"Debriefing-on-Demand"

A Pilot Assessment of Using a "Pause Button" in Medical Simulation

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Introduction: Simulation is an effective tool in medical education with debriefing as the cardinal educational component. Alternate debriefing strategies might further enhance the educational value of simulation. Here, we pilot a novel strategy that allows trainees to initiate debriefing at any point during the scenario, when they consider it necessary.

Methods: With ethics approval, 8 postgraduate year 1 anesthesia residents (with no previous exposure to high-fidelity simulation) were randomly assigned to lead 2 of 8 scenarios with 2 debriefing strategies. With "debriefing-on-demand," residents had the option to initiate debriefing at any point in the scenario by activation of a "pause button"—in addition to undergoing conventional debriefing at the end of the scenario. Those randomized to "conventional debriefing" were debriefed only at the end of the scenario. All were allocated as team leader with both debriefing strategies and as a participant in remaining scenarios. Residents provided feedback regarding each method using Likert scales and completion of open-ended statements.

Results: Debriefing-on-demand was easily integrated into all scenarios, and most learners (88%) supported its use in future simulation sessions. The following 4 themes emerged from qualitative analyses: (1) improvements in the clarification and integration of knowledge, (2) reductions in stress/anxiety, (3) facilitated reflection on action, and (4) maintained realism comparable with conventional debriefing.

Conclusions: Debriefing-on-demand was easily integrated into all scenarios and well received by these trainees new to simulation. Larger trials that use validated tools are needed to determine the absolute impact of debriefing-on-demand on stress levels and the overall learning value of simulation for trainees at different levels of training.
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Key Words: Simulation, Debriefing, Medical education.

Simulation is becoming a standard curricular component of medical education. Simulation allows trainees the opportunity to gain exposure to acute clinical scenarios without the risk of patient harm.[1] Debriefing has consistently been reported as the most important educational component of simulation.[2–4] Despite this, little investigation has been performed with respect to best practices of debriefing, relating specifically to timing and method.[5,6] Debriefing conventionally occurs at the end of the scenario, and although intended to promote collaborative reflection on action, it may instead result in didactic teaching sessions when participants have limited simulation experience. There are a number of challenges specific to medical trainees new to simulation, which may hinder full participation in the reflective process at the end of the scenario. Medical trainees with no or very little exposure to simulation often view it as a stressful environment because of a perceived lack of clinical knowledge and fear of judgment by peers and educators.[7] They may experience cognitive overload more easily than those more experienced with the simulation environment and may struggle to continually learn (i.e., absorb information) throughout a scenario. For example, Fraser et al[8] (2012) demonstrated that medical students could not accurately perform a diagnostic cardiac examination (which they had just learned in simulation) if they were highly stressed. In a more recent randomized controlled trial, Fraser et al[9] (2014) demonstrated that unexpected simulator death (and high stress) interfered with learning and affected their performance/anxiety levels even in subsequent simulator sessions.

Given the importance of debriefing on the overall educational value of simulation, we considered it necessary to explore the development of alternative debriefing methods to potentially reduce high stress/anxiety levels, which can be particularly problematic for trainees new to the simulation environment. Our group developed "debriefing-on-demand," an approach that allows the trainee to control the

