Anxiety and Performance in Prehospital Emergency Care Simulation Assessments

Christopher Stein, PhD

Introduction: Anxiety experienced by students participating in simulations may impede their learning and performance. The added anxiety brought about by the socioevaluative nature of simulation assessments may accentuate this effect. This study aimed to assess the relationship between anxiety experienced by emergency care students and performance in an authentic prehospital emergency care simulation assessment.
Methods: The State-Trait Anxiety Inventory (STAI) was completed before and after a simulation assessment by 58 emergency care students across all academic years of study of a 4-year degree program in prehospital emergency care. The state anxiety component of the STAI was plotted together with marks obtained by each student using a standardized assessment tool, and curve estimation was used to determine the nature of the relationship between state anxiety scores and marks.
Results: Mean preassessment STAI scores were lower than mean postassessment scores (48.74 vs. 57.74), but mean scores from both groups were greater than normal mean scores for college students. The relationship of both preassessment and postassessment STAI scores with assessment marks was best described by a quadratic curve suggesting that performance was better at both the lower and higher ends of the range of STAI scores compared with the middle. Postassessment STAI scores provided a better fit with simulation assessment marks.
Conclusions: This study did not confirm the expected decrease in performance associated with increasing anxiety but rather suggests that some students may have the ability to respond positively to the highest levels of anxiety during simulation assessments.
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Key Words: Simulation, performance, anxiety.

Simulation has enjoyed wide adoption in both teaching and assessment across a broad range of health care disciplines.[1,2] Emergency care is no exception from this trend, with simulation having gained in popularity in the education of both hospital-based and prehospital emergency care professionals.[3–7] In a discipline where clinical learning opportunities for student clinicians can be both difficult to control and risky for patients, simulation offers a safe, ethically acceptable, and structured alternative for learning life-saving skills.[8] Similarly, simulation offers a way to assess a range of emergency care scenarios that may be otherwise impossible to assess in a repeatable, standardized way.

Stress is considered a normal part of caring for seriously ill and injured patients and is an important aspect of simulated care of such patients,[9,10] as is a student's ability to cope with stress and deliver an acceptable quality of care. In addition to the stress inherent in real and simulated emergency care, assessment of students in this environment adds another source of stress. Any assessment, which inherently involves the possibility of being judged negatively, may induce a socioevaluative source of stress.[11] Simulation assessments also combine a unique set of factors that tend to heighten the experience of assessment stress. During a simulation assessment, decisions need to be made in real time with very little time to weigh alternatives. In addition, feedback in the form of patient responses or clinical data is immediate, placing pressure on students to evaluate these data, modify their management plan, and continue oversight of patient care simultaneously. Feedback may also heighten the stress experienced by students during an assessment, if they interpret this as suggesting that care already delivered is not adequate leading to clinical deterioration of the simulated case.

The anxiety-inducing effect of stress experienced during simulations in health care education has been well documented. Students report a range of different sources of anxiety including perceptions about the supportiveness of simulation instructors,[12] personal factors such as self-confidence or feelings of embarrassment about making mistakes,[12,13] being observed or assessed in general,[12–14] being video recorded,[12–14] being responsible for a lead clinical role,[12,13] and anticipating events during a simulation.[12] It is possible that heightened levels of stress during simulations may affect student performance.

Stress, whether originating from the nature of emergency care or from the nature of being assessed or both, may induce varying cognitive and psychomotor responses from students during a simulation. According to a theory of situational appraisal and 2-stage response to stress,[15] students in a simulation may first appraise the situation and gauge how demanding it is

From the Department of Emergency Medical Care, University of Johannesburg, Johannesburg, South Africa.

Correspondence to: Christopher Stein, PhD, Department of Emergency Medical Care, University of Johannesburg, PO Box 524, Auckland Park 2006, Johannesburg, South Africa (e-mail: cstein@uj.ac.za).

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and then determine whether they have the personal and environmental resources to deal effectively with it. In situations where students appraise available resources as being adequate for the demands, the perception will be one of a challenge, which typically induces positive effects on performance. Demands appraised as being in excess of resources, on the other hand, result in a perception of distress leading to anxiety and typically negative effects on performance. Such effects may influence memory and decision making.[11,15]

Studies investigating the effect of stress and anxiety on student performance have produced mixed results. Drawing on cognitive load theory to hypothesize that emotional state and its effects on cognitive load might have negative effects on performance, 2 similar studies on different student populations found evidence supporting this hypothesis.[16,17] A mixed methods study investigating variables affecting simulation learning in nursing students found that anxiety did not mediate cognitive learning outcomes, although data from the qualitative component of the study highlighted a belief by students that anxiety had a negative effect on their performance.[18] Another mixed methods study with nursing students who completed 2 emergency simulation scenarios found no significant difference in performance across 3 graded levels of physiological anxiety (measured by assessment of heart rate variability). However, these authors claim to have identified a relationship suggesting that high levels of anxiety were associated with poor performance and vice versa for low levels of anxiety.[19] Conversely, stress and anxiety measured with cardiac monitoring and a nonvalidated questionnaire were not found to significantly predict performance in a simulated case among a group of emergency medicine residents.[20]

Leblanc et al[21] studied the effect of various stressors on clinical performance in a group of advanced care paramedics. Performance measured by means of a global rating scale was significantly lower in a high-stress simulated scenario compared with a low-stress scenario; however, a more detailed checklist of clinical actions showed no significant difference between the scenarios. In a study involving medical students completing advanced cardiac life support training, a randomly selected group was exposed to a set of stressors. When assessed 6 months later, the student group with greater stress exposure demonstrated significantly better practical performance in a simulation.[22] Last, in a study investigating stress and anxiety in a group of student nurse anesthetists performing an anesthetic induction simulation, marked increases in salivary α-amylase between baseline and during the simulation were observed.[23] These increases were the greatest in a group of low performers and high performers (as defined by the authors), with moderate performers showing almost no increase. The authors conclude that what they interpret as high levels of stress can induce both poor and good performance in different students.

The studies described previously have used a range of different research designs, stress and anxiety measurement techniques, and student populations and, as mentioned previously, have produced varying results some suggesting a positive and some a negative relationship between stress and anxiety and performance. Only 1 study has investigated this relationship in a population of prehospital emergency care personnel.[21] However, in this particular case, the research participants were not students. Little work has been done in the area of prehospital emergency care student simulation, stress, anxiety, and performance. This study aimed to describe the relationship between anxiety and performance during authentic simulation assessments in a sample of university prehospital emergency care students.

METHODS

Population and Sample

The study population was made up of all students registered for a 4-year professional degree program in the Department of Emergency Medical Care at the University of Johannesburg, South Africa. The bachelor of health sciences in emergency medical care program leads to registration at the Health Professions Council of South Africa as an Emergency Care Practitioner, the top tier of advanced life support–level prehospital emergency care provider. Simulation is used throughout all years of the program for both teaching and assessment.

The sample was composed of all students who consented to participate in the research, which involved data collection before and after scheduled simulation assessments in each academic year of study toward the end of 2018.

Setting and Simulation Assessments

The simulation assessments were conducted in the Faculty of Health Sciences Simulation Laboratory on different days, each scheduled in advance as formal assessment dates. In the first- to third-year assessments, students completed a 15- to 20-minute adult emergency care scenario relevant to their clinical level, whereas the fourth-year assessment involved a 20- to 30-minute pediatric emergency care scenario. Cases for each simulation assessment were selected by the lecturer responsible for the module in each academic year of study. Final selection and approval of cases were done with the input of an external moderator who was an experienced clinician. With the exception of the second-year group, student numbers in the other academic years of study required simulation assessments to be held over 2 days. To prevent disclosure of the simulation assessment case, 2 different cases judged to be of similar complexity and difficulty were selected for each of the 2 assessment days. A brief description of the simulated cases used in the assessments is given in Table 1. The final mark for each simulation assessment was weighted together with other assessments within each academic year of study and counted toward a final subject mark for the year.

Simulations were assessed similarly in all 4 academic years. The same simulation assessment tool was used for all simulations. The tool was composed of a set of assessment outcomes chosen by the lecturer who compiled the assessment in each year. These outcomes were assigned weightings by 3 independent experts, and the average of the three was used as the final weighting for each assessment outcome. An assessment rubric was constructed with a set of scores and descriptors for each assessment outcome. The assessment rubric was approved by the external moderator in each case. Score categories were best practice, competent, omitted, not yet competent, minor harm, and major harm. Two and 3 independent

TABLE 1. Description of Simulations

First year

Simulation A: A 59-year-old male type 2 diabetic patient who is taking oral hypoglycemic medication and has a reduced oral food intake. The patient is confused and disorientated with a right-sided hemiparesis and hypoglycemia confirmed with a reagent strip blood glucose test. Required management includes peripheral intravenous access and administration of 2 doses of intravenous 50% glucose solution, packaging, and transfer to hospital

Simulation B: A 75-y-old male patient who was assaulted with a blunt object the previous evening. The patient is found lying supine in bed at home and is initially responsive only to painful stimuli. Clinical assessment reveals a soft tissue injury to the scalp, bradypnea, mild hypoxemia, and noisy respiration suggestive of a partial airway obstruction. Required management includes manual airway maneuvers and ongoing management of the airway, supplemental oxygen administration, packaging, and transfer to hospital.

Second year

A 30-y-old HIV-positive male patient who has been experiencing severe diarrhea for 48 H and is moderately dehydrated. The patient is found alert and orientated, but with slight hypotension, dry mucous membranes, and a tachycardia. Required management includes peripheral intravenous access, intravenous fluid administration, packaging, and transfer to hospital.

Third tear

Simulation A: A 30-y-old male patient who has entrapped lower limbs after an accident where a boat that he was working on has collapsed. The patient is found still entrapped at the level of the upper legs (no pelvis involvement). He is conscious but very anxious. Clinical assessment reveals that he is complaining of being cold with severe pain at the level of the entrapment. He presents with a tachycardia and a slightly elevated blood pressure. Required management includes passive rewarming, establishing intravenous access with warmed fluids, providing analgesia, and ensuring adequate preparation for release of the entrapped limbs.

Simulation B: A 30-y-old male patient who has been involved in a boating accident where he fell overboard and was subsequently removed from the water after roughly 1 min. Clinical assessment reveals signs of a blunt head injury resulting in a reduced level of consciousness and potential airway compromise. The patient is also experiencing hypothermia. The required management includes airway management with spinal motion restriction, establishing intravenous access, passive rewarming techniques, sedation and analgesia, and packaging and transfer to hospital.

Fourth year

Simulation A: A 5-y-old male child involved in a pedestrian accident. The child is found confused and disorientated with mild hypoxemia, pallor, tachycardia, and hypotension. Clinical assessment reveals soft tissue injuries to the right scalp and face, chest and leg, right-sided reduced air entry and hyporesonance, right-sided chest pain (worse on inspiration), and right-sided pain over the upper leg. Required management includes supplemental oxygen, peripheral intravenous access, intravenous fluid administration, splinting, intranasal and/or intravenous analgesia, spinal motion restriction, and transfer to hospital.

Simulation B: A 5-y-old male child who has accidentally ingested digitalis. The child is found confused and disorientated with a bradycardia and electrocardiographic changes suggesting hyperkalemia. After approximately 10 min, the patient has a generalized tonic-clonic seizure. Required management includes supplemental oxygen administration (after start of seizure, as arterial oxygen saturation decreases), peripheral venous access, intravenous fluid administration, intravenous (or intramuscular) administration of a benzodiazepine, packaging, and transfer to hospital.

external assessors used the score sheet and the assessment rubric to assign scores for each assessment outcome but were blinded to the outcome weightings. A final mark for the simulation assessment was calculated by summing the weighted scores.[24] All results with a final mark less than 50% were reviewed by the external moderator who referred to the assessor's written notes, or video recordings if necessary, in making a final decision in each case.

On the day of each simulation assessment students had an opportunity to check their equipment before entering the assessment room. An age appropriate simulator was used for each set of assessments (SimMan ALS, SimMan 3G, and SimJunior; Laerdal Medical, Stavanger, Norway). Students were accompanied in the assessment by another student who acted as their partner and was allowed to assist the student being assessed with procedures but was not allowed to initiate actions or make decisions.

Students in the first and second academic years of study were assessed live, meaning that assessors were present in the simulation room, while the students completed the simulation and were directly observed by them. Students in the third and fourth academic years of study were assessed by means of a live wireless video and audio feed displayed on 2 large television screens (views from 2 different angles) in a separate room. Live assessment has always been the default method used for simulation assessments; however, at the time of data collection, a trial of remote assessment using live video and audio feeds was taking place and was being used for some assessments. In all assessments, a lecturer was present in the room to operate the simulator and provide contextual information about the case when required. In some cases, a moderator was present for all or part of the assessment but only observed.

Measurement of Anxiety

Student anxiety was measured with the State-Trait Anxiety Inventory (STAI) for adults (Form Y).[25] The STAI consists of 40 questions, 20 of which measure state anxiety and 20 of which measure trait anxiety. State anxiety is acute anxiety present at the time of the test and trait anxiety is a longer-term and relatively constant individual level of anxiety. Each of the 40 items in the STAI is a statement to which participants respond by selecting 1 response on a 4-point scale. Reliability of the STAI has been established by Spielberger et al,[25] with a high internal consistency (Chronbach $\alpha = 0.93$ in a sample of college students). Reliability of the STAI tends to be higher under conditions of acute anxiety.[25] The students were requested to complete the STAI roughly 5 to 10 minutes before beginning their simulation assessment and again immediately afterward. Only the state component of the STAI was used in this research (references to STAI mean the state component of the STAI).

Ethics

This research was ethically approved by the Faculty of Health Sciences Research Ethics Committee at the University of Johannesburg (Ethical Clearance REC-01-80-2017).

Statistical Analysis

Descriptive data are presented as means and 95% confidence intervals. The curve estimation function in IBM SPSS (Version 26.0; IBM Corporation) was used to fit a range of possible curves to a scatterplot of preassessment and postassessment STAI scores versus simulation assessment marks for all students. Curve fit was assessed by R^2 value, significance, and examination of residuals for random distribution and normality (random distribution by visual assessment of a predicted value $\times$ residual scatter plot and normality by visual assessment of a normal Q-Q plot and 1-sample Kolmogorov-Smirnov test). The STAI scores and marks between student groups with assessors positioned in the same room and positioned in a different room were compared with an independent samples *t* test. $P < 0.05$ was considered significant.

RESULTS

Fifty-eight students in total, across all academic years of study, consented to participate in the research. Descriptive data for the participants, marks, and STAI scores (preassessment and postassessment) are shown in Tables 2 to 4.

The sample of consenting student participants was predominantly male with the first year of study having the largest representation and the second year of study the smallest representation. When the 4 academic years of study were split into the 2 junior (first and second) and 2 senior (third and fourth) years, there was roughly equal representation in the sample (30/58%–52%, 28/58%–48%; Table 2).

Simulation assessment marks were distributed fairly evenly between first-, third, and fourth-year groups varying by approximately 4%. The second-year group marks were the highest in the sample, by approximately 15% from the next highest group mean. This group also had the greatest mark variance as indicated by the wide 95% confidence interval. Only the second-year group breached the preset 50% threshold for competence, which was not attained by the sample as a whole (Table 3).

Mean preassessment STAI scores across all academic years were lower than postassessment scores; however, even the lower mean preassessment scores were higher than the normal mean STAI scores for college students, which is between 36.47 ± 10.02 (male) and 38.76 ± 11.95 (female).[25] Both preassessment and postassessment STAI scores were higher in the 2 senior years of study groups than in the 2 junior years of study groups. On both occasions, the third-year group had the highest overall mean STAI scores (Table 4).

Curve fitting of mark versus preassessment and postassessment STAI score data points for 58 participants yielded a best fit for quadratic curves in both cases (Figs. 1, 2). The value of R^2 for the mark versus postassessment STAI score curve was greater than for the preassessment data set (0.102 vs. 0.032, respectively). Residuals for the better-fitting postassessment curve (Fig. 2) were random and normally distributed (Kolmogorov-Smirnov $P = 0.200$) with overall model significance of 0.051. The U-shape of the postassessment curve suggests that both low levels of anxiety (STAI scores between 20 and 40) and high levels of anxiety (STAI scores between 60 and 80) may be associated with better performance than anxiety levels in the middle of the observed range (STAI scores between 40 and 60).

