Research Article

Journal of Trauma Studies in Education
Volume 5, Issue 2 (2026), pp. 88-108
ISSN: 2832-1723 (Print), 2832-1731 (Online)
http://doi.org/10.70085/jtse.v5i2.235

Trauma Symptoms: The Presence and Predictive Value Among Physical and Occupational Therapy Graduate Students Taking a Gross Anatomy Course

Sue E. Curfman
Belmont University

Ryan C. McConnell
Belmont University

Rosanne M. Thomas
Northern Illinois University

William J. Best
Belmont University

Gary P. Austin
Belmont University

ABSTRACT

This study explored trauma symptoms and predictors of performance in graduate students before and after exposure to human donors during an anatomy course. Among the 133 participants, the median trauma symptom scores significantly decreased from pre- to post-course ($p = .004$). Of the 43 participants who experienced an increase in trauma symptoms, 9% met the minimal clinically important difference, indicating a clinically significant worsening of symptoms; 7.5% of participants had symptoms sufficient for a diagnosis of posttraumatic stress disorder. White race, Hispanic/Latino ethnicity, no recent death of a loved one, and increased baseline trauma symptoms predicted increased post-course trauma symptoms. Woman gender, preexisting anxiety diagnosis, increased baseline trauma symptoms, and 0% participation in dissection predicted student course success. Considerations for trauma-informed education may increase as healthcare training programs recruit a more diverse student body to better reflect the demographics of the general population.

Keywords: Education Trauma, Post traumatic stress disorder, Academic outcomes

Trauma symptoms are increasingly present among undergraduate and graduate students in health professions programs (Curfman et al., 2018; Mayer et al., 2022). In these curricula, students may encounter death, engage in emotionally charged content, or experience bodily

This article is published under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND).

exposure that can provoke distress or reactive trauma responses (Newman & Ruehter, 2025; Nolan & Roberts, 2021). Cadaver-based anatomy laboratory sessions are a core component of health professions education (Cheverko et al., 2025; Milian et al., 2024); however, these sessions necessitate direct confrontation with death, which may lead to psychological distress among students.

Despite students' perceived value of working with human donors, some report psychological effects from the experience (Hussein et al., 2016; Zubair et al., 2021). Health professions students exposed to human donor dissections have reported development of acute stress disorder, which includes many of the same trauma symptoms of posttraumatic stress disorder (PTSD), but of shorter duration (Zubair et al., 2021), as well as anxiety or trauma symptoms (Curfman et al., 2018; Romo-Barrientos et al., 2020). These symptoms include a broad range of experiences such as hypervigilance, sleep disruptions, self-destructive behavior, intrusive reexperiencing of difficult memories and dreams, challenges with memory and concentration, irritability, and emotional withdrawal (American Psychiatric Association, 2022), which can contribute to reduced academic performance (Amirian et al., 2022; Flowers & Bernard, 2020).

As manual techniques and interpersonal touch are hallmarks of the professions of physical therapy (PT) and occupational therapy (OT), students must interact closely with one another's bodies regularly during their professional training programs. Trauma may challenge this dynamic and create learning barriers, elevating the importance of studying the impact of trauma among PT and OT students (Strauss et al., 2019). The purposes of this study were to 1) determine the degree to which students experience trauma symptoms during exposure to and/or dissection of human donors in this post-COVID era, and 2) identify predictive variables for trauma symptoms and academic performance in gross human anatomy courses.

LITERATURE REVIEW

Anatomy education is considered by many clinicians to be valuable for developing clinical knowledge and skills, learning to interpret diagnostic imaging, and advancing their professional development (Sbayeh et al., 2016). Cadaveric dissection and prosection activities, in particular, have been reported by students as effective ways to enhance their clinical skills, facilitate connections between basic and clinical sciences, and gain a deeper understanding of human body structures (Asante et al., 2021; Sbayeh et al., 2016). Further, students have acknowledged the effects of cadaver dissections on their professional identities as they reflect on mortality and spirituality (Hussein et al., 2016; Madgwick et al., 2024).