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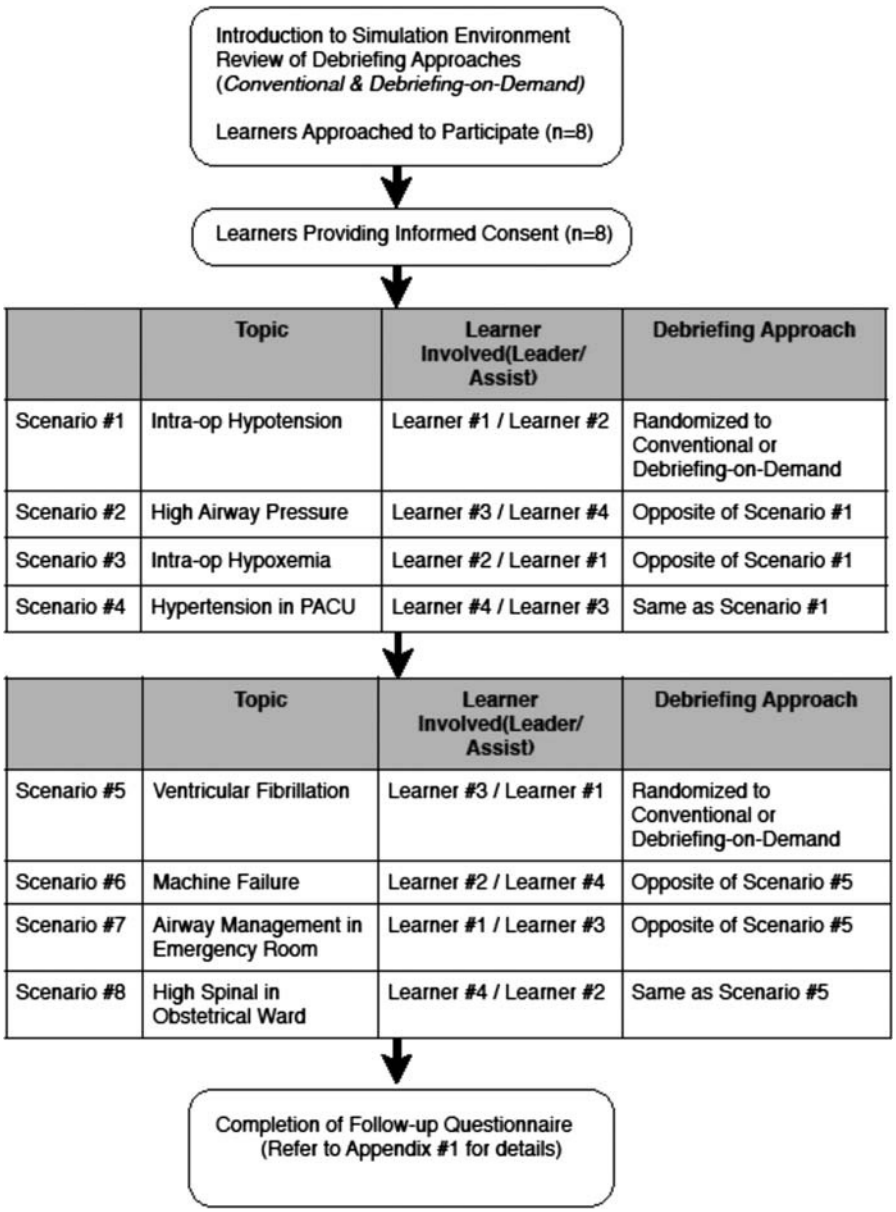
timing and the content of the debriefing session by activation of a "pause button." We postulated that the introduction of the pause button would facilitate debriefing integration within the specific scenario, so that reflection would be more relevant, in real time, and in accordance with the trainees' immediate needs. The intended result would be reduced anxiety. In addition, this approach may allow those newly exposed to simulation to progress further in managing critical events after the pause and, therefore, improve the overall learning value of the scenario. The primary purpose of our current pilot study was to determine the feasibility of implementing debriefing-on-demand into our simulation scenarios in terms of logistics and perceptions of junior trainees (new to simulation) compared with "conventional" debriefing. This pilot study may provide the information necessary to determine if further investigation into the educational impact of debriefing-on-demand is warranted.

METHODS

After approval from our institutional research ethics board and signed informed consent were obtained, 8 postgraduate year 1 anesthesiology residents were recruited to participate in this prospective investigation to assess the feasibility of implementation of our novel debriefing-on-demand approach in terms of logistics and residents' perceptions. Participation in the study was voluntary, although attendance at the 2-day workshop was a mandatory component of the postgraduate year 1 program. The workshop was designed to assist in skill development for crisis resource management. During a 2-year period, 8 first-year anesthesiology residents (4 per year) were randomized to be a team leader in 2 of 8 simulation scenarios with conventional and novel debriefing methods (Fig. 1). All participants had completed 2 months of training in anesthesiology but had no previous experience with high-fidelity simulation.



	Topic	Learner Involved(Leader/ Assist)	Debriefing Approach
Scenario #1	Intra-op Hypotension	Learner #1 / Learner #2	Randomized to Conventional or Debriefing-on-Demand
Scenario #2	High Airway Pressure	Learner #3 / Learner #4	Opposite of Scenario #1
Scenario #3	Intra-op Hypoxemia	Learner #2 / Learner #1	Opposite of Scenario #1
Scenario #4	Hypertension in PACU	Learner #4 / Learner #3	Same as Scenario #1

	Topic	Learner Involved(Leader/ Assist)	Debriefing Approach
Scenario #5	Ventricular Fibrillation	Learner #3 / Learner #1	Randomized to Conventional or Debriefing-on-Demand
Scenario #6	Machine Failure	Learner #2 / Learner #4	Opposite of Scenario #5
Scenario #7	Airway Management in Emergency Room	Learner #1 / Learner #3	Opposite of Scenario #5
Scenario #8	High Spinal in Obstetrical Ward	Learner #4 / Learner #2	Same as Scenario #5

FIGURE 1. Recruitment and randomization structure.

All participants received a standardized introduction to simulation, which included establishing a safe learning environment, reviewing the debriefing process, and orientation to the Laerdal 3G High Fidelity patient simulator in a mock operating room. To further familiarize the residents, all participated in an introductory scenario with both methods of debriefing (conventional and debriefing-on-demand) before randomization. The 5 Sim-PICO components of both debriefing processes used in this pilot study are summarized in Figure 2 in accordance with the debriefing recommendations for improved reporting and standardization of the debriefing process in simulation research.[5]

The 8 scenarios included in the study were developed for junior anesthesia trainees with no previous exposure to simulation and were designed to teach basic initial management of anesthesia crises with emphasis on communication, teamwork, and resource management. Scenarios were paired for complexity and randomly assigned to participants via sealed opaque envelopes (see Document, Supplemental Digital Content 1, http://links.lww.com/SIH/A260, for the list of scenarios and learning objectives). The debriefing method to be used for each scenario was also assigned in a block randomized fashion using sealed envelopes. All residents were exposed to each of the debriefing methods as the team leader and also as an active participant in each of the remaining scenarios.

Before the scenarios, trainees were told they could activate the pause button to initiate debriefing at any point in the scenario when they were feeling stressed and/or overwhelmed and were unsure of what to do next. Upon activation, the scenario was paused, and debriefing, focusing on the area identified by the individual learner, occurred at the bedside. The debriefing session was facilitated by a highly experienced member of the simulation faculty and kept as brief as possible (<5 minutes), although attempts were made to include all learners in the ensuing discussion. Trainees were not relieved of their responsibility as the clinical decision maker and were not specifically told what to do to proceed. Instead, they were guided to think through the problem that they were experiencing, assisted with gaps in medical knowledge, prompted to generate options, and made aware of team resources available. After the debriefing session, team members were required to resume management of the clinical scenario at the exact point where it had been paused. After completion of all scenarios, all participants took part in a conventional structured debriefing facilitated by an experienced simulation faculty member in the dedicated debriefing room. Debriefing at our simulation center falls within the framework of "debriefing with good judgment" as described by Rudolph et al.[10]

After each session, all scenario participants completed a short feedback form with Likert scales to assess the impact of debriefing-on-demand on the simulation process overall, their anxiety/stress levels, the perceived clarification and integration of knowledge, as well as the realism of the scenarios when compared with conventional debriefing. A more detailed questionnaire (Appendix 1) containing both Likert scales and open-ended statements regarding the pause