TABLE 2. Sample Demographic Distributions

Sex	n (%)
Male	31 (53)
Female	27 (47)
Academic year of study	n (%)
First	21 (36)
Second	9 (16)
Third	13 (22)
Fourth	15 (26)
	Mean (95% CI)
Age	22.22 (21.22–23.23)

TABLE 4. Sample Preassessment and Postassessment STAI Score Distributions

	Mean (95% CI)
STAI preassessment	
First year	47.47 (40.86–54.08)
Second year	39.00 (14.11–63.89)
Third year	55.91 (48.60–63.22)
Fourth year	51.40 (43.04–59.76)
All years	48.74 (45.10–52.38)
STAI postassessment	
First year	57.81 (51.75–63.87)
Second year	44 (34.22–53.78)
Third year	62.85 (56.29–69.41)
Fourth year	61.47 (54.94–68.00)
All years	57.74 (54.18–61.30)

CI, confidence interval.

The academic year for each participant data point is shown in the scatter plot in Figure 3. All academic years were distributed across a range of STAI scores and no single group predominated at the higher range of STAI scores (60–80).

Because 2 different approaches were used with regard to positioning of assessors relative to students (in the same room as students and in a different room), and because this may have affected student anxiety and possibly performance, STAI scores and marks for the 2 groups were compared. The mean STAI score for first- and second-year students (with assessors positioned in the same room) was 53.67 (±14.44), whereas that for the third- and fourth-year students (with assessors positioned in a different room) was 62.11 (±11.18), a significant difference ($P = 0.016$). Mean marks for the same groups, respectively, were 46.77% (±19.55%) and 38.54% (±17.07%). This difference was not significant however ($P = 0.093$).

DISCUSSION

In this study on emergency care student anxiety and simulation assessment performance, mean STAI scores across all academic years of study before and after a simulation assessment were elevated above the normal range for college students. Simulation assessment performance, as measured by student marks, was related to STAI score in a nonlinear fashion—with a stronger relationship between postassessment STAI scores and performance. The nature of this nonlinear relationship suggests a positive effect on student performance at both the lower and higher ends of the observed anxiety spectrum.

In this study, it was not possible to measure anxiety during each simulation assessment as this required the administration

TABLE 3. Sample Mark Distribution

Academic Year	Mark (%), Mean (95% CI)
First year	42.29 (35.16–49.41)
Second year	57.22 (38.43–76.02)
Third year	38.77 (28.30–49.24)
Fourth year	38.33 (28.67–48.00)
All years	42.80 (37.88–47.71)

CI indicates confidence interval.

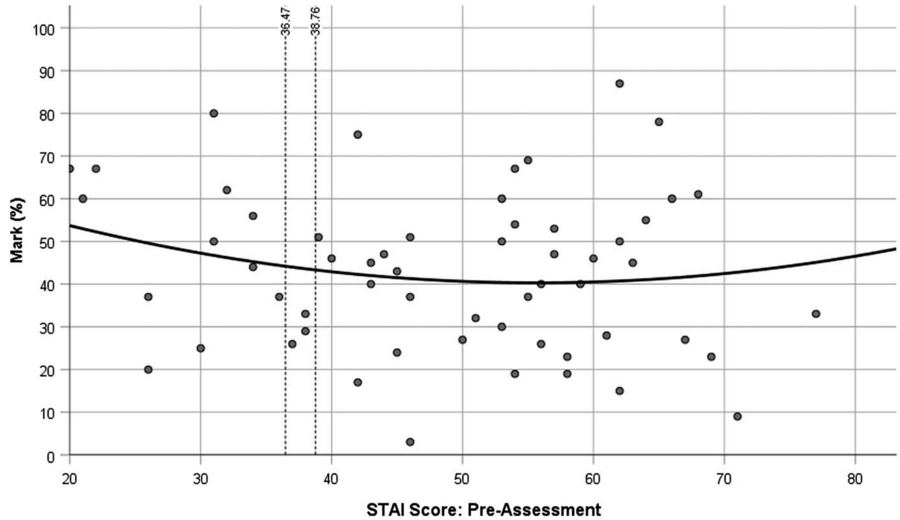

FIGURE 1. Quadratic curve: mark vs preassessment STAI score. R^2 = 0.032, P = 0.407, dashed references lines are male (36.47 ± 10.02) and female (38.76 ± 11.95) STAI means for college students.

of the STAI. Consequently, only 2 cross-sectional snapshots of anxiety were possible—one immediately before and one immediately after each assessment. Both of these may be influenced by a range of factors. For the preassessment anxiety measure, these include each student's interpretation of readiness for the assessment, memories of previous assessment experiences (and outcomes), knowledge of what is at stake in a particular assessment, and a general sense of anxiety that tends to precede any assessment due to anticipation of the process (and, in the case of simulation assessments, the socioevaluative component). For the postassessment anxiety measure, these could include some or all of the preassessment factors together with perceptions of performance in the assessment and the effects of socioevaluative stress.

When considering the effect of simulation assessment-related anxiety on performance, the postassessment anxiety measure captures a broader range of contributing factors, including recent experience of the assessment itself, than does the preassessment measure. The preassessment STAI data were included here for comparison as a rough baseline measure of anxiety preceding the assessment, but not affected directly by experience of it. Although the shape of both curves depicting preassessment and post-assessment relationships between performance and anxiety is roughly similar (Figs. 1, 2), postassessment anxiety accounts for more variation in performance than preassessment anxiety. Thus, the effect of experiences during the assessment on anxiety, measured afterward, seems to be more important for performance than the level of anxiety experienced before the assessment, although there may be some interaction between the two. This relationship has been identified in a meta-analysis of anxiety and performance research.[26]

Although the overall model fit in Figure 2 was not significant, the results suggest relatively good performance of some students on the extreme right of the x-axis, with STAI scores between 60 and 80. These results contradict 2 theories that predict reduced performance in response to anxiety in those undergoing assessment. Cognitive interference theory holds that competition for working memory reserves brought about by the simultaneous processing of simulation-related tasks and negative self-statements induced by anxiety will reduce task

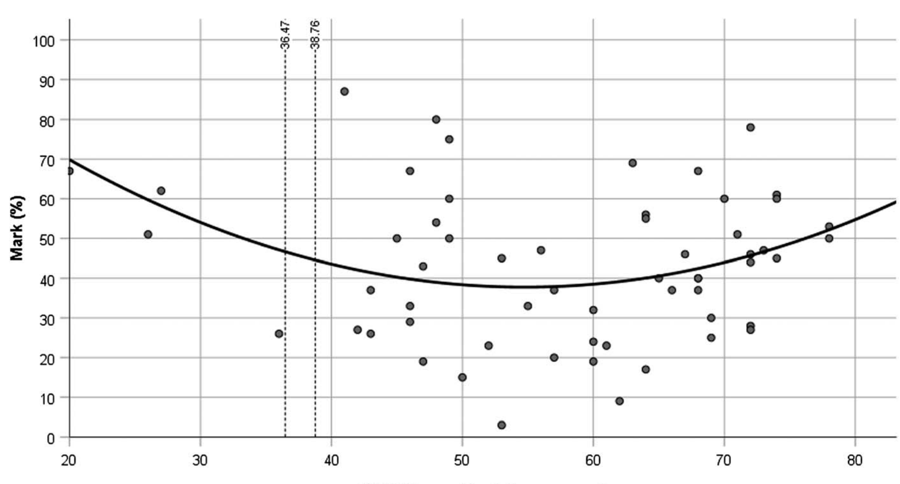

FIGURE 2. Quadratic curve: mark vs postassessment STAI score. R^2 = 0.102, P = 0.051, dashed references lines are male (36.47 ± 10.02) and female (38.76 ± 11.95) STAI means for college students.

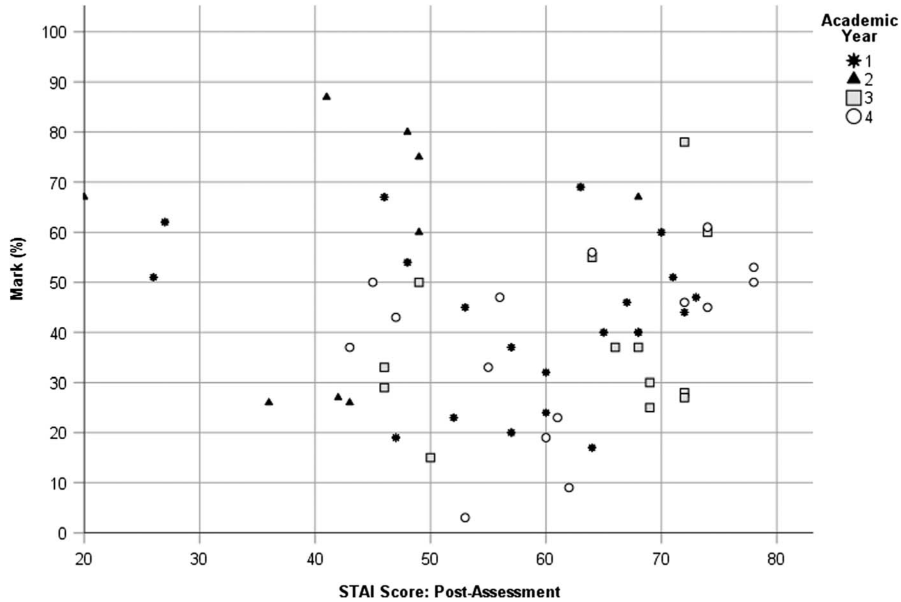

FIGURE 3. Scatter plot of mark vs postassessment STAI score grouped by academic year.

performance.[27,28] Similarly, cognitive load theory predicts reduced access to working memory based on the possible influence of extraneous cognitive load caused by student emotions, producing a negative effect on performance.[29] Although cognitive load theory applies mainly to learning rather than assessment, Schlairet et al[17] found some evidence of a negative effect of increased cognitive load on performance during simulation assessments.

The left side of the curve in Figure 2 does seem to support the notion, as predicted by the 2 theories previously mentioned, of an anxiety-induced reduction in performance as STAI scores increase from 20 to approximately 55. However, the relationship identified between student performance and higher STAI scores suggests a possible effect of 1 or more moderating influences. One possible explanation for this effect is that some emergency care students might possess personal characteristics that allow them to learn and perform more effectively in such high anxiety environments. Alternatively, there may have been some other contextual influence such as varying levels of preparedness among students, although preparedness has been shown to have mixed influences on students' actual and perceived performance.[18] Another possibility is that with accumulated exposure to real clinical cases in emergency care during clinical learning, some students might have adapted to this relatively high-stress environment and developed coping mechanisms facilitating better performance than would otherwise be expected. Although this may be the case in some individuals, it does not seem to be a general pattern as indicated by Figure 3, which shows that students in the higher anxiety range were a mix of all academic years and not just more senior students with more accumulated clinical learning experience.

Only 2 other studies have produced some evidence of an improvement in performance with increased stress or anxiety in the context of simulation assessments. The study by DeMaria et al[22] assessed the effect of what might be referred to as extraneous sources of stress introduced by an actor playing the role of a family member during a resuscitation scenario. This was quite different to the focus of the current study, which was on the experience of anxiety by students arising from participation in the simulation assessment process as a whole. The improved performance identified by DeMaria et al[22] occurred only in those exposed to greater stress and was observed after a period of 6 months. Because of these differences, it is not possible to directly compare the current study to that of DeMaria et al.[22]

McKay et al[23] identified an acute increase in stress, as measured with a salivary α-amylase assay, between the period immediately before and immediately after an anesthesia induction simulation in a group of nurse anesthetists. When performance data were categorized into groups representing low, moderate, and strong performers a marked stress increase was evident in the low and strong performer groups but not in the moderate performer group (the stress increase in the low performer group was statistically significant, whereas in the strong performer group, it was not). Although these authors did use the state component of the STAI to measure student anxiety, they unfortunately do not report how STAI scores were distributed across the 3 performance groups. Thus, although McKay et al[23] do seem to have identified a pattern similar to that observed in the current study with regard to stress and performance, it is not possible to directly compare salivary α-amylase levels with state STAI scores.

In attempting to explain these results, it is important to consider that many other factors undoubtedly affect performance as measured by the marks that this cohort of students obtained. In the relationship between anxiety and performance depicted in Figure 2, anxiety accounted for roughly 10% of the variance in performance, which underscores this point. By comparison, a meta-analysis of data on linear relationships between anxiety and academic performance identified an overall negative 0.21 effect size.[26] Nevertheless, anxiety is considered to be an important (and perhaps modifiable) factor affecting performance in simulation.

Being observed, and specifically being video recorded, has been identified as a source of anxiety among students participating in simulations.[12–14] Two different approaches were used in this study with regard to positioning of assessors relative to students during the simulation assessments, as described under Setting and Simulation Assessments hereinabove. The presence of assessors in the same room as students during the assessments may be considered a source of socioevaluative anxiety, possibly producing heightened levels of anxiety in the first- and second-year student group. Only 1 study has investigated the effect of assessor presence on student anxiety during simulation assessments using a quasi-experimental research design, with results showing no significant effect on state STAI scores.[30] Although a significant difference in STAI scores in students completing the simulation assessments with these 2 approaches was identified in the current study, the higher mean STAI scores were in the student group where assessors were located in a different room.

In both cases hereinabove, students were video recorded with 2 video cameras positioned to capture the simulation from different angles. In the first- and second-year group, 1 video camera was recording to memory, and in the third- and fourth-year group, 1 video camera was recording to memory while both cameras were simultaneously transmitting video and audio wirelessly to a separate room where assessors were located. It is thus unlikely that the presence of video recording equipment in the simulation room, which had the same configuration in both groups, could explain this difference. Another factor that may have contributed to the difference in STAI scores between these groups is the effect of increased task complexity of simulation assessments in third and fourth year.[31] It thus remains unclear what specific effect the presence of assessors in the simulation assessment room may have on student anxiety and performance. This study used a sample of simulation assessments using a mix of the 2 approaches and aimed to describe anxiety and performance in the whole group rather than focus on a particular subgroup.

Limitations

Some limitations apply to this research and should be considered when evaluating the results presented previously. Data from only 1 simulation assessment were used. Students typically complete between 3 and 5 simulation assessments during a given year, and the relationship between performance and anxiety in those simulation assessments may have been different to those observed and reported here. Because data from a single assessment were used, it was also not possible to assess the effect of time or accumulated simulation assessment experience on this relationship. Interrater reliability has not been assessed for simulation assessments, including those comprising the data set in this study, because it has not been considered useful in the postassessment moderation of results. A study is currently underway to investigate interrater reliability in a longitudinal sample of past simulation assessments using the same assessment tool.

The sample available was relatively small; however, it represented 55% (58 of 105) of the total student count in the department and was constrained by those who voluntarily gave informed consent to participate. Overall significance of the model in Figure 2 was very close to, but not less than, 0.05, and this may represent a type II error based on the available sample size. Last, the STAI does not differentiate between the so-called worry component of anxiety and the emotionality component. The worry component has been associated with a stronger predictive value for performance deficits than the emotionality component,[31] and thus, the STAI-based measurement of anxiety may underestimate the effect of anxiety on performance compared with a measurement tool capable of discrimination between the 2 components.

Future Research

The observed relationship between anxiety and performance in this study requires corroboration in a similar population. Although there is no reason to believe that the set of simulation assessments in this study were significantly different in scope or complexity than any others that this group of students may have completed in a given academic year, a longitudinal study would be beneficial to describe the nature of this relationship over time and to investigate whether any time-related factors such as accumulated experience (with simulations or clinical experience) may affect it. Further study into the 2 different dimensions of anxiety (worry and emotionality) may identify which of these best predicts changes in performance and may be useful in better understanding the causes and theoretical underpinning of the relationship observed in the current study.

Numerous factors such as preparation time, student coping mechanisms and personality types, simulation workload, cognitive load, and a range of others require investigation as possible predictors or moderators of the observed effect of anxiety on performance. Given the unusual results when comparing STAI scores in the 2 groups of students with and without assessors present in the simulation room, the question of what effect this has on stress and anxiety deserves further and more rigorous study. Last, students anecdotally report that the anxiety experienced by them during simulation assessments is typically greater than that experienced during real clinical emergency patient care where their performance is also judged. Research is needed to investigate this claim and to describe the nature and effects of anxiety during authentic patient care on performance.

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