safe to take interpersonal risks" [5]. Promotion of psychological safety is particularly pertinent when the simulation involves interprofessional learners, as multiple societal elements may affect learners' perceived sense of security during debriefing

[6–8]. Adherence to the core values delineated by the Interprofessional Education Collaborative (IPEC) is crucial to promoting interprofessional educational and clinical excellence. These core competencies delineate a code of ethics and values and promote respect for all team members' roles and responsibilities [9].

The COVID-19 pandemic has had a profound effect on medical education, and simulation education in particular [10]. Due to the physicality of many simulations, this education has often been disrupted for our surgical learners. Simulation training has had to adapt and rely more on virtual telecommunication platforms. When delivering virtual or hybrid simulation education it is essential to consider the virtual element of the debriefing environment and take steps to mitigate factors that may erode the psychological safety [11, 12]. The best practices of debriefing should be maintained to foster maximal reflection to allow correlation of the external stimulus (learning event) with the learner's internal frame of reference [2, 13]. An effective debrief can stimulate the learner to consider whether their internal frame of reference is suitable or whether, based on the learning experience, they require behavioral change to improve their clinical practice [13].

Virtual or hybrid simulation education delivered utilizing the brief-simulation-debrief model increases the cognitive load of simulation educators, since many are less experienced with virtual formats than with traditional in-person simulation events. To maintain high quality debriefings and ensure that virtual or hybrid events translate into learning, it is useful to implement conceptual frameworks as a basis for practice, which can "codify ways of thinking about a problem or issue, help represent complexity, and illuminate key aspects" [11, 14]. Cheng et al. describe a Community of Inquiry (CoI) as one such framework useful for virtual debriefing to maximize psychological safety within the environment [11]. The CoI outlines three core elements: cognitive, social and teaching presence. The social presence refers to the importance of making interpersonal connections during the debrief between learners, and between learners and educators. The educator or teaching presence refers to the involvement of the educator in structuring the debriefing discussion, facilitating these discussions to maximize learner understanding and providing instruction when appropriate to ensure that the learning is maximized. Finally, the cognitive presence refers to the degree to which the learners are critically reflecting and inferring meaning from this to translate into learning. Barriers to effective virtual or hybrid debriefings include reduced non-verbal clues through computer interface, including eye contact leading to reduced ability of educators to detect issues threatening psychological safety, lack of privacy, perceived or real, interruptions and technical issues. These negatively impact the use of effective debriefing strategies such as matched body language that can increase the cohesion of a learner group [11, 15].

When crafting virtual simulation education events during times of social distancing, having a framework to mitigate the barriers to effective debriefing may improve psychological safety and educational value. Depending upon social distancing rules and status of learners with regard to isolation or quarantine, hybrid educational events may also be utilized. Although created for a virtual learning environment, the CoI framework may also be useful for hybrid simulation events. The aim of this work was to assess the efficacy for learning and psychological safety of implementing the CoI framework to structure virtual team-to-team debriefings during a hybrid interprofessional trauma simulation with teamwork and communication as central learning objectives.

Methods

During all phases of the simulation event, focus was placed on incorporating strategies to mitigate barriers to social, educator and cognitive presence within virtual team-to-team debriefings using the framework provided by Cheng et al. [11].

Pre-course preparation

All participants were sent a pre-recorded Zoom presentation detailing expectations of the learning event. The goals were to deliver interprofessional trauma simulation education for residents and nurses to foster teamwork, communication, leadership, and critical thinking skills whilst learning from, with and about each other. Learning objectives were centered around the four pillars of interprofessional education (IPE) and included: "on completion of the trauma simulation in the simulation center participants will be able to clearly define and explain the specific roles and responsibilities of each member and how they relate to provision of effective trauma care". The importance of fostering a safe learning environment, strategies to achieve this in the virtual format and commitment to a fiction contract were discussed. The fiction contract required learners to view the patient and treat them as if they were a family member, solve their presenting problems as they would in a real life situation and to stay in their role throughout the simulation. The pre-course material emphasized that the experience would be used for learning and not assessment i.e. formative, and encouraged the participants to maximize the opportunity to learn with the objective of improving patient care. Finally the IPEC principles of interprofessional education and rationale behind these were taught i.e. values and ethics, roles and responsibilities, communication and teamwork.

