

Supplemental Digital Content

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Supplemental Digital Appendix 1

Description of the Simulation Context and Scenarios Used in a Study of Simulation at the Frontier of the Zone of Proximal Development, 2016–2017^a

Simulation overview

Before enrolling in the multidisciplinary dedicated transitional year on acute care at the University Medical Center Utrecht, students take a formative multimodal pretest to focus on the elective entrustable professional activities that are the objectives of the year ahead. The junior residency-level test consists of 2 parts. The first part assesses knowledge with a written test, know-how with case-based discussions, and skills with objective structured clinical examinations. The second part is an assessment of clinical performance in acute care that takes place in a simulated environment. Students take a similar posttest at the end of the year.

This study focused on the second part of the pretest, i.e. the simulations.

The simulation test has a total duration of 3 1/2 hours for groups of 4 students, including introduction, familiarization, 12 individual tests (4 students in 3 scenarios), individual debriefing, waiting, breaks, and a group debrief and closure.

With the description below we adhere to the guidelines for reporting simulation research by Cheng et al.²⁹

Simulation environment

The simulation pretest took place in the Simulation Center of Rijnstate Hospital, Velp, the Netherlands. The center offers a secluded and quiet area for simulation consisting of a briefing room, a 54-m² (581-ft²) simulator room, a control room behind a one-way screen, a debriefing room, and a waiting area. The simulator room mimics a room in a clinical environment and deploys a 2010 Laerdal Sim Man (Laerdal Benelux B.V., Amersfoort, the Netherlands). This high-fidelity manikin features a wide range of pulsations, heart sounds, and breath sounds and allows surgical interventions such as chest drains and a full range of airway management from bag-mask ventilation to cricothyroidotomy. The manikin is positioned in a hospital bed. No moulage is used on the manikin. Props are occasionally used, e.g., a bladder-flushing system in a post-TURP (trans-urethral resection of the prostate) hemorrhage scenario. A working 18G IV cannula is in situ in an antecubital vein.

The manikin can be connected to a monitor that can display pulse oximetry, noninvasive blood pressure, 3-lead electrocardiogram, capnography, and temperature. Further options, such as invasive blood pressure, are theoretically available but are not used in the scenarios. The interval between successive blood pressure measurements can be adjusted, alarms can be muted or switched off, and alarm limits changed.

Three trolleys are present in the room, containing all the medication commonly used during resuscitation and emergency care, standard airway equipment, and disposables (crystalloid solutions, oxygen face masks, nebulizers, oropharyngeal airways, endotracheal tubes, etc.). A CPR cart is available with a biphasic defibrillator and medication commonly used during CPR (adrenaline, amiodarone). The shockable and non-shockable cardiac arrest algorithms are

attached to the CPR cart. An IV pole is present and includes syringe pumps. Oxygen is supplied from the hospital medical gases pipeline system. A working suction system is present. A working telephone is mounted on the wall. A desktop computer is available with a working internet connection to facilitate online information searches.

Simulation sessions are run by anesthesiologists and anesthetic nurses who are all level 1 EuSim certified simulation facilitators (<https://eusim.org>).

Participant orientation

The simulation session starts with an induction talk that includes a description of the program of the day and an introduction of all facilitators.

Next, participants are offered a tour so they can familiarize themselves with the simulation environment. The tour includes looking at the content of the carts and trolleys and getting acquainted with the look and feel of the manikin and operation of the monitor, piped oxygen and suction system, telephone, and defibrillator.

Simulation exposure and scenarios

The participant acts individually as the doctor attending to emergency calls to the emergency room or ward. Participants collaborate with a single “nonobstructive” nurse. The nurse is able to provide whatever the student requests (within reason) but does not make any suggestions regarding therapy and drug doses. The nurse can gently prompt the student by asking what the

next step or priority will be. The nurse does not correct inappropriate therapy suggestions and will not take the initiative to commence life-saving interventions (e.g., chest compressions).

Scenarios have been developed collaboratively by simulation center physicians and physicians involved in student and resident training in anesthesiology, cardiology, emergency medicine, intensive care medicine, or respiratory medicine. Scenarios require acute care for cases of anaphylaxis, postoperative hemorrhage, or acute myocardial infarction. Scenarios are tasks that a first-year postgraduate could encounter. The scenarios reflect the entrustable professional activities that have been defined for the Utrecht dedicated transitional year on acute care. Participants are requested to provide the best care possible within their abilities. They are allowed to use personal aids such as handbooks, written notes, and smartphones.