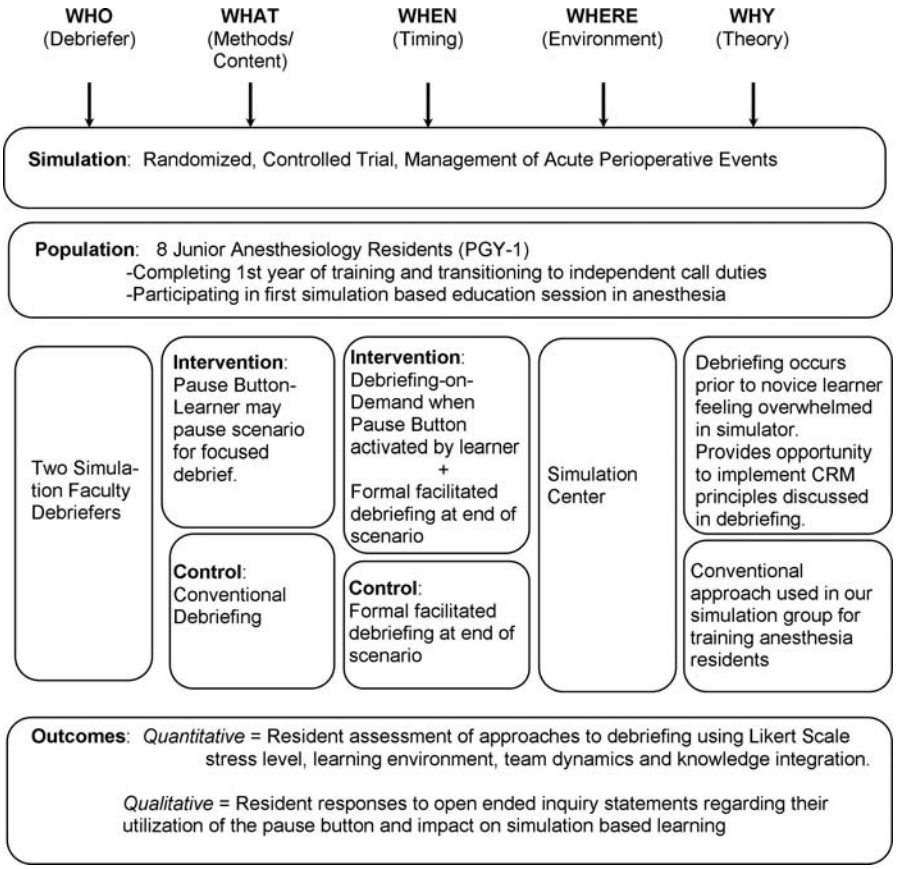


FIGURE 2. Sim-PICO components of debriefing processes used in the study (modified from Raemer et al,[5] 2011).

button and its impact on the debriefing and the educational process was completed at the end of the workshop after their participation and/or exposure to all scenarios. All measurement tools were developed and piloted for readability and comprehensibility by our group.

All responses to open-ended statements were anonymized and transcribed verbatim. Thematic content analysis was used to analyze narrative data provided in the surveys using an established approach.[11] Open coding was performed independently by 2 faculty members with extensive experience in postgraduate medical education as well as simulation scenario design and delivery (M.M., J.E.B.). Codes created and assigned in the data were reviewed by an additional investigator experienced in this analysis technique (R.W.) and adjusted for consensus before laying the coding frame on the entire narrative data set until data saturation. After completion of this process, major themes and subthemes were identified by connecting and clustering the codes and then illustrated with specific deidentified exemplars from the narrative transcription. Triangulation of narrative data was performed with scaled questionnaire data and exemplars used to support and illustrate the findings accordingly. Reporting is in accordance with recommended standards of reporting for qualitative research.[12]

RESULTS

From July 2011 to July 2012, a convenience sample of 8 first-year anesthesia residents (4 per year) participated in this study. The debriefing-on-demand approach was incorporated into the established clinical scenarios without any logistical difficulties. Overall, the majority of participants (7/8 or 88%) reported that debriefing-on-demand added value to simulation and supported its use in future simulation sessions.

During the study, the pause button was activated in 4 different scenarios but only once during each scenario despite its ongoing availability. The pause button was activated most often by the learner allocated as the team leader (3/4) for that scenario. The debriefing-on-demand sessions were most commonly requested for aspects of medical knowledge surrounding the development of a differential diagnosis and review of a management plan for the clinical scenario. Our on-demand debriefing sessions were all less than 5 minutes in duration, which made a negligible difference given that our conventional debriefing sessions are highly variable (i.e., 20–40 minutes, depending on the scenarios and the trainees) and the duration is not routinely tracked at our center.

Both the scenario-specific feedback and the final feedback indicated overwhelming support for the use of debriefing-on-demand on demand throughout the simulation workshop. Those who activated the pause button indicated that it improved their management of the clinical scenario, facilitated useful debriefing within the context of the scenario, and increased their comfort in participating in the subsequent debriefing session. All residents provided feedback regarding the impact that the pause button had on their simulation experience including stress/anxiety, integration of knowledge, maintenance of realism, and the debriefing process overall. The results are presented in Table 1.

Four themes emerged during the thematic analysis of the trainees' responses to open-ended statements surrounding use of the pause button: (1) improved clarification and integration of knowledge, (2) reduction in stress/anxiety, (3)

TABLE 1. Summary of Participant Feedback Regarding the Use of the Pause Button/Debriefing-on-Demand Technique During the Simulation Scenarios

	Disagree	Neutral	Agree
Stress level and environment			
Decreased overall stress	0	3 (37.5%)	5 (62.5%)
Feel more comfort as leader	0	1 (12.5%)	7 (87.5%)
Decrease performance anxiety	1 (12.5%)	3 (37.5%)	4 (50%)
Realism scenario maintained	0	1 (12.5%)	7 (87.5%)
Realism patient maintained	0	1 (12.5%)	7 (87.5%)
Team dynamics			
Allowed team to work together	0	1 (12.5%)	7 (87.5%)
Team leader more effective	0	1 (12.5%)	7 (87.5%)
Realism of team maintained	0	1 (12.5%)	7 (87.5%)
Realism of my behavior maintained	1 (12.5%)	0	7 (87.5%)
Integration of knowledge			
Increased my comprehension	0	1 (12.5%)	7 (87.5%)
Gave me time to reflect on management	0	0	8 (100%)
Gave time to consider options	0	0	8 (100%)
Improved my management of situation	0	0	8 (100%)
Maximized knowledge obtained	0	0	8 (100%)
Debriefing process			
Useful debriefing occurred around knowledge	0	0	8 (100%)
Useful debrief around team dynamics	0	3 (37.5%)	5 (62.5%)
I felt more comfortable participating in debrief	0	1 (12.5%)	7 (87.5%)
Overall assessment			
Pause button added value to simulation experience	0	1 (12.5%)	7 (87.5%)
I would use the pause button in future simulation sessions	0	1 (12.5%)	7 (87.5%)

improved reflection on action, and (4) maintained realism of the scenario.

Improved Clarification and Integration of Knowledge

The use of the debriefing-on-demand provided learners the opportunities to clarify events, increase their situational awareness, and review how their existing medical knowledge could be applied in developing a management plan. The concept of clarification and integration of knowledge was coded in all participants' comments with respect to why they activated the pause button. As an example, one resident stated that [my] goal in pressing the pause button was "to clarify the issues at hand and develop a reasonable plan for my next couple of steps." This was also seen in the subtheme of "moving forward" in which the learners were able to gain from the remainder of the scenario because the pause button provided the opportunity for them to "manage the scenario," "get back on track," and/or to "appreciate the next events" when they might not otherwise have been able to progress and continue to learn beyond that point in the scenario. This is illustrated by the following comment from one of the trainees in which they reported that, "Having the ability to stop to gather my thoughts and verbalize them helped me clarify my management plan [so] I could implement something productive rather than continuing to feel as though I was struggling."

Reduction in Stress/Anxiety

The responses of the residents suggested that there was a significant level of stress and anxiety toward participating in their initial simulation sessions despite efforts to create a safe, protected learning environment. As the scenarios progressed, some participants reported increasing stress levels, which led to activation of the pause button in 4 of the 8 scenarios where the pause button was available. Learners suggested that they were most likely to implement the pause button when "the cumulative stress and scenario factors were together making decisions hard to arrive at" or when "I felt lost/unsure of what to do next [and] where to guide my team/actions." The debriefing-on-demand approach was developed to provide participants some sense of control over the evolution of events to reduce their anxiety level. The impact on anxiety was highlighted in the following participant's statement regarding (what they considered to be) the best part of the pause button: "Being able to take a step back and clarify some issues when feeling overwhelmed so that the benefit of the scenario isn't lost [by] being completely uncertain how to proceed."

Improved Reflection on Action

The following statement regarding how the pause button (and debriefing-on-demand) influenced the debriefing experience for one learner eloquently summarizes some of the potential benefits of debriefing-on-demand in terms of reflection in action: "I was able to debrief when my mind was 'full' immediately, rather than waiting until the end and trying to remember everything I was struggling with. It also allowed me to be more effective in my care so that other issues could come up to discuss as well (rather than struggling with the same hurdle throughout the scenario)." Other participants felt the pause button "creates a focal point in the post scenario discussions" and observed that it was "hard to remember (the) entire sequence of events at the end so it gave a midpoint recap."

Maintained Realism of the Scenario

After completion of all 8 scenarios, the majority of trainees new to simulation reported that realism of both team behavior and the clinical scenario overall was maintained with activation of the pause button. However, one trainee did not share this view as indicated by the following statement: "…the total outcome of the scenario is likely different than if I didn't have that option, i.e., having to come up with workarounds…" All of the simulation instructors valued the improved ability to have patient deterioration occur at a realistic rate.

DISCUSSION

Overall, the debriefing-on-demand approach was easily and successfully integrated into our simulation sessions for the junior anesthesia residents upon their initial exposure to high-fidelity simulation. In addition, most learners supported its use in future simulation sessions and reported that it added value to simulation compared with the conventional debriefing method. This debriefing approach provided individual learners the unique opportunity to control the timing and content of the debriefing session in accordance with their individual needs. In fact, the development of this novel debriefing approach was motivated in part by the desire to reduce the performance anxiety often expressed by learners during their initial exposure to medical simulation. We suggest that this increased level of control may serve to reduce stress and thus improve new trainees' ability to integrate knowledge and effectively reflect on their actions in the scenario, which may thereby improve the overall learning value of simulation.

Even though residents' responses indicate that a significant level of anxiety remained during the simulation sessions, the majority reported that anxiety levels were reduced with on-demand compared with conventional debriefing. Residents also reported that the availability of the pause button increased their comfort in the role of team leader. As facilitators, we also observed an increased willingness of several residents to engage in on-demand compared with conventional debriefing sessions.

Those who teach simulation with conventional debriefing understand the issue of having to artificially slow the pace of the scenario to provide new trainees sufficient time to detect an abnormality, formulate a plan, and then respond to the evolving situation. This leads to the concern that we are falsely reassuring our learners that real-life clinical events would happen on a slow time frame. Debriefing-on-demand provides an alternative solution to this problem. By giving the resident the ability to pause the clinical situation at any point, our group believes that the timeline of the scenario (when not paused) may more closely reflect the timeline of actual clinical events. Although our sample was small, most residents did report that the realism was maintained both with respect to the team behavior and the clinical scenario. Future investigations will be required to examine

realism with on-demand debriefing across different types of scenarios (emergent vs. nonemergent) and across levels of training.

Another potential benefit of the on-demand debriefing method (as described by several participants) is that it provides a focal point in the timeline of the scenario, which serves as a frame of reference for the subsequent debriefing session. It also allows trainees to reflect (during the conventional debriefing session) upon how they integrated the knowledge and implemented the management plan subsequent to the on-demand debriefing session. This provides a unique opportunity to put into practice the crisis resource management concepts that were discussed and ensures that important issues are not forgotten or bypassed at the conclusion of the scenario.

Although mentioned previously, the authors feel it is important to emphasize that with the debriefing-on-demand technique, trainees are not relieved (or rescued from) their responsibility as clinical decision makers. Instead, they are guided to think through the problem and are only assisted with gaps in medical knowledge, made aware of the available resources, and prompted to generate options to manage the situation. They are also required to resume the scenario at the precise point at which it was paused without obtaining additional equipment or other resources. Another potential benefit of additional in-scenario debriefing is that it provides trainees with the opportunity to contrast and reflect upon their approaches before and after the pause.

Some educators and clinicians may argue that debriefing on demand might allow residents to avoid failure and be deprived of the experience of "being it," which is of paramount importance in their readiness for independent call. However, as mentioned previously, the trainees are not relieved of their responsibilities or rescued by attending staff but are instead better equipped to manage the situation. In light of evidence that high stress in simulation can impede learning (likely because of high cognitive load),[7] our approach may be beneficial in that it may serve to reduce stress levels and allow trainees to learn beyond the point in the scenario at which cognitive overload might occur in the absence of debriefing-on-demand. In fact, it has been demonstrated that extreme stress such as that provoked by unexpected simulator death may even affect future simulation training.[9] Although some might consider experiencing failure (and perhaps even unexpected simulator death) to be beneficial for learning independence, we suggest that it might be more suitable for senior residents and not for junior trainees new to the simulation environment. Again, future multicenter investigations are required to further examine the impact of on-demand (compared with conventional) debriefing with different scenarios (emergent vs. nonemergent or high vs. low stress, long vs. short, etc) in trainees at different stages of training.

The small sample size in the current investigation precludes a comprehensive evaluation of the debriefing-on-demand approach. However, the sample size is simply a reflection of the limited number of new postgraduate trainees entering our department annually. However, from the outset, this study was intended only as a pilot to determine the feasibility (in terms of logistics and favorable trainee perceptions). Although small, this pilot did successfully demonstrate feasibility. Without such evidence, as demonstrated here, there would be no basis on which to base a future multicenter investigation, which is both costly and time consuming.

Another potential limitation of the current pilot is that the assessment tools were developed and tested by our group, but they have not been validated in the literature. Even so, one of the main purposes of this pilot was to gain insight into how our new anesthesia trainees perceived our on-demand debriefing relative to the conventional debriefing method. Our assessments did provide an inclination that debriefing-on-demand may be perceived as beneficial in several respects (compared with conventional debriefing) and is therefore worthy of further investigation.

In summary, the debriefing-on-demand approach was successfully incorporated into our simulation scenarios and was well received by this group of junior trainees new to simulation. Although our sample was small, these trainees did report that the pause button reduced their anxiety levels, improved team dynamics, clarified and improved the integration of knowledge, and maintained the realism of the scenarios compared with conventional debriefing. Future multicenter investigations with validated assessment tools will be required to determine the true impact of debriefing-on-demand on trainees' stress levels and the educational benefits compared with conventional debriefing for different simulation scenarios (emergent vs. nonemergent) and for learners at different levels in their medical training. Principles defined in these investigations may then be extended not only to different scenarios and learners at different levels of training but also to other medical specialties.

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Appendix I: Debriefing-On-Demand: Participant Feedback Questionnaire.

Instructions: Below is a series of questions, both scale-based and open-ended inquiry statement, asking you to compare the use of the pause button with the conventional method of debriefing that occurs at the end of the scenario.

Part A: Scale-Based Questions.

In comparison with the conventional method of debriefing, the use of the pause button had the following effects on my simulation-based educational experience:

Part B: Open-Ended Inquiry Statements

1. The best part of the pause button was…
2. I was most likely to implement the pause button when…
3. The worst part of the pause button was…
4. The pause button improved the debriefing experience in the following way…
5. The pause button deterred from the value of debriefing in the following way…
6. How would you feel about using the pause button during future simulation experiences?

Part C: Additional Comments (Optional).

	Strongly Disagree		Neutral		Strongly Agree
With regard to participant stress level and learning environment:					
The pause button decreased my overall stress level in participation.	1	2	3	4	5
The pause button made me feel more comfortable in my role as a team leader.	1	2	3	4	5
The pause button decreased my anxiety in performing in front of my colleagues.	1	2	3	4	5
The realism of the scenario was maintained with the pause button.	1	2	3	4	5
With regard to team dynamics:					
The pause button allowed the team to work together more effectively.	1	2	3	4	5
The pause button allowed me as team leader to use my team more effectively in assigning roles, responsibilities, and tasks.	1	2	3	4	5
The realism of the team's behavior was maintained with the pause button.	1	2	3	4	5
The realism of my behavior as team leader was maintained with the pause button.	1	2	3	4	5
With regard to integration of clinical knowledge:					
The pause button increased my comprehension of the clinical scenario at hand.	1	2	3	4	5
The pause button gave me time to reflect on appropriate management decisions.	1	2	3	4	5
The pause button gave me time to consider different management options.	1	2	3	4	5
The pause button improved my management of the clinical situation.	1	2	3	4	5
The pause button improved the clinical knowledge I obtained from participation in the scenario.	1	2	3	4	5
With regard to the debriefing process:					
When the pause button was activated, useful debriefing occurred around clinical knowledge.	1	2	3	4	5
When the pause button was activated, useful debriefing centered around team dynamics and communication.	1	2	3	4	5
Because of the debriefing that occurred during the scenario, I felt more comfortable participating in the debriefing at the end of the scenario.	1	2	3	4	5