Using a flipped classroom approach where learners are provided learning materials before the event to deepen understanding during the simulation; learners were given the ATLS primary and secondary survey materials to review prior to the simulation. Our video-education team (three trauma attendings, one surgeon and educational SME, one nurse, one APRN) recorded an "ideal trauma activation" scenario in our simulation center for review by learners prior to the simulation activity. The video was created by education and subject matter experts and highlighted the importance of leadership, teamwork, closed loop communication and definition of clear interprofessional roles and responsibilities for effective trauma team performance. To foster cognitive presence within the debrief, learners were given PDF copies of the Trauma Team Communication Assessment (TTCA-24) and details of how to apply this to structure peer feedback on the day of the simulation. The TTCA-24 is a validated tool by which trauma team performance can be assessed and includes measure of: team flow, team relationships, team space negotiation, team noise management, team listening and team emergent leadership. The materials were reviewed by the local Institutional Review Board and determined not human subject research due to quality improvement nature of the work.

COVID-19 restrictions

At the time the work was conducted, the Centers for Disease Control (CDC) mandated social distancing permitting seven people in the simulation room and nine in the large debrief room. We therefore required one sim room and two debrief rooms for all learners to be accommodated for each educational event conducted. In order for everyone to benefit from the simulation education we connected all three rooms via Zoom. High-definition cameras and microphones were used to minimize degradation of the image received and to improve educator presence. The brief, simulation and debrief were all performed using a hybrid format where teams of learners alongside a supervising faculty facilitator were together in person in separate rooms, and linked by Zoom. The "simulation group" of learners were all in a simulation room performing the scenario supervised by a faculty member. The "debriefing group" of learners and a faculty member were in a separate room linked to the simulation room via zoom. The third group was a directed observation group. The debrief was conducted virtually between the "simulation group" and the "debriefing group", led by the faculty member in the debriefing room.

Educator rehearsal

The organizing team met regularly in the planning phase of this event to strategize to increase the efficacy of the event in general and the virtual team-to-team debriefings in particular. A rehearsal was conducted before the simulation took place in which facilitators and technical support staff performed a "test run" of connectivity and communication strategies. At this time, strategies to deal with technical issues were discussed. A sound and image check in every room prior to the event and any identified issues resolved. Rehearsal of the camera zoom function was performed to facilitate maximizing the interaction between each speaker and the team within the other room by zooming in on whoever was currently speaking.

Interprofessional trauma simulation: brief and scenarios

The simulation events followed the brief–simulation–debrief model. The brief was structured and performed over Zoom with one group and a facilitator in each room. To improve the cognitive presence of the virtual debrief, the rules of engagement were clearly described in terms of expectations of participation of learners within both the simulation and the peer feedback section. Material from the pre-course resources was emphasized, in particular the importance of committing to the learning experience and fostering psychological safety with descriptions of strategies to be applied during the session to maximize this. In addition, the domains and descriptors of the TTCA-24 were reiterated and all learners given paper copies to make notes on for each simulation to provide a learner-centered strategy for reflection and application of the concepts within the tool pertaining to effective team work.

Learners were divided into two trauma teams for each educational event. Each trauma team had the following roles: senior GSR, junior GSR, senior EMR, junior EMR and a nurse. One group had 15 min to perform the simulation (simulation group), while the other observed via Zoom and provided peer feedback for the debrief (debrief group). The groups then switched roles. This process was repeated twice for a total of four unique trauma scenarios of increasing complexity. For the first two scenarios each member of the team played themselves within the scenario. For the second two scenarios, the senior EMR and GSR exchanged roles to gain appreciation of the other's perspective. The Trauma FX mannekin (TacMed Solutions, Anderson, SC) was used during these simulations to increase the fidelity of the experience.

Interprofessional trauma simulation: virtual team-to-team debriefing

Virtual team-to-team debriefings were led by the facilitators in each room utilizing a co-facilitation strategy to try and reduce the cognitive load for each educator [11].

Facilitators role modeled fallibility and shared their previous experiences of their own trauma activations highlighting mistakes they had made and what they learned from this [11]. Facilitators were careful to use validation and normalization as debriefing strategies and also to communicate explicitly with learners e.g. refer to learners by name and to recap their opinions, to enhance social presence. In addition, the plus/delta debrief model was selected as a tool to provide a simple structure for the debrief and to further reduce educator cognitive load and enhance educator presence. To further maximize educator presence, the "speaker view" function was used in zoom such that when one room was talking the picture was maximized. Additionally, when a member of the debriefing group was speaking to the simulation group, the camera zoom was used to maximize their presence. We used 72 inch TV screens in the simulation and debrief rooms to improve educator presence of those facilitators in adjacent rooms.

To maximize the cognitive presence within the virtual debriefing, we provided all learners with the Trauma Team Communication Assessment (TTCA-24) tool to guide reflection on their own performance and allow them to provide structured peer feedback to their fellow learners. Learners were specifically asked to reflect upon how they could can incorporate metrics of the tool into their performance as team member or team leader during a trauma activation.

Evaluation

All learners completed pre-/post-assessments utilizing Interprofessional Collaborative Competencies Attainment Survey (ICCAS). The ICCAS has been psychometrically validated in previous work and contains 20 items that are scored using a seven-point Likert scale, from strongly disagree to strongly agree. Within the 20 items there are 6 subscales which are in line with the recognized interprofessional education collaborative core competencies for practice: communication, collaboration, roles and responsibilities, collaborative patient-centered approach, conflict management and team functioning. Learners were asked to reflect upon their competency in these areas on completion of the event.

In line with the structure of the debriefings, assessment of psychological safety in the team-to-team virtual environment was crafted around the key CoI domains to enable organizers to determine how effective each aspect was and identify areas in which improvement could be made for subsequent events. Learners were asked to compare the virtual debriefings with their previous experience in in-person debriefings. The general surgery, emergency medicine residents and nurses traditionally participate separately in programmatic technical and non-technical in person simulations.

Results

25 learners in total participated in a number of half-day trauma simulation educational events (13 GSR, 5 EMR, 3 medical students, 2 trauma APRNs and 2 trauma RNs). Demographics are shown in Table 1.
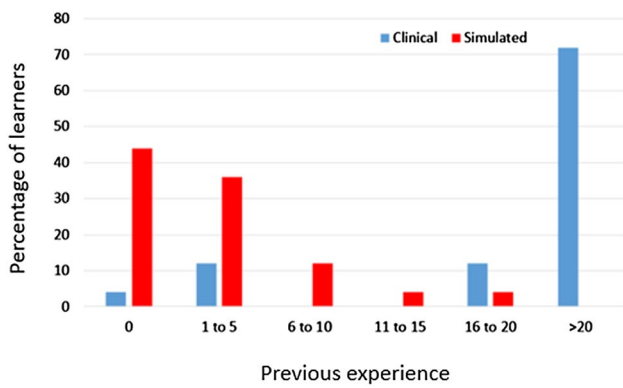
Pre-assessment

The majority of learners (72%) had been involved in > 20 clinical trauma activations; however, 80% learners had been involved in five or less simulated trauma activations. Figure 1. Prior to the learning event, most learners felt they were an effective member of the trauma team (20% strongly agree, 68% agree). The majority (60%) felt their knowledge of what was required to effectively lead a trauma team was "excellent" or "good", and 44% rated their confidence in leading an effective trauma team as "excellent" (8%) or "good" (36%).

Table 1 Learner demographics

Learners	
General surgery residents	**13**
PGY 3	7
PGY 2	6
Emergency medicine residents	**5**
PGY 3	3
PGY 2	2
Nurses	**4**
APRN	2
RN	2
Medical students	**3**
Age (median, years, range)	29 (25–37)
Race/ethnicity	
Asian or Asian American	1
American Indian or Alaska Native	0
Black or African American	0
Hispanic/Latinx	1
Native Hawaiian or Other Pacific Islander	0
White	23
Two or more races	0
Other	0
Gender	
Female	14
Male	11
Non-binary/third gender	0
Prefer to self-describe	0
Prefer not to say	0

Bold indicates total learners in the group

Fig. 1 The number of trauma surveys learners had been involved in before the learning event, for the clinical and simulated setting

Post-assessment

Following the simulation event, there was improvement in learner's belief that they were an effective member of the trauma team, and in their knowledge and confidence to lead a trauma activation (Fig. 2a and b).

Most learners (64%) felt that the debriefing online was effective (28% strongly agree, 36% agree). Similarly, the majority of learners felt comfortable and safe sharing and reflecting in the virtual debriefing environment (32% strongly agree, 36% agree). However, importantly, 3 (28%) learners "strongly disagreed" with both of these statements; one GSR and two nurse learners. When considering the CoI domains, 88% learners (22) "agreed"/"strongly agreed" that virtual team-to-team debriefing had social, cognitive and educator presence (Fig. 3). Again, one GSR and two nurse learners "strongly disagreed" with these statements.

All participants "strongly agreed" (20/25) or "agreed" (5/25) that the simulation translated into learning for them for all subscales of the ICCAS competencies.

Fig. 2 Efficacy for learning of the simulation event: comparison of learner effectiveness, knowledge and confidence before and after the simulation event: **a** Learner agreement with the statement "I am an effective member of the trauma team"; **b** Knowledge: learner agreement with the statement "my knowledge of what is required to lead an effective trauma team is"; Confidence: learner agreement with the statement "my confidence in leading an effective trauma team is"
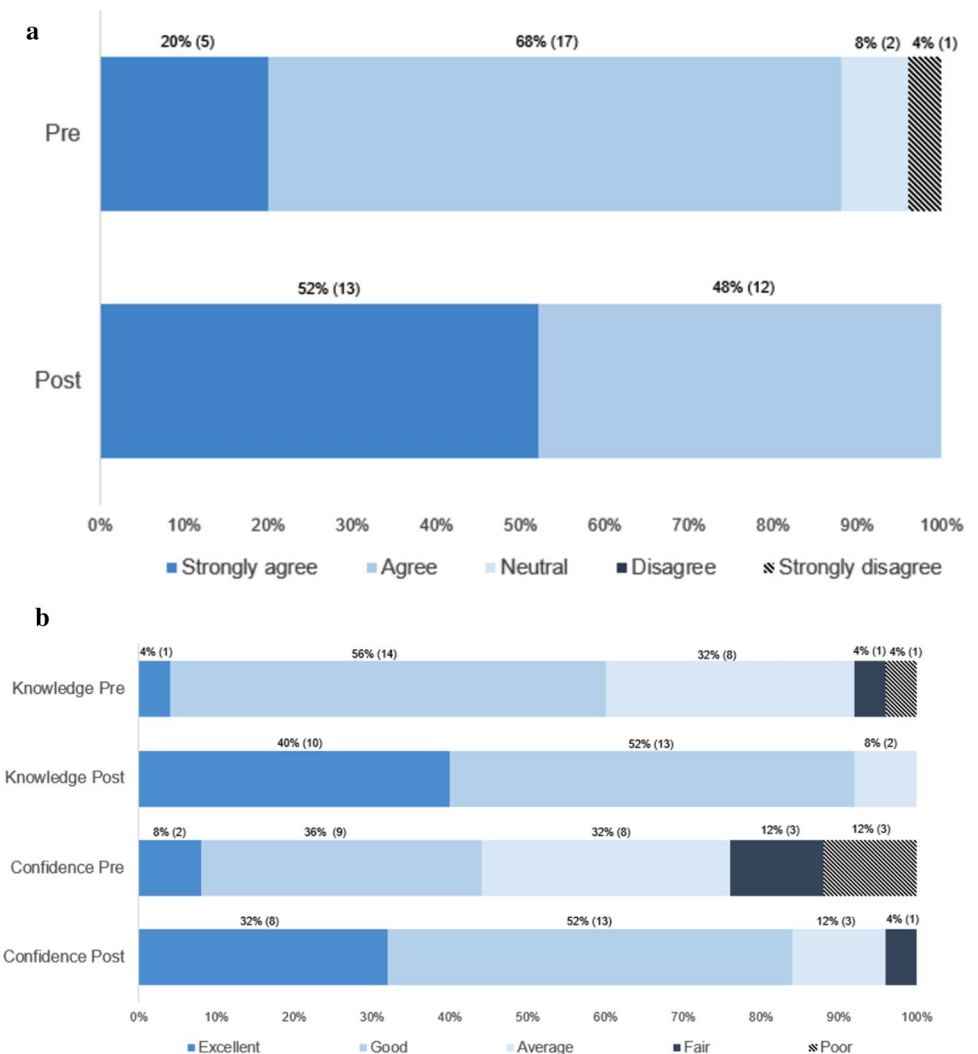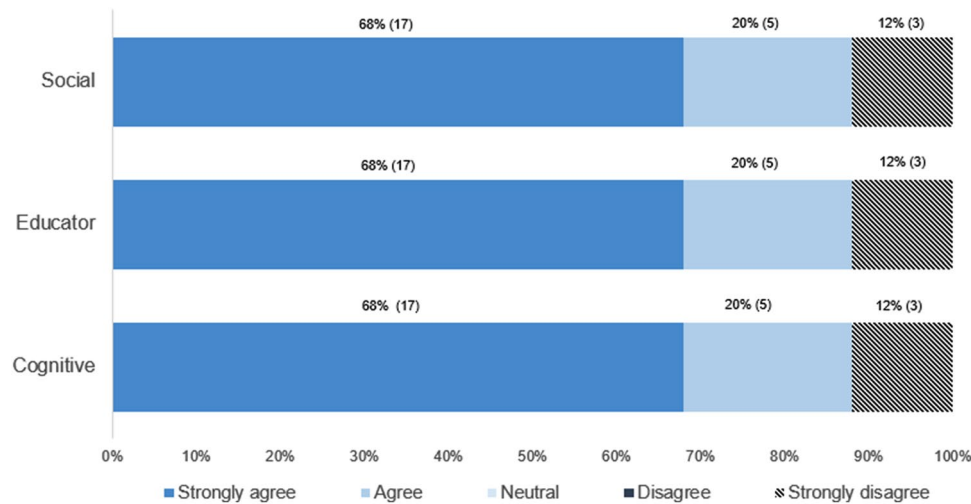
Fig. 3 Efficacy and psychological safety of virtual debriefing compared to in person debriefing as rated by learners in interprofessional trauma simulation. Social: learner agreement with "I believe that in the virtual debriefing today the learners and educators felt socially present and "real" during their online interactions". Educator: learner agreement with "I believe that in the virtual debriefing today, the educators felt "present" to me as a learner". Cognitive: learner agreement with "I believe that in the virtual debriefing today, I was able to gain meaning from our trauma simulations through reflection"

Discussion

The COVID-19 pandemic has raised multiple challenges to the delivery of effective simulation education. Quality debriefing is vital to effective learning, therefore it is crucial for simulation educators to identify and maneuver around the barriers to effective virtual or hybrid debriefing. With new COVID-19 waves and dynamic social distancing restrictions, simulation education needs to be deliverable and effective both in virtual and hybrid formats. This is important not just in pandemic times, but as we move forward and determine how best to incorporate virtual and hybrid pedagogies into post-pandemic education. Through careful attention to recommendations provided by the CoI framework in all stages of the simulation event, we demonstrate that virtual team-to-team debriefing can be effective in terms of cognitive, social and educator presence, and translate to learning exemplified by improved learner knowledge and confidence post-event. These findings are pertinent not only to continuing effective resident education but also may guide educators crafting distance simulation for learners in underserved or rural areas to mitigate healthcare and educational disparities.

In addition to the challenges of the virtual debriefing, educators must recognize and address the barriers to psychologically safe debriefings when interprofessional learners are involved. We demonstrate that despite the majority of learners feeling that there was social, cognitive and educator presence in the virtual team-to-team debriefings, and feeling safe to participate, a small number of learners "strongly disagreed" with this. Although in the minority, these views are important. This learner group ($n = 3$) had

a disproportionately high number of nurses within it and may represent the challenges associated with social identity within the learning groups. A learner's social identify is determined as a self-concept relating to their perceived membership within a group [6–8]. There are multiple interpersonal and interprofessional factors that contribute to this. Previously, studies have shown that some physicians are not receptive to feedback from nurses. Physicians' lack of willingness to receive feedback from nurses among other personal experiences may contribute to our nurse learners feeling uncomfortable in the virtual debriefings [16, 17]. Future work will be directed at collecting qualitative data surrounding this theme to identify factors important to these perceptions. Through this current work we have shown that even with careful attention to mitigating challenges of inclusion and psychological safety within the virtual team-to-team debrief there are some learners who remain very comfortable. Despite this, 100% learners strongly agreed or agreed the event met all ICCAS competencies; so the perceptions surrounding the virtual debrief do not appear to have affected learning within the IPEC defined interprofessional domains.

The COVID-19 pandemic has provided a catalyst for adaption of medical education to the virtual platform. As we move towards a post-pandemic world, educators should continue to focus on lessons learnt during this period of social distancing. Identification of strategies that can be successfully implemented into continued surgical education is important. Virtual and hybrid debriefing is an important tool in our armamentarium as this facilitates access to educational events and educational subject matter experts by

learners and faculty in educationally underserved areas. For example, the educational event we describe could be virtually offered in rural areas of our state to improve trauma education in Level 2–4 trauma centers. With effective virtual debriefings, this enables healthcare professionals in these areas to practice high patient risk, low frequency events to improve the standard of patient care. In addition, virtual simulation delivery enables learners to have multiple means of engagement with the event, especially in the case of a hybrid model such as this, which is important to ensure effective learning for all our learners in accordance with the Universal Design for Learning (UDL) theory [18, 19].

This study does have limitations. We performed this work at a time that social distancing and mask wearing restrictions were mandatory at our institution. The COVID-19 pandemic social distancing and masking restrictions have been fluid and therefore the applicability of this work once these restrictions are lifted may be limited. In addition, this work was performed at one academic institution and with a relatively small cohort and thus results may not be reliably extrapolated to other geographical locations. Further, learners had mostly participated in uniprofessional simulation training and debriefing before this event. It would have been interesting to compare the virtual team-to-team interprofessional debriefs to both truly virtual and in-person debriefs in terms of psychological safety and efficacy, however at the time of the investigation in-person events were not permitted. Making the comparison between the data from these virtual team-to-team debriefings and to in-person debriefings at a time with no social distancing would be subject to significant bias due to many potential confounders i.e., different working conditions, different COVID-19 local numbers, different learner stressors, and would not be a valid comparison. In addition, we collected data regarding self-assessment and survey data, which can be subject to self-report bias. Objective tools exist to assess the psychological safety of teams; however, these are limited to the in-person environment [20]. This limitation coupled with the fact that utilization of an objective tool to provide an external measure of psychological safety within the events would increase the cognitive load of the facilitators and likely reduce the educator presence and, by extension, social and cognitive presence. For these reasons, such tools were not used within this work.

A relatively small learner group was included in this study. This was appropriate as this represented the entire cohort of target learners at specific PGY levels in each specialty and the trauma nurse population. Due to the fast moving changes occurring with social distancing during the current COVID-19 pandemic it is challenging to compare like with like as educational changes are implemented during various phases. Recruiting further participants to this work temporally distant from the original group would risk

incorporation of bias. Future work may address these challenges by developing multi-institutional projects to improve learner pool. Another limitation, related to the impact of COVID-19 on our educational activities, was that we were only able to collect data pertaining to Kirkpatrick's level 1 [21, 22], or reaction, and were limited to assess the effect of these simulations on learning and impact through analysis of clinical performance. Finally, we studied the efficacy and psychological safety in a trauma activation simulation scenario and the applicability of these results to simulations involving other clinical scenarios may be limited. Despite this, trauma activations are an example in which excellent interprofessional communication, teamwork, leadership, respect and clear roles and responsibilities are crucial for effective patient care. These attributes are learning objectives within many simulation scenarios. In addition, this scenario provided a great opportunity to foster cognitive presence in the debrief through utilization of a validated assessment tool addressing the primary learning objectives of the event. This can provide an important template for future simulation events to guide debrief structure around the CoI framework.

Conclusions

Virtual and hybrid debriefings are challenging with multiple barriers to ensuring psychological safety and efficacy. Structuring debriefings using the CoI framework we demonstrate virtual team-to-team debriefings can be effective for most learners. Educators should recognize the implications of social identity theory, particularly the effects of hierarchy, on comfort level of learners. Developing strategies to optimize virtual and hybrid simulation learning environments is essential as this pedagogy persists during and beyond the COVID-19 pandemic.

Declarations

Conflict of interest The authors have no conflicts of interest.

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