Three scenarios are run consecutively. After all students in a group have completed a scenario in turn, the simulator is set up for the next scenario. Each scenario lasts approximately 8 to 12 minutes, and participants are allowed one attempt per scenario.

Right before the simulation, the participant is briefed on the emergency call by one of the facilitators. The participant is allowed to make additional enquiries (examples below) or ask for clarifications.

An example of a scenario is provided below:

Participant instructions

The patient is Mr. Van Arnhem, and he is 56 years old. For about an hour he has been suffering from chest pain. You will now see him in the emergency department.

Manikin operator information

Additional information, to be elicited by the participant:

History

Chest pain came on suddenly

Tight pressure-like

Never had this before

Started during leisurely cycling from bakery to home

Pain did not improve while sitting on the couch at home

Past medical history: NIDDM [non-insulin-dependent diabetes]

ABCDE approach

A: Not obstructed

B: SpO₂ 90%, respiratory rate 20/min, pale, clammy/sweaty, normal breath sounds, CVP

[central venous pressure] normal, trachea in midline

Action: Supply O₂ via nasal cannula 2 l/min, aim for SpO₂ >95%

C: NIBP [noninvasive blood pressure] 120/80, heart rate 60/min, capillary refill < 2 seconds, no abdominal pain

Action: Nitro spray sublingually, IV access, order blood sample and ECG

Operator: Sinus rhythm C on monitor!

D: Pupils equal in size and light reactive. GCS [Glasgow Coma Scale] max, glucose 5.6 mmol/l

E: No edema, no external findings

Sequel

Patient becomes unresponsive.

Declare cardiac arrest:

1. Address patient: “Mr. Van Arnhem, are you with me?”
2. Call CPR team.
3. Ascertain arrest: airway maneuver and look–listen–feel for 10 seconds
4. Start BLS [basic life support].

Examiner checklist

	Complete and timely execution (2 pts)	Incomplete or delayed execution (1 pt)	No execution (0 pts)
Introduces him or herself to patient			
Takes a focused history			
Enquires about past medical history			
Enquires about medication used			
Asks for or applies monitoring			
Recognizes tachypnea			
Performs auscultation of lungs			

Performs auscultation of heart			
Provides oxygen			
Performs or orders arterial gas analysis			
Identifies suboptimal saturation			
Measures capillary refill time			
Identifies poor peripheral circulation (cold, clammy, constricted)			
Orders urgent blood tests			
Considers possibility of coronary syndrome			
Inserts IV cannula			
Orders ECG			
Recognizes ischemia on ECG			
Administers NTG sublingually or by IV			
Administers morphine in reasonable dose			
Administers acetylsalicylic acid			
Completes ABCDE			
Recognizes cardiac arrest within 5 seconds			
Administers painful stimulus			
Asks for help of resuscitation team			
Opens airway			
Looks–listens–feels			
Starts chest compressions			
Initiates bag-mask ventilation			

Applies ratio 30:2			
Calls supervisor			
Uses SBARR			
CRM aspects			
Giving orders			
Taking orders			
Closed-loop communication			
Graded assertiveness			
Uses names			
Impression of overall clinical performance (technical and nontechnical) during this case			
Fail	Borderline	Pass	
How can the participant improve their performance?			

Abbreviations: NTG indicates nitroglycerin; SBARR, situation, background, assessment, recommendation, response; CRM, crisis resource management.

A facilitator (anesthesiologist) assesses students from behind a one-way screen with a scenario-specific checklist, with consultation with the other facilitators. Given the assessment setting,

scenarios are not adapted to the actual experience level of the participants. Scenarios have the same difficulty level for all participants.

Feedback and debriefing

Each participant is debriefed in private immediately after the scenario by the EuSim-certified anesthesiology resident who observed the participant during the scenario. First of all, attention is given to the emotions of the participant. Then feedback is provided according to Pendleton's rules (what went well, what were areas for improvement). Diagnosis and medical management are discussed succinctly with possible suggestions for further study. The debriefing lasts approximately 5 minutes. Video reflection is not used.

After all participants have completed the 3 rounds of scenarios, the facilitator that acted as session lead gives a group debrief. The group debrief lasts approximately 20 minutes and includes discussion of crisis resource management (CRM) principles.

^aParticipants were 11 students beginning their 6th, and final, year at the University Medical Center Utrecht.

Supplemental Digital Appendix 2

Interview Guide From a Study of Simulation at the Frontier of the Zone of Proximal Development, 2016–2017^a

Opening

Discuss: Introduction of interviewer and participant, objective of the interview, analysis of data, anonymity, audiorecording (deleted after analysis), right to end study participation (during or after interview)

[Start recording.]

Focus on Experience

Please take a moment to think back about the simulation test. Try to remember how you felt, what aspects made an impression. . . . Take all the time you need.

[Pause.]

Opening question

Could you please describe your experience, your thoughts and feelings at the time, to the best of your ability?

Explicating and explorative questions about the simulation experience

- Which aspects and/or moments were most prominent and significant?
- What feelings were elicited?
- What thoughts were you having?

- How did you feel physically?
- How did you feel psychologically?

Clarifying questions (applicable to all stages of interview)

- Can you explain that further? What do you mean exactly?
- Can you give me an example?

Questions regarding time prior to the simulation test

- What were your thoughts and feelings regarding the simulation pretest in the preceding days?
- What were your thoughts and feelings regarding the simulation pretest the day before?
- What contributed most to those thoughts and feelings?

Further questions regarding the simulation pretest itself

- How did you feel in the simulation room?
- What did you feel physically during the simulation?
- Did you experience stress? In what way did this manifest itself?
- Were you in a hospital environment?
- How did you experience time during the simulation?
- Which medical role(s) did you assume? (e.g., student, junior doctor)
- Were you dealing with a patient (rather than a manikin)?
- Did the manikin elicit emotions? If so, which ones?
- If the “patient” deteriorated, were you affected? And if so, how?
- Which aspects of the simulation contributed most to your experience?

After the simulation pretest

- How did you feel immediately afterwards?
- What did you think of the short debriefings?
- How did you feel the first couple of days following the simulation pretest?
- Did the simulation pretest influence your feelings regarding the dedicated transitional year? If so, in what way?
- Did the simulation pretest influence your motivation regarding the dedicated transitional year or regarding your future as a doctor? If so, in what way?
- How did it feel to be tested on a level you haven't reached yet?
- Do you think you could encounter similar situations as a junior doctor?

Conclusion

Can you think of anything relevant to your experience that hasn't been discussed?

Is there anything you would like to add, change, or clarify?

Thank the participant.

[Stop recording.]

^aParticipants were 11 students beginning their 6th, and final, year at the University Medical Center Utrecht.

Supplemental Digital Appendix 3

Composite Textural Description Used in a Study of Simulation at the Frontier of the Zone of Proximal Development, 2016–2017^a

Coming to the Simulation Center

Before the simulation pretest, students felt low-level tension, as for any assessment, but all students slept well. Many students felt a bit apprehensive because they did not know exactly what to expect or how they would react to the unfamiliar circumstances. Whereas a single student dreaded the test, anticipating failure, most travelled to the simulation center in good spirits. Students did not prepare extensively for the test, but some students discussed possible scenarios or the ABCDE (airway, breathing, circulation, disability, exposure) approach with peers.

Students universally appreciated the cordial welcome to the center. The friendly, relaxed atmosphere was comforting, and students emphasized the professional nonjudgmental first impression staff made: “It was really helpful that the staff acted very casual . . . and often made a joke. For me that reduced the tension” (Participant [P] 2).

The simulator facility tour relieved tension further, although some students found too much detailed information was given.

Authenticity

The simulation room was collectively perceived as an authentic hospital facility, for example, an intensive care room. Students experienced it as a “pleasant” and “spacious” room. The presence

of relevant working equipment was particularly perceived as real. Items consistently mentioned were the vital signs on the monitor changing in accordance with the clinical situation, the defibrillator, piped oxygen system, drug vials, and a telephone with access to the simulated hospital switchboard. Participants noted that wearing a doctor's coat and the presence of a nurse added to the sense of realness. According to a few participants, the direct availability of equipment trolleys and a crash cart did not correspond to a realistic ward setting.

All students mentioned the manikin in relation to the authenticity of the simulation. The manikin was perceived as almost a real person. The manikin's ability to speak, its palpable pulsations and breath sounds, and the ability to monitor its vital sounds made it almost seem "alive."

I kind of believed that the sounds were coming from the manikin and not from a person speaking someplace else. Especially at moments of high stimulus density, one isn't able to mark it [the manikin] as unrealistic. (P4)

Initially, it's strange to talk to a manikin, but once you get an answer back, you are completely drawn in. (P1)

I was talking to a manikin, but I did approach him as I would approach a patient. (P10)

The lack of facial expression and temperature and the unchanging skin color were perceived as unreal. Several students thought a changing skin color was the crucial missing element for making a diagnosis of anaphylaxis.

I do think [skin color] is very important. After I had missed [the anaphylaxis], you do realize you have to explicitly ask, "What can you tell me about the appearance of the patient? What is this person's color?" With normal patients, obviously, you can immediately tell something's wrong. (P11)

The manikin elicited empathy in quite a few students who wanted to “comfort him” and “rescue the patient,” especially when the manikin was expressing his fear or begged for help: “When the situation deteriorated, it felt like losing a patient for real” (P2).

Students largely remained aware of being in a simulated environment, and some students saw the manikin mostly as an educational tool.

If the patient deteriorated, I saw this as a prompt that something had to be done. (P3)

I wasn't very stressed about doing something wrong, like giving the wrong medication. . . . If it had been a real person, I would have been much more stressed out. . . . It was more like, “Let's see what goes wrong and learn from that. . . . This is practice, and this is a manikin.” (P10)

Being able to speak with the manikin, do a physical exam, and provide treatment made it almost like a patient encounter. A few students were concerned about damaging the manikin with invasive procedures: “I didn't dare to do everything, like stabbing the manikin with a needle in case of a pneumothorax” (P3).

The scenarios were considered very compelling, and all students believed they could end up in similar situations as newly qualified doctors. The only unrealistic aspect of the scenarios was the fact that no one appeared after the student called for help. Most students accepted this as part of the simulation, assuming “nobody would arrive anyway.”

During the Scenario

Scenarios started gently, but the manikin soon started to deteriorate, rapidly increasing pressure on the participants, oftentimes overwhelming them.

The simulation started gradually and then stimulus 1, and stimulus 2, and stimulus 3 hit me, and I had to filter. . . . There are so many possibilities. And where is everything stocked? So many things to be sought, so many things not to be found, all those options. Leave them be; let's focus on the patient. (P4)

Sometimes I felt like a deer caught in the headlights. That unease, that is what I call stress. (P3)

Virtually all participants experienced the deterioration as stressful. Some students noticed sweaty palms or an increase in heart rate, whereas others were unaware of any bodily sensations. A few students described the room as “intimidating,” experienced the “walls closing in” in relation to stress about the deteriorating manikin: “You are sweating more, are getting a real adrenaline rush. It made me double my efforts, but once the patient deteriorates, you start to feel a little claustrophobic in that room” (P2).

Primarily, stress manifested mentally. Students felt pressed to take decisions and do things but struggled to think clearly. Students indicated having difficulty accessing their knowledge or prioritizing and sometimes forgetting what they intended to do.

When I saw on the monitor that it wasn't going well, thoughts were racing through my mind. "It could be this, or this, or this. I could do several things, but which one? And when?" (P6)

I tried to read the sheet with CPR instructions, to understand them, and then execute them. But then I realized: I'm reading them, but I'm not processing them. I'm not my usual calm self. (P8)

Outside the room, before and after the simulation, I had a clear picture of the situation and what course of action to take. As soon as I went inside, I had a blackout. (P8)

Students also described feelings related to being frozen in place or in time. Generally, time passed slowly when students felt stuck, and time went faster during periods of activity.

I think initially I didn't move at all. I walked up to the patient, and then I stood there, being stuck and extremely nervous. (P3)

The pulse oximeter made a penetrating, beeping sound. It felt like time had frozen. . . . If you don't know what to do, then every second is painful and feels like a minute. (P3)

I thought, "I don't know what to do". . . and then time is going so slowly. At those moments, I thought, "Ooh, they might as well come in because there's no point to it anymore!" (P5)

"Not Just a Game, but Still Simulation"

Every student remained more or less aware of being in a simulation. Some in particular saw almost everything in light of the simulation exercise. The continuous awareness of being in a simulated environment mitigated the effects of stress and helped these students stay composed.

I see those ST elevations [elevation of the ST segment on the ECG]. That's probably just a myocardial infarction. Then I thought, "This is a simulation, what will probably go wrong?" I thought, "He will probably get VF [ventricular fibrillation]." (P9)

I was kind of assuming the manikin was going to crash. So I was thinking about the diagnosis: What could it be? And what could then go wrong? (P11)

It is in my nature to perform best in a demanding and stressful situation. I never experience this as such; rather, I act hyperalert and feel very much at ease. . . . Primarily, it made me happy and euphoric. (P9)

Most of the time I felt quite calm. Except for that tunnel vision [I had]. But I certainly didn't experience a panic attack. (P11)

I was pleasantly surprised to find I stayed calm and was still able to think, especially as I want to specialize in anesthesiology. But, of course, the real world is different. I knew it was a manikin, and a disastrous situation was going to be created. You do realize something is going to happen that won't necessarily be my fault; I just need to solve it to my best ability. (P10)

Role and Performance

The setup with a "non-obstructive" nurse requiring instructions forced the students into the role of doctor, and this situation was novel, exciting, and impressive for the participants.

I felt like a real doctor in the simulation. This was one of the few times I felt completely responsible for a patient. I realized this immediately. And it felt quite good. (P2)

I particularly enjoyed the independence one had to demonstrate. It makes me thrive. I find it amazing. . . . Having to give very precise orders to make sure something gets done is something I really enjoyed. (P9)

A majority of the participants indicated that they focused on medical management, and this focus kept feelings about the patient at bay. However, many mentioned feelings of doubt and worry about their performance, and these feelings were “unpleasant” and “a shocking revelation.”

I was primarily occupied by my own medical competence and incompetence, so I wasn't thinking, “Darn, I am losing that patient.” (P2)

A junior doctor on his first evening shift, with realistically too little ability. That's what I felt like. (P4)

It also made students feel “unprofessional” when they didn't give clear instructions to the nurse or retracted them: “I felt like crawling into a corner. . . . It was like, ‘Oh dear, I am sending her [the nurse] all over the shop!’” (P6).

Perceptions of poor performance significantly contributed to stress.

I don't stress out easily, but on the other hand I have certain expectations of myself. So it is stressful in some way if you cannot live up to those. (P7)

I wouldn't call it fear, but perhaps that's the best way to describe it. . . . Somebody could die just because I intervene in the wrong way. (P6)

Urgent situations in which the course of action was not evident triggered feelings in the students of incompetence and “lack of control” in which their initial confidence faded, the self-image of a doctor crumbled, and the limits of their competence were exposed.

When I knew more, or felt in control, I felt a little bit ahead in my medical training.

When not [feeling in control], I went back to being a medical student. (P11)

There were short moments when I knew what to do. Those felt like being a resident doctor. But as soon as I thought “help!” it was more like, “I’m a medical student. I don’t know!” (P8)

Often, this feeling of uncertainty reverted to one of certainty if the manikin had a cardiac arrest.

Students explained that the protocolled approach of basic life support provided “firm ground”; the students often experienced a paradoxical sense of relief or even of being in their “comfort zone” executing “standard procedures.”

If the patient is deteriorating, it places you on firm ground. At least you can do something. (P3)

When the patient had to be resuscitated, I thought: “Shit! . . . but let’s do it!” You kind of know how to make a start, which is comforting. . . . Comforting, because you know where you stand. (P11)

Students’ perceptions of their own performance varied from “outright failure” to a “bare pass.”

Most students had expected to perform poorly in this pretest and did not really mind as there were no consequences to “failing” the formative test.

I’m just not ready [for such clinical situations]. I can’t really say I felt angry or like a very big failure. Because I didn’t expect to perform much better than I did. (P6)

I’m rather perfectionist by nature, so it is annoying to fail. Regardless of what you do. On the other hand, it’s a relief, knowing you’re not expected to be perfect. (P11)

Despite this expectation not to do well and the absence of formal consequences, all students regarded their performance and knowledge level as “a shocking revelation” and “disappointing” to varying degrees.

Basically, I think it’s a matter of not wanting to fail. And you know you will fail. (P4)

It was very intense. I was confronted with my incompetence, the realness of the simulation, and the demanding nature of emergency situations. It truly was a mirror. (P3)

It was so bizarre that I didn’t notice the patient was basically bleeding out. It was so obvious! . . . It’s just a shocking revelation. Because at these moments, you realize you are far from knowing enough [to manage] such a situation. (P6)

That evening, I thought: “Hopefully I won’t experience these feelings as a qualified doctor.” Being at such a loss. (P2)

Of course it is frustrating to still feel, after 5 years of studying, like [you are] failing. (P4)

Being Observed and Assessed

Generally, students did not mind, hardly noticed, or tended to forget the observation. Several students mentioned the one-way screen helped them to ignore the fact that they were being watched. Also, the staff’s attitude was helpful. Students appreciated the nonjudgmental and informal atmosphere and that they knew who was observing. “I knew [the staff] weren’t eager to let us fail. Rather to make sure we learn something” (P9).

During moments of uncertainty, students became slightly more aware of the one-way mirror, and a few were preoccupied by the ongoing assessment of their performance.

I am being watched. I must do something! (P3)

When the scenario ended, I walked out, and then I realized they have seen me blow it. That voice saying, “Let’s stop” felt a bit like a condemnation. Especially if the scenario went badly. Then it [leaving the room] kind of felt like a walk of shame. (P2)

[Note: The facilitator’s actual words were “end of scenario.”]

After the Scenario

Most students felt a sense of relief at the end of the scenario, especially if they felt uncertain or stuck.

If it went that badly, then [the end of the scenario] felt like a kind of relief. Like being put out of my misery. (P4)

I felt relieved. I was thinking, “Alright, I can’t think of anything else to do!” (P11)

All students found the short personal debriefing sessions after each scenario crucial to their learning, especially the “immediate” and “to-the-point” nature. They appreciated the constructive feedback in that not just the mistakes but also the correct actions were highlighted. This was helpful in regaining self-confidence. In addition, participants regarded being able to vent emotions, “to let off steam,” in a safe and nonjudgmental environment as valuable.

You only learn from mistakes if you get the correct answer later or if you can discuss it. Without that debriefing, the simulation would be much less useful. (P4)

I am very good at recalling what went wrong, even though there were also things that did go well. It is nice that that is being pointed out. (P6)

Motivation to Learn

The simulation pretest reinforced students' orientation toward acute medicine, and students did not experience being unfit for this domain. Students felt more aware of the short-term and long-term challenges ahead and were motivated to improve upon themselves.

It reinforced my aspirations. This is what I want to excel in, so I'd better put in some effort now, because I want to do better than I did today. (P3)

As a resident in—say—cardiology, being called for a resuscitation, you could easily make the same mistakes. . . . Only with more responsibility. . . . I want to have the skills to do it well. It is such a weird idea that it actually happens: People with my current competence level ending up in real situations like these. (P7)

I was a little frustrated, because you know you will fail. But it was also rather nice, as it provided me with another goal to work toward. (P1)

I feel I have a long way to go before I'm ready to be a resident. . . . I now know where my gaps are and which areas to improve upon. (P8)

The simulation pretest made the students more aware of the goals and expectations of the dedicated transitional year, and the students expected it to direct their learning in their final year. They were keen to exploit the learning opportunities in the year ahead.

Without the simulations, I also would have started my final year clerkships. But perhaps I would have been more passive. Now I really want to get the most out of this year. (P2)

I assume I will experience this [similar situations] multiple times in the year ahead, and that I will progress. So, it'll probably be all fine in the end. (P8)

From now on, when situations like these occur, I may perceive them differently.

Meaning, I'll try to engage more with what's happening at the time. Also, as a means to prepare me for the posttest. (P11)

It is very informative to know what's expected from you once you qualify. . . . It's a sort of guideline, outlining the gaps in my knowledge. It demonstrates what I should study in greater depth or what I should pay attention to during my clerkships. (P9)

I didn't mind being tested on a more advanced level. [It is] just something to work toward. I now know where I stand today and where I'll hopefully be at the end of the year. (P5)

Aftermath

Many students felt “exhausted” and “mentally tired” on the day of the simulation, but some felt “euphoric” or “energetic.” Some students realized they had gone through something special: “I realized this is a unique experience nobody or hardly anybody from my medical school will have” (P2).

Everybody enjoyed the simulation, describing it as “fun.” Students emphasized this, stating that although the simulation was intense and stressful, they still had a great time and enjoyed it. The enjoyable aspect of the simulation for the students was solving a puzzle and realizing they could handle complex medical situations to a certain degree.

I was impressed that I myself had to give orders or directions to a nurse and had to press the “defibrillate button” myself. I couldn't stop thinking about it the rest of the day. (P2)

Besides knowing where I should be at the end of medical school, it [the experience of the simulation] might also give me a sort of confidence, knowing I am capable to help out in an emergency situation until the real team arrives. (P9)

Supplemental digital content for Groot F, Jonker G, Rinia M, ten Cate O, Hoff RG. Simulation at the frontier of the zone of proximal development: A test in acute care for inexperienced learners. Acad Med.

^aParticipants were 11 students beginning their 6th, and final, year at the University Medical Center Utrecht.