Students in health professions programs encounter stressful or traumatic situations during their didactic and clinical training, such as conflict with professors, caring for patients with serious illnesses, facing patient death, experiencing mistreatment by patients, or making a medication error (Mayer et al., 2022; Newman & Ruehter, 2025). Cadaver-based instruction may present a source of distress to students during early didactic training and impact their learning performance. Although some research indicates that exposure to cadaver dissection results in a reduction in state anxiety (i.e., situational anxiety) on the self-reported State-Trait Anxiety Inventory (Romo-Barrientos et al., 2020), and in PTSD symptoms as measured by the PTSD Checklist for the Diagnostic and Statistical Manual

of Mental Disorders, Fifth Edition (PCL-5) (Curfman et al., 2018), these results are not universal (Zubair et al., 2021). Students with preexisting anxiety or trauma symptoms may be more vulnerable to distress and continue to experience symptoms after the lab. Results of a questionnaire administered to medical students enrolled in an anatomy course demonstrated significantly higher levels of pre-lab anxiety among those with preexisting death-related anxiety (Quince et al., 2011). Additionally, students who had experienced the death of a loved one were less likely to view dissection as "enjoyable." These data suggest that cadaveric dissection or prosection may amplify anxiety or trauma symptoms in students with preexisting symptoms.

Trauma responses may vary, as cultural factors can influence the biopsychosocial experience of trauma and subsequent traumatic stress reactions (Marsella, 2010). For some students, the practice of dissecting a human body may conflict with their cultural norms or spiritual beliefs (Madgwick et al., 2024). Trauma responses can vary by gender as well, as some research indicates that trauma symptoms are more prevalent in women (Nolting et al., 2025). However, evidence suggests women in healthcare professions programs are more resilient, as they demonstrate a greater ability to cope compared with men (Ali et al., 2024; Sándor et al., 2015).

To better support students and reduce retraumatization, many educators have implemented trauma-informed teaching approaches (Mayer et al., 2023; Nolan & Roberts, 2021). Although trauma-informed approaches may vary in methodology, principles of safety, trust, support, collaboration, empowerment, and cultural or gender awareness are central themes (Substance Abuse and Mental Health Services Administration [SAMHSA], 2014). The "Four Rs" from SAMHSA provide a framework for educators to realize the impact of trauma, recognize the signs of trauma, respond by creating trauma-informed policies, and strive to resist retraumatization. Applying these principles to cadaver-based anatomy instruction may help educators support students from diverse backgrounds.

METHODS

This study was a prospective, longitudinal, within-participant investigation of graduate student responses to a gross human anatomy course at two universities in the United States in 2022. The Institutional Review Boards of Belmont University (#1280) and Indiana Wesleyan University (#1730.22) approved this study.

Participant Recruitment

Investigators recruited students in the Doctor of Physical Therapy (DPT1), Doctor of Occupational Therapy (OTD), and Master of Science in Occupational Therapy (MSOT) programs at a university in the central southeastern United States and students from the Doctor of Physical Therapy (DPT2) program at a university in the midwestern United States on the first day of their respective anatomy courses.

Anatomy Courses

Neuromusculoskeletal anatomy courses are required components of the DPT, OTD, and MSOT curricula at the participating institutions. DPT students performed full-body dissections of human donors in small groups, while OTD and MSOT students utilized

previously dissected human donors (i.e., prosection). Instructors delivered class content through a combination of lectures and labs, with assessments conducted through 2–4 written and practical examinations. During practical examinations, students identified and answered questions related to the structures of the donor. To align with OT course content, written examinations for OTD and MSOT students included both anatomy and non-anatomy content. The total laboratory time for DPT and OTD/MSOT courses was 84–88 hours and 8–26 hours, respectively. Each program required concurrent enrollment in an additional 8–14 course credit hours.

Data Collection

Data collection was conducted via Qualtrics (Provo, UT), with pre and post surveys sent on the first and final day of the courses, respectively. At both time points, participants completed the Life Events Checklist (LEC-5; Weathers et al., 2013a) and the PCL-5 (Weathers et al., 2013b), both of which are based on the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5; American Psychiatric Association, 2013).

Pre and Post Surveys

Before the course, participants reported descriptive data via a pre survey that included demographic information, whether they had prior exposure to human cadavers, whether their decision to attend their specific graduate program was impacted by the opportunity to work with human donors, whether they had experienced the death of a family member or friend in the preceding six months or during the semester, and whether they had received a diagnosis of an anxiety disorder or PTSD and any related treatment. Participants also rated their level of anxiety associated with working with human donors at the beginning and end of the course via a 10-point Likert scale in which participants rated *no anxiety* as zero and *severe anxiety* as 10. Following the course, participants provided data describing their level of involvement in dissection during the course.

Life Events Checklist for DSM-5

Participants completed the LEC-5 to assess the degree of exposure to traumatic events before the anatomy course and exposure to non-anatomy-related traumatic events during the course. The LEC-5 is a 16-item, self-reported questionnaire designed to assess exposure to potentially distressful or traumatic events, as well as an additional item that assesses any other extraordinarily stressful event not captured in the first 16 items (Weathers et al., 2013a). For each questionnaire item, respondents reported whether the traumatic event (a) *happened to them personally*; (b) *they witnessed the traumatic event happen to someone else*; (c) *they learned about the event happening to a family member or close friend*; (d) t*hey were exposed to the traumatic event as part of their job (e.g., paramedic, police, military, or other first responder)*; (e) *they are unsure if any of the response options fit*; or (f) *the traumatic event does not apply to them*. When completing the form at the beginning of the course, participants were instructed to consider their entire lives. When completing the form following the course, participants were asked only to consider events that occurred during the course.

LEC-5 scores were calculated by awarding one point for each endorsed item (Letica-Crepulja et al., 2020; Weis et al., 2022). The LEC has demonstrated good test-retest reliability (item-level $\kappa > .50$) and strong convergence of total scores (Pearson r range, 0.34–0.48) with validated PTSD symptom severity measures, such as the Traumatic Life Events Questionnaire (Kubany et al., 2000), PTSD Checklist (Blevins et al., 2015), and the Clinician Administered PTSD Scale (Gray et al., 2004).

PTSD Checklist for DSM-5

Participants completed the PCL-5 at the beginning and the end of the course as a threshold for a provisional PTSD diagnosis and to measure changes in trauma symptoms. The PCL-5 is a self-reported questionnaire of trauma symptoms composed of 20 items that correspond to the 20 criteria for PTSD outlined in the DSM-5 (Weathers et al., 2013b). Students rated how bothered they were by each item on the PCL-5 using a 5-point Likert scale (*not at all* [0], *a little bit* [1], *moderately* [2], *quite a bit* [3], or *extremely* [4]) with ratings summed to provide a symptom severity score ranging from 0–80. At the beginning of the course, the PCL-5 asked participants to report symptoms they had experienced during the previous month. At the end of the course, the PCL-5 asked participants to report symptoms they had experienced during the course.

The PCL-5 has acceptable internal consistency and test-retest reliability, construct validity, a seven-factor Hybrid Model, recommended cut-off scores between 31 and 33, and the ability to index sensitivity to clinical change (Forkus et al., 2023; McDonald & Calhoun, 2010). We used the cutoff score of ≥ 31 to indicate symptoms consistent with a preliminary diagnosis of PTSD. Clinically important differences in PCL-5 scores were measured via the minimal clinically important difference (MCID) of ≥ 10 points (Bovin et al., 2016).

Course Performance

All courses included practical examinations that focused on anatomy and involved exposure to cadavers. There was also significant variation in the content of written examinations across the various anatomy courses; therefore, the mean practical examination scores were determined to be the most valid measure of student performance.

Outcome Measures

The primary outcome measures were trauma symptoms and performance in the anatomy course. The post-PCL-5 score measured the degree of trauma symptoms experienced at the end of the course. The average practical examination grade measured performance in the anatomy course.

Statistical Analysis

We conducted analyses using IBM SPSS Statistics (version 29.0.) Box plots, histograms, Q-Q plots, and Shapiro-Wilk tests were used to assess the normality of post-PCL-5 scores and anatomy practical examination scores, which were determined to be not

normally distributed. A Wilcoxon signed-rank analysis was performed to evaluate the change in PCL-5 scores throughout the study.

Generalized linear models were used to determine the predictive value between the study variables and PCL-5 total scores and average practical examination grades in gross anatomy. While examination scores can be considered discrete data, it is typical to consider them as continuous data when performing generalized linear models, given the robustness of regression (Dobkin et al., 2010; Dobson & Barnett, 2018). All variables were assessed for multicollinearity. Only variables with low concern for multicollinearity (based on the correlation matrix, variance inflation factors, and tolerance levels) and those retained after running backward multilinear regression models (based on the most appropriate adjusted R^2 values) were retained in the final models. Any standardized residual with an absolute value greater than three was considered an outlier. At most, two outliers were removed, as reflected in the sample size for each model in the results section below.

The best fit models were determined for each analysis using the lowest Akaike's Information Criterion, Bayesian Information Criterion, and most appropriate goodness of fit using the Omnibus testing. Each model was adjusted for the covariates previously described. Residual analysis was performed to check the validity of the generalized linear model assumptions. All assumptions were met. The PCL-5 scores were analyzed with a gamma log link family of distributions to assess the predictive value between the variables and PCL-5 total scores, whereas a normal, linear distribution was used for predicting lab practical averages. A priori significance was set at $p \leq .05$, and 95% CIs were reported. Adjusted R^2 was reported for the effect size of the overall model, and η^2 was reported for individual variables. Variables with normal distribution are reported as means with SDs, and abnormal distributions are reported with medians and IQRs. Regression slope coefficients are reported.

There are various methods reported for scoring the LEC-5 (weighted, unweighted, frequency); therefore, sensitivity analyses were run using the different variations of the PCL-5 and anatomy practical examination averages. We used the weighted LEC score in our analysis.

FINDINGS

Investigators invited a total of 160 students enrolled in the DPT (DPT1, $n = 58$; DPT2, $n = 24$), OTD ($n = 43$), and MSOT ($n = 35$) programs to participate in the study. Of the 160 invited students, 155 consented to participate in the study.

Presurvey Data

Presurvey responses for the 133 participants who completed all surveys are presented in Table 1. Most participants identified as White ($n = 123$, 92.48%), women ($n = 113$, 84.96%), and not Hispanic or Latino ($n = 128$, 96.24%). The median age was 23 (range = 20–47, IQR = 22–25). Owing to the low number of non-woman, non-man, and non-White participants, and to ensure sufficient statistical power to detect within-group differences, two participants (Genderqueer, $n = 1$; Not Listed, $n = 1$) were excluded from the analysis, and race was dichotomized into White and non-White categories.

Most participants reported that they had never seen a human donor and that the opportunity to work with human donors did not influence their decision to choose a

particular institution. A total of 24 (18.05%) participants reported that a family member or friend had passed away in the six months preceding the study. Prior to the anatomy course, 38 (28.57%) participants reported a preexisting anxiety diagnosis, and nine participants (6.77%) reported a preexisting PTSD diagnosis. The median level of anxiety related to working with human donors was 4.00 (range = 0.00–10.00, IQR = 2.00–6.00) prior to the start of the course. At the end of the course, the median anatomy lab practical grade average was 86.50 (range = 51.30–100.00, IQR = 77.60–93.10).

Table 1: Demographic and Descriptive Data

Variable	*n*	%
Race		
White	123	92.48
Non-White	10	7.52
Ethnicity		
Not Hispanic or Latino	128	96.24
Hispanic or Latino	5	3.76
Gender		
Woman	113	84.96
Man	20	15.04
Program		
DPT1	46	34.59
OTD	40	30.08
MSOT	29	21.80
DPT2	18	13.53
Previous exposure to human donors		
Never seen a human donor	82	61.65
Observed a human donor that had already been dissected	46	34.59
Performed group human donor dissection	5	3.76
Desire to work with a human donor		
Opportunity to work with human donors did not influence the decision to attend the program	80	60.15
Opportunity to work with human donors positively influenced the decision to attend the program	49	36.84
Did not want human donor experience	4	3.01

Note. Total sample, $N = 133$. DPT1 = Doctor of Physical Therapy cohort 1; DPT2 = Doctor of Physical Therapy cohort 2; MSOT = Master of Science in Occupational Therapy; OTD = Doctor of Occupational Therapy.

PCL-5 Scores

Median PCL-5 total scores for the entire sample were below the cutoff for a provisional diagnosis of PTSD at the beginning and end of the course. These values significantly decreased from the start of the anatomy course to the end of the course (p = .004); however, this change did not meet the MCID of 10 points. Changes in median PCL-5 scores by demographic category, experience of a recent death of a friend or family member, and preexisting PTSD or anxiety diagnosis are listed in Table 2 and displayed in Figure 1. PCL-5 scores increased for 43 (32.33%) participants, and 12 (9.02%) participants experienced a change that met the MCID. Of the five (3.76%) participants who had post-PCL-5 scores that met the threshold for a preliminary diagnosis of PTSD, only one of these participants had a pre-PCL-5 score that met this threshold. Of the seven (5.26%) participants whose pre-PCL-5 scores were zero and who reported an increase in PCL-5 score at the end of the study, none met the PCL-5 threshold for a preliminary diagnosis of PTSD; one of these participants met the PCL-5 MCID.

Across the full sample, a numerically greater proportion of participants experienced improvement in their PCL-5 scores at the end of the course compared with participants who had unchanged or worsened PCL-5, as presented in Figure 2 and Appendix A.

Table 2: Pre- and Post-Anatomy Course PCL-5 Scores

Variable	*n*	Pre-PCL-5 Score Median	Post-PCL-5 Score Median	Change	*p*
All participants	133	9.00	5.00	– 4.00	.004*
Gender					
Women	113	9.00	5.00	– 4.00	< .001*
Men	20	3.50	5.50	+ 2.00	.032
Race					
White	123	8.00	5.00	– 3.00	.004*
Non-White	10	14.00	11.50	– 2.50	.799
Ethnicity					
Not Hispanic or Latino	128	8.50	5.00	– 3.50	.001*
Hispanic or Latino	5	13.00	21.00	+ 8.00	.223
Experienced recent death of a friend or family member					
No recent death	109	8.00	5.00	– 3.00	.106
Recent death	24	14.00	3.50	– 10.50	.006*
Previous PTSD diagnosis					
No	124	8.00	4.00	– 4.00	.018*
Yes	9	14.00	5.00	– 9.00	.086

Variable	*n*	Pre-PCL-5 Score Median	Post-PCL-5 Score Median	Change	*p*
Previous anxiety diagnosis					
No	95	7.00	5.00	– 2.00	.109
Yes	38	12.00	6.50	– 5.50	.007*

Note. Total sample, $N = 133$. PCL-5 = Posttraumatic Stress Disorder Checklist for the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition; PTSD = posttraumatic stress disorder. *$p \leq .05$.

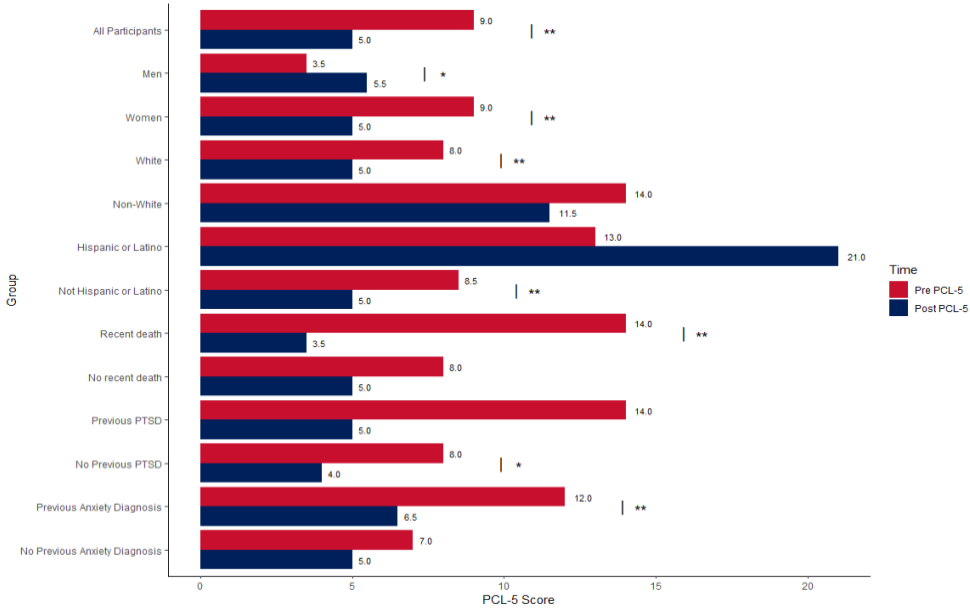


Figure 1: Median Pre- and Post-PