# Peer-assisted learning in simulation-based medical education: a mixed-methods exploratory study

Leo Nunnink [1,2] Andrea Thompson,[1,2] Nemat Alsaba,[3] Victoria Brazil[3]

## ABSTRACT

**Introduction** Peer-assisted learning (PAL) is well described in medical education but there has been little research on its application in simulation-based education (SBE). This exploratory study aimed to determine the perceptions of senior medical students at two universities to teaching and learning in SBE using PAL (PAL-SBE).

**Methods** Ninety-seven medical students at two universities working in small groups with facilitator oversight wrote, ran and debriefed a simulation scenario for their peers.

This was a mixed-methods study. Participants completed a written free-text and Likert survey instrument, and participated in a facilitated focus group immediately after the scenario. Thematic analysis was performed on the free-text and focus group transcripts.

**Results** Student-led scenarios ran without major technical issues. Instructor presence was required throughout scenario delivery and debrief, making the exercise resource intensive. Participant responses were more positive regarding learning as peer teachers in simulation than they were regarding participation as a peer learner. Five themes were identified: learning in the simulated environment; teaching in the simulated environment; teaching peers and taking on an educator role; learning from peers; and time and effort expended. Perceived benefits included learning in depth through scenario writing, improved knowledge retention, understanding the patient's perspective and learning to give feedback through debriefing.

**Conclusion** PAL in SBE is feasible and was perceived positively by students. Perceived benefits appear to be greater for the peer teachers than for peer learners.

## INTRODUCTION

Peer-assisted learning (PAL) is a well-described teaching strategy that can enhance students' content knowledge and educational skill,[1] but there is a paucity of literature relating to its use in simulation-based education (SBE) in health profession education.

There are diverse approaches, formats and aims described for PAL. One working definition describes PAL as '….people from similar social groupings who are not professional teachers helping each other to learn and learning themselves by teaching.'[2 3] In medical education, peer educators are medical students teaching and learning from other medical students. The theoretical underpinnings of PAL in medical education include social learning theory[4] where behaviour, the individual and the environment interact to determine learning. Observation and modelling of peers' behaviour becomes a driver for learning through PAL. This has been expressed as a 'cognitive and social congruence between peers…. to promote delivery of appropriately pitched teaching in a safe environment.'[5]

PAL is generally positively perceived by learners.[6 7] Suggested learner benefits of PAL include a non-threatening learning environment[8] and teaching that is targeted at an appropriate level based on the tutors' understanding of the learners' likely learning needs.[9] Peers-as-learners in PAL programmes have shown objective improvements in cognitive development, psychomotor development and leadership skills[10] using assessment modalities that include written examinations and assessments of clinical skills.[11–13]

The benefit of teaching as a peer tutor is less examined, but has been shown to be associated with improved academic and clinical performance.[12 14 15] Peer tutor surveys have shown additional perceived benefits that include improved teaching skills, communication skills, cross-professional understanding and an increased concern for patients' welfare.[16–19] Whether there is benefit in having peer tutors create lesson content is not established. In one study, peer tutors expressed positive responses to their teaching materials being prepared for them by experts,[20] while in another peer tutors found creating the lesson content itself a valuable part of the exercise.[21]

### PAL and SBE

Using PAL in SBE may not be intuitive to simulation educators given the educational and technical expertise required for the design, delivery and debriefing of SBE. However, there is conceptual alignment between drivers of learning through PAL and learning through SBE. A 2017 review of PAL in medicine[22] outlines many of the areas of overlap between PAL and SBE, including a safe environment in which to learn from mistakes, deliberate practice and immediate feedback.

A conceptual framework for the methods by which PAL is achieved is offered by Topping and Ehly.[23] The framework considers the organisational and structural features of the interaction, conflict and challenge, scaffolding and error management, as well as communication and affect.

As a team-based exercise, observation and imitation are core elements of SBE, even when the peers are merely co-participants. Conflict and challenge are seen as elements of PAL, 'necessary to loosen blockages from old myths and false beliefs'[23] and also have parallels in the transformative learning processes that are often quoted as important in

simulation.[24][25] 'Support, scaffolding and error management'[23] in PAL are similarly relevant in instructor-facilitated simulation. Unique to PAL-SBE is the learning value to the peer instructor in providing that support and scaffolding, in being alert to their peers' performance as learners, and providing error detection and correction both in the scenario and the subsequent debrief. In most PAL, the peer instructor has the opportunity to '…. provide a cognitive model of competent performance.'[23] In PAL-SBE, the learner seeks to achieve competent performance through experimentation rather than through modelling of either peers or instructors.

Few prior studies have evaluated PAL in simulation.[26–29] One study[27] required medical students to write a scenario based on one of three trauma clinical presentations. Written scenarios were assessed without actually being performed. As an assessment instrument, the written scenario was found to have acceptable validity. In a nursing study[26] near peers worked as simulated patients in faculty-run scenarios. In a study of first-year nurse anaesthetist students,[28] second-year students worked as peer teachers to run faculty-written task-focused intubation scenarios. Another nursing study[29] had senior students teach patient assessment skills in a simulator laboratory, within very tight constraints, and found equal performance outcomes compared with instructor-led teaching. No previous study has allowed students free rein to choose a clinical topic, write a scenario and run it for their peers.

The authors have previously reported a 12-month pilot project involving 79 final-year medical students who wrote and ran SBE.[30] This demonstrated that peer-led SBE was challenging but feasible and hinted at unanticipated potential benefits. These included an improved understanding of the patient's perspective through acting as a simulated patient, and better understanding of interprofessional roles through acting as a nurse confederate.

Drawing on the literature and our previous work, in this study we sought to extend our understanding of student perceptions of PAL in SBE. We sought to understand what students perceived to be the benefits and drawbacks of peer teaching and learning in an open-ended fashion, and to better understand student perceptions of giving and receiving feedback.

## METHODS
### Study design
We used a convergent design method with qualitative and quantitative data obtained simultaneously and analysed in a complementary fashion.[31] Quantitative data were obtained using a purpose-written Likert survey instrument targeted at specific questions. Qualitative data were obtained from free-text written responses and verbal responses during focus groups. Thematic analysis of these data provided the opportunity for an open-ended exploration of students' perceptions of PAL-SBE.

### Study setting and participants
Medical students at Bond University and University of Queensland (UQ) complete a number of simulation scenarios in discrete programmes as part of their training. The Bond University medical programme is a 5-year undergraduate programme with an integrated simulation curriculum. Scenarios include both simulated patient and manikin modalities, selected according to the scenario content. The UQ medical programme is a 4-year postgraduate programme incorporating simulation in the final year. Students complete 2 days of SBE in teams using a manikin patient simulator.

Study participants were final-year medical students at UQ and fourth-year medical students at Bond University. Recruitment took place from July 2017 to November 2018. Students from both institutions who had participated in PAL-SBE sessions were invited to participate. Participation in the SBE was a required learning activity, but participation in the evaluation was voluntary. Students who chose not to participate in the study did not complete the survey instrument or focus group.

### PAL simulations
Elements of the PAL-SBE intervention are described according to the method developed by Cheng et al.[32] Participating students were asked to write, facilitate and debrief a scenario-based simulation in groups of two to four. During a 2-week preparation period, students were tasked to develop a scenario based on a clinical encounter or topic of interest. In a session scheduled for up to 2 hours, they were provided with a scenario template and general guidance about writing scenarios and learning objectives. Students were given a very brief introduction to debriefing. As novice educators, they were taught to debrief using the simple plus-delta model.

UQ students had an available dedicated simulation space, Laerdal 3G manikin with vital signs and voice control from a separate control room, and two simulation faculty members. Members of the student groups were required to act as the patient voice and as nursing confederates in the scenario they designed. Technical support was by simulation faculty. Example scenarios included acute severe asthma, trauma, status epilepticus, viral encephalitis, anaphylaxis and pulmonary embolism. Most groups chose emergency medicine presentations rather than deteriorating ward patients.

Bond University students had an available dedicated simulation space, trained simulated patients and nurses as nursing confederates. Example scenarios include dizziness, recurrent falls, vertigo, delirium and chest pain.

During this preparation phase, students were supported by simulation faculty, who provided expert feedback on scenario design and planning for delivery. Students were initially asked to provide their scenario topic and were given feedback as to whether this was amenable to learning through SBE. Once a topic had been finalised, students were free to craft their scenario and were given feedback on request.

At both institutions, groups then joined for a half-day session in which they alternately participated as both teachers and as learners in peer-led simulation sessions, supported by simulation faculty. Students were expected to debrief the simulation, leading a reflective discussion on clinical, communication and teamwork aspects of the scenario. Video-assisted debriefing was not used.

### Data collection
Immediately after the PAL-SBE session, participants completed an anonymous written survey instrument comprising a 5-point Likert scale as well as written free-text responses to open-ended questions regarding PAL. Participants then immediately joined an instructor-facilitated focus group, led by LN at both institutions using a semistructured topic guide Focus group size varied from 4 to 16 participants and session duration was 20–40 min. Focus group discussions were transcribed verbatim.

The evaluation instruments and interview guide were designed by authors AT and LN during a 12-month pilot phase which has been reported.[30] The written survey instruments and interview guide are provided in the online supplemental material.

## Data analysis

Quantitative Likert item survey data are presented descriptively.

Qualitative data analysis was performed according to the six-step process described by Braun and Clarke.[33] Written free-text responses from the surveys and interview transcripts were independently coded by two authors. LN used NVivo (QSR International), AT used Microsoft Excel. An independent inductive analysis of the free-text questions was also performed by VB and NA. Authors then met to compare findings and create agreement on relevant themes and subthemes. 'Orphan' themes identified by only a single author were merged with others or removed by consensus. Themes were reviewed and defined in an iterative process involving frequent return to source data. Data sufficiency (no new identified themes in the last study cohort) had been achieved by study completion.

Once a set of agreed themes and subthemes was established, the themes were presented to a selected group of study participants for member checking. The participant group were comfortable that themes reflected the opinions expressed and did not recommend modification or inclusion of additional themes.

## Researcher characteristics

The research team are all clinicians, educators and simulation advocates. LN is an intensive care specialist with responsibility for SBE for final-year medical students undertaking their critical care rotation at UQ. LN is involved with student assessment and progression decisions, and it was made clear to students that participation/non-participation would not have any impact on their results or progress. LN has been the lead investigator in several educational research projects with quantitative results. AT is a simulation specialist from a nursing background who supports SBE for UQ medical students but is not involved with student assessment. NA is an emergency physician and medical educator with broad responsibilities for Bond University medical student teaching and simulation in particular. VB is an emergency physician and experienced simulation educator who is lead for SBE in the Bond University medical programme. VB has been the lead investigator in several educational research projects using both qualitative and quantitative methods.

## RESULTS

Ninety-seven students participated in the study. There were 26 students from Bond University (100% participation) and 71 out of a potential 93 at UQ (76% participation).

Likert scale responses are provided in table 1. Students generally found the exercise valuable as a learning exercise both as a participant and as a peer teacher. Student response indicated that they thought they could contribute to their peers' learning. The greatest variation in responses was in relation to giving and receiving feedback, although the majority disagreed that it was difficult to deliver feedback to or receive feedback from a peer. Overall, 92% of participants answered that they would recommend the PAL exercise to their peers, while none answered that they would not.

Thematic analysis of discussions and written free text are presented in table 2. There were 5 themes and 18 subthemes. Exemplar text has been included for each subtheme. Where significantly conflicting opinions were expressed, an example representing each perspective has been included in the responses.

Five themes were identified, encompassing both experience as teachers and learners.

## Learning in the simulated environment

There were numerous comments about the value of simulation in general, not specific to the PAL-SBE exercise. A recurring sentiment was that any additional SBE was beneficial, whether facilitated by faculty or peers. Although pleasing, it was not relevant to the study question regarding the value of PAL-SBE specifically.

## Teaching in the simulated environment

Although students stated that it was challenging to tailor scenarios that were educationally appropriate for their peers, it is interesting to compare this with the reported experience of their SBE participants That is, students as learners found their peer-selected scenarios to be well pitched and in some cases more relevant than faculty-written scenarios. This suggests that the concerns regarding scenario selection were ones of perception rather than objective result.

Managing the unfamiliar technical skills and logistics of simulation was a challenge for students. Although a faculty member was assisted with scenario design and manikin controls, students were uncertain about the capabilities of the technology. Students found it difficult to prepare for and respond to participant actions, particularly when scenario progression deviated from what was expected.

A factor that students saw as important in creation of scenarios that ran effectively was faculty input into scenario development and delivery.

Consistent with the survey results, developing a patient script (and voicing the patient, for those using a manikin) helped students gain a patient-centred perspective on their chosen presentation.

## Teaching peers and taking on an educator role

Students found there was value in teaching as a learning exercise. Thinking through a patient's presentation in detail, creating pathology and radiology results, and considering patient

**Table 1** Likert responses to written survey, n=97

| Please indicate your level of agreement with the following: | Strongly disagree | Disagree | Neutral | Agree | Strongly agree |
|---|---|---|---|---|---|
| I am better able to manage emergency/deteriorating patients as a result of the peer-learning simulation | | | 2 (2%) | 61 (63%) | 34 (35%) |
| I found value in writing/running a scenario compared with just participating in one | | 1 (1%) | 15 (15%) | 48 (49%) | 33 (34%) |
| My team was able to deliver an effective simulation session* | | | 3 (3%) | 59 (61%) | 34 (35%) |
| I had valuable contributions to make to my peer colleagues' learning | | | 12 (13%) | 63 (66%) | 21 (22%) |
| I found it difficult to receive feedback from a peer | 32 (33%) | 53 (55%) | 7 (7%) | 4 (4%) | 1 (1%) |
| I found it difficult to deliver feedback to a peer | 20 (21%) | 53 (55%) | 18 (19%) | 4 (4%) | 2 (2%) |
| I found educational value in my peer's feedback on my performance | | | 2 (2%) | 9 (9%) | 58 (60%) | 28 (29%) |
| I understand the patient experience better as a result of delivering the simulation | | | 7 (7%) | 25 (26%) | 43 (44%) | 22 (23%) |

*One non-respondent for this question.

**Table 2**  Themes and subthemes identified in written free-text responses and focus groups, (n=97)

| Theme | Subtheme | Examples |
|---|---|---|
| Learning in the simulated environment | Practical clinical learning | *It's great to be able to have an environment where we can make some mistakes at this stage of our learning, without any kind of critical consequences. And then really get a good learning experience from those mistakes. Not everything has to go right.* |
| | Retention of knowledge | *…being able to participate in a simulation creates a better learning environment that sticks, rather than just reading.* |
| Teaching in the simulated environment | Challenges of case selection | *I think a lot of the times these cases were taken from what we've seen at hospitals, so it's good to see what other teams have seen as well, and how they've managed compared with what you've been able to see, because we don't actually get to see a lot of the same things.*<br>*I would prefer if you guys (faculty) already had 20 simulated cases already there and we choose which ones are interesting to us…. Rather than us just making up these random cases and trying to scramble as to what might be a good learning point for us to do.* |
| | Learning about simulation teaching | *You actually get to experience all the stages from writing up, to actually preparing on the day, briefing, and then debriefing. You go through different roles, and I think that's a good thing to experience, especially as team work.*<br>*One of the biggest problems that I had was finding out what is possibly an issue with the limitations of the device, versus this is how the patient is actually presenting.* |
| | Experiencing patient perspective | *You do get another perspective, though. Like voicing the patient, for instance, I kind of have a bit more of an idea of what it might be like for the patient, lying there in ED, in pain, and just having a group of people talking about you but not involving you in the conversation, being kind of… Like that kind of perspective that you don't get as the doctor.* |
| | Appreciation of logistics of simulation teaching | *I think the main thing that tripped our group up…. was when the people doing the sim kind of went off of what we we're meaning (them) to do and none of us knew what to do to get them back on the path. We didn't have any contingency plan…. How do we get them to check the blood pressure? How do we get them to realise they need call the blood bank?* |
| Teaching peers and taking on an educator role | Learning in more depth through teaching | *Designing a sim allowed me to gain an in-depth knowledge of the expected management protocol for our condition. It also helped me understand the potential pitfalls in managing such conditions. Useful for working out how labs/ vitals/ etc will present in different pathologies and recognising resources to guide management.* |
| | Debriefing/providing feedback | *I think the most valuable part of the peer sim is to debrief and actually getting familiar with the case yourself enough to talk about it in that much detail and actually know how to manage it.*<br>*Sometimes you feel like you don't want to be too critical of your peers because you know how hard it is in the room when everything's happening. Like when we were giving feedback, I definitely didn't want to come across like 'you guys sucked. What were you thinking?' Because, it's so hard and like we know it's hard. But I think I agree it is really important to have that negative and positive feedback because otherwise we're not learning…. I felt like I had to consciously give myself permission to say things.* |
| | Uncertainty in providing quality teaching | *Have I studied this enough? Is this in enough depth? Do my colleagues find this relevant, interesting, useful? Like it's hard to know if you're hitting the right points.* |
| | Working with faculty | *I really appreciated the iterative process with getting feedback from (faculty) and changing the scenario and lab results. The process made my clinical reasoning a lot stronger.* |
| | Teaching peers | *But, I definitely thought it was really fun to come up with this scenario but then also to talk to people afterwards and be like, this is kind of what we were going for and run through the debrief. I thought that doing all of that was really fun.*<br>*I didn't enjoy this aspect. I prefer to be the learner than the peer (teacher) for sims.* |
| Learning from peers | Receiving feedback from peers | *I found there was actually a significant advantage to have peer feedback, because it's a lot easier for me, I think it's a lot easier for a lot of people, to take criticism, to take critical feedback from a peer than it is from a consultant or registrar.*<br>*But a student can say the same thing, and you (instructor) can say the same thing, what you have is you have this ability to make it very coherent and simple in a way that translates well to me as something I can learn from, and keep with.* |
| | Peer learning through observation | *I think it was useful to see or observe other students. Like we always see more senior clinicians all the time, managing a problem, taking care of it, and to see other people with our same level of training trying to work through it was a little reassuring in a way.* |
| | Peer learning through competition | *….they've set up something, can we get through this scenario and keep our patient intact, or have they beaten us? It's maybe a little bit of fun if we think of it that way.* |
| | Appropriateness of level of difficulty | *I thought everyone would agree that (the peer scenarios were) really fair, that each student should have pretty good knowledge about it…. I thought the debriefs were really good to be by other students, because they kind of just hit the points that as a fourth year medical student it's probably appropriate that this is what you already, what you actually know. Instead of just going too far above where you (are). I thought the thing written by students just ensured that it was pitched (appropriately), and I thought that it was.* |
| Time and effort expended | Group work | *The value of team work both in designing as well as participating in a case…*<br>*The sims can only be as good as the effort the teams put into them. Some team members slacked a lot.* |
| | Value of PAL-SBE relative to other activities | *I thought that was really important, because I'm happy to put time into it, because I think it's been really worthwhile…as far as the benefit gained, I think just doing and watching the scenarios is the most helpful. So I didn't notice it being hugely more beneficial that we or our classmates were running the sims today.* |
| | Additional workload | *I don't think the work was a concern at all. We shouldn't expect to not do any work at (medical) school anyway.*<br>*It was difficult to find time on my already very busy rotation to write our scenario so it felt like the more in-depth aspects were missed.* |

ED, emergency department; PAL, peer-assisted learning; SBE, simulation-based education.

pathophysiology and responses to interventions all added to deep knowledge acquisition and retention.

Debriefing and providing feedback to peers was the subject of mixed responses. Providing negative feedback to peers was seen to be important but difficult, with students concerned about being perceived to be critical. Others found debriefing to be a worthwhile learning experience, requiring detailed understanding of the clinical case to be able to critique others' performance. Several participants expressed anxiety about their ability to provide a high-quality teaching experience for their colleagues.

### Learning from peers
Some participants found peer feedback to be less threatening than feedback from senior colleagues. Others expressed that instructor feedback was more concise and more targeted.

Students found the experience of observing peers to be instructive and somewhat reassuring. This applied both to observation of peers participating in simulation and the observation of the scenario challenges that peers had created for them. Students were heartened to find that they could generally deal with scenarios that were considered testing by their peer instructors. Competition was viewed positively, with perceived

educational value in solving the scenario 'puzzle' that had been set by peers.

### Time and effort expended

Students provided mixed responses as to whether the exercise provided a valuable return for time invested, or whether students would have better engaged with other learning activities, for example, instructor-led simulation. Time pressure was a perceived barrier to scenario preparation. Of those participants who mentioned group work, most were unhappy about unequal contributions within the group.

### DISCUSSION

The elements of challenge, error detection and correction that are common to both SBE and PAL[23] were perceived by students to be important to learning. Separating perceptions of the learning value of peer-facilitated SBE from that of faculty-facilitated SBE was difficult—that is, we received many generically positive responses about SBE. Although survey data indicated that students were positive about learning from SBE facilitated by peers, free-text responses did not indicate a perception of superiority over faculty-led scenarios.

Key components of social learning, such as observation of peers and competition with peers, were identified and seen as beneficial. However, these were considered equally applicable to working with peers, as co-learners, in faculty-led SBE. The most consistently positive responses related to learning through instructing are providing the support and scaffolding for others' learning.

Students generally found that identifying a topic and writing a scenario contributed to better retention and deeper understanding of a clinical condition. Students gained further detailed knowledge by educating their peers in the post-scenario debriefing. Survey data were quite positive about students' experiences providing feedback. Debriefing their peers' performance provided what was for many a first opportunity to provide feedback in a supported environment—an important skill as they progress to become educators themselves.

Peer learners thought that there was adequate support for learning provided by their peer instructors. Although students-as-teachers saw choosing a scenario as difficult, students-as-learners found them to be at an appropriate level. Given that the perceived benefits of PAL-SBE for the peers-as-instructors seemed to be greater than for the peers-as-learners, it may be a strategy that works more effectively for near-peer teaching rather than for peers in the same cohort.

When students acted as the 'patient' voice, they were able to gain an understanding of the patient's perspective as evidenced by majority support in our survey responses. Students were able to provide feedback on their peers' often suboptimal communication strategies and use of jargon. However, those students who took on the nurse confederate role did not identify this as a useful method to gain an understanding of cross-professional roles, in distinction to our early findings during a pilot phase.[30] Although not observed in this experience, care should be taken not to allow student role-playing to project negative stereotypes of other professionals or patients.[34]

Emotional arousal is a feature of learning through simulation,[35] although whether it is advantageous[36] or disadvantageous[37 38] to learning remains unresolved. Having a scenario created and debriefed by a peer who is not in a position of authority may help to facilitate learning by modulating that activated state. Surprisingly, emotional arousal did not appear as a theme in our

data. Students felt less threatened by peer-led debriefs than by instructor-led debriefs.

Although not the primary goal of our study, we expanded on our pilot study[30] to further demonstrate that PAL-SBE is feasible, working with both simulated patients and manikins in two different medical programmes. However, our study did not show two key benefits attributed to PAL in the published literature—specifically reduced costs and expanded capacity provided by student instructors.[22 29] Instructor presence was mandatory throughout delivery and debriefing, and having students write scenarios required *more* time than having instructors deliver prewritten scenarios. Having groups of students lead one-off simulation scenarios cannot be recommended on the basis of resource utilisation alone. Leaving out the learning outcomes and looking purely at cost-effectiveness, a longer duration simulation placement for one or few students (as has been described by some of the current authors)[39] may make more sense.

### Limitations

Student reflections are by self-report only and no objective measure of their learning, behaviour or skill was undertaken within the study. However, our evaluation strategy was considered appropriate for an exploratory study of a previously unreported activity—student-led simulation where the students are entirely free to choose, write, run and debrief their scenario.

The study authors were also facilitators for the PAL-SBE sessions, and we accept that students may have been biased toward more positive responses in their reflections as a result of wanting to please us, despite anonymous survey responses.

---

### What is already known on this subject

► Peer-assisted learning (PAL) has a well-established role in medical education with demonstrated benefits for both peer learners and peer teachers.
► Few studies have examined the role of PAL in simulation-based education (SBE). Studies to date have found educational benefits to PAL-SBE comparable with facilitator-led SBE, but peer teachers had very constrained roles—either scenario writing or debriefing, or acting in or delivering prewritten scenarios.

---

### What this study adds

► This is the first study to give students free reign to choose topics then complete the process of scenario writing, delivery and debrief. Senior medical students at two universities were able to do so successfully. Students were able to write and deliver scenarios but required experienced facilitator oversight with the result that there was no reduction in resource utilisation.
► Students found participating in peer-led scenarios beneficial, without clear preference compared with instructor-facilitated scenarios. Observation of and competition with peers were perceived to be important for learning.
► Peer teachers identified scenario topic choice and debriefing as the most difficult elements. Thinking through a patient's presentation and responses to interventions were perceived to benefit a detailed understanding of pathophysiology and pharmacology. Acting as a patient helped students understand the patient's perspective.

Hence, we have tried to focus on the specifics of their perceptions, rather than binary positive or negative reflections.

## Implications for further teaching and research

Our study has demonstrated PAL-SBE is a teaching modality that can be successfully incorporated into an SBE programme. It has the potential to add to learning through knowledge acquired by writing scenarios and experience acquired through students placing themselves in the patient role. Students additionally gain experience in providing feedback through debriefing. If adopted in this manner, PAL-SBE is resource intensive and does not provide the cost savings that are typically associated with use of peers as teachers.

There are a number of avenues for further research. The patient journey, as experienced by the students, warrants exploration. Could a real patient function as an educator or coach for students who are role-playing? Additionally, we used a very simple debriefing model with limited instruction. Could students adopt more sophisticated debriefing models, and if so do these provide transferable skills which may be applicable more broadly in their graduate role?

## CONCLUSION

Incorporation of simulation scenarios written and run by students into a simulation programme (PAL-SBE) is feasible and positively perceived by students. Students appeared to perceive greater learning value from teaching using simulation compared with learning through peer-led scenarios.

**ORCID iD**
Leo Nunnink http://orcid.org/0000-0002-9242-8690

## REFERENCES

1 Silbert BI, Lam SJP, Henderson RD, et al. Students as teachers. *Med J Aust* 2013;199:164–5.
2 Ross MT, Cameron HS. Peer assisted learning: a planning and implementation framework: AMEE guide No. 30. *Med Teach* 2007;29:527–45.
3 Topping KJ. The effectiveness of peer tutoring in further and higher education: a typology and review of the literature. *High Educ* 1996;32:321–45.
4 Bandura A. *Social learning theory*. Englewood Cliffs, N.J: Prentice-Hall, 1977.
5 Bulte C, Betts A, Garner K, et al. Student teaching: views of student near-peer teachers and learners. *Med Teach* 2007;29:583–90.
6 Rashid MS, Sobowale O, Gore D. A near-peer teaching program designed, developed and delivered exclusively by recent medical graduates for final year medical students sitting the final objective structured clinical examination (OSCE). *BMC Med Educ* 2011;11:11.
7 Colaco SM, Chou CL, Hauer KE. Near-peer teaching in a formative clinical skills examination. *Med Educ* 2006;40:1129–30.
8 Nelson AJ, Nelson SV, Linn AMJ, et al. Tomorrow's educators … today? Implementing near-peer teaching for medical students. *Med Teach* 2013;35:156–9.
9 Lockspeiser TM, O'Sullivan P, Teherani A, et al. Understanding the experience of being taught by peers: the value of social and cognitive congruence. *Adv Health Sci Educ Theory Pract* 2008;13:361–72.
10 Secomb J. A systematic review of peer teaching and learning in clinical education. *J Clin Nurs* 2008;17:703–16.
11 Blank WA, Blankenfeld H, Vogelmann R, et al. Can near-peer medical students effectively teach a new curriculum in physical examination? *BMC Med Educ* 2013;13:165.
12 Knobe M, Münker R, Sellei RM, et al. Peer teaching: a randomised controlled trial using student-teachers to teach musculoskeletal ultrasound. *Med Educ* 2010;44:148–55.
13 Graziano SC. Randomized surgical training for medical students: resident versus peer-led teaching. *Am J Obstet Gynecol* 2011;204:542.e1–542.e4.
14 Wong JG, Waldrep TD, Smith TG. Formal peer-teaching in medical school improves academic performance: the MUSC supplemental instructor program. *Teach Learn Med* 2007;19:216–20.
15 Qureshi ZU, Gibson KR, Ross MT, et al. Perceived tutor benefits of teaching near Peers: insights from two near peer teaching programmes in South East Scotland. *Scott Med J* 2013;58:188–92.
16 McKenna L, French J. A step ahead: teaching undergraduate students to be peer teachers. *Nurse Educ Pract* 2011;11:141–5.
17 Brannagan KB, Dellinger A, Thomas J, et al. Impact of peer teaching on nursing students: perceptions of learning environment, self-efficacy, and knowledge. *Nurse Educ Today* 2013;33:1440–7.
18 McLelland G, McKenna L, French J. Crossing professional barriers with peer-assisted learning: undergraduate midwifery students teaching undergraduate paramedic students. *Nurse Educ Today* 2013;33:724–8.
19 Andrew Jay E, Starkman SJ, Pawlina W, et al. Developing medical students as teachers: an anatomy-based student-as-teacher program with emphasis on core teaching competencies. *Anat Sci Educ* 2013;6:385–92.
20 Robinson Z, Hazelgrove-Planel E, Edwards Z, et al. Peer-assisted learning: a planning and implementation framework. Guide supplement 30.7--practical application. *Med Teach* 2010;32:e366–8.
21 Hill E, Liuzzi F, Giles J. Peer-assisted learning from three perspectives: student, tutor and co-ordinator. *Clin Teach* 2010;7:244–6.
22 Herrmann-Werner A, Gramer R, Erschens R, et al. Peer-assisted learning (pal) in undergraduate medical education: an overview. *Z Evid Fortbild Qual Gesundhwes* 2017;121:74–81.
23 Topping KJ, Ehly SW. Peer assisted learning: a framework for consultation. *J of Psychol Consult* 2001;12:113–32.
24 Scott-Smith W. Transformative Learning and High-Fidelity Simulation. In: Brown J, Noble L, Papageorgriou A, eds. *Clinical communication in medicine*. Chichester, UK: John Wiley & Sons, 2015: 200–5.
25 Parker B, Myrick F. Transformative learning as a context for human patient simulation. *J Nurs Educ* 2010;49:326–32.
26 Owen AM, Ward-Smith P. Collaborative learning in nursing simulation: near-peer teaching using standardized patients. *J Nurs Educ* 2014;53:170–3.
27 Steinemann SK, Berg BW, Turban JW, et al. Student-written simulation scenarios: a novel cognitive assessment method in a trauma curriculum. *Hawaii Med J* 2011;70:172–5.
28 Szlachta J. Peer instruction of first-year nurse anesthetist students: a pilot study of a strategy to use limited faculty resources and promote learning. *J Nurs Educ* 2013;52:355–9.
29 Dumas BP, Hollerbach AD, Stuart GW, et al. Expanding simulation capacity: Senior-Level students as teachers. *J Nurs Educ* 2015;54:516–9.
30 Nunnink L, Thompson A. Peer-assisted learning in scenario-based simulation. *Med Educ* 2018;52:557–8.
31 Fetters MD, Curry LA, Creswell JW. Achieving integration in mixed methods designs-principles and practices. *Health Serv Res* 2013;48:2134–56.
32 Cheng A, Kessler D, Mackinnon R, et al. Reporting guidelines for health care simulation research: extensions to the CONSORT and STROBE statements. *Adv Simul* 2016;1:25.
33 Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006;3:77–101.
34 Purdy E, Alexander C, Caughley M, et al. Identifying and transmitting the culture of emergency medicine through simulation. *AEM Educ Train* 2019;3:118–28.
35 Rogers T, Andler C, O'Brien B, et al. Self-reported emotions in simulation-based learning: active participants vs. observers. *Simul Healthc* 2019;14:140–5.
36 Demaria S, Bryson EO, Mooney TJ, et al. Adding emotional stressors to training in simulated cardiopulmonary arrest enhances participant performance. *Med Educ* 2010;44:1006–15.
37 Leblanc VR, Regehr C, Tavares W, et al. The impact of stress on paramedic performance during simulated critical events. *Prehosp Disaster Med* 2012;27:369–74.
38 Harvey A, Bandiera G, Nathens AB, et al. Impact of stress on resident performance in simulated trauma scenarios. *J Trauma Acute Care Surg* 2012;72:497–503.
39 Brazil V, Caughley M, Middleton L, et al. Medical students as simulation educators: students' experience of a 7-week simulation-based education rotation. *BMJ Simul Technol Enhanc Learn* 2021;7:108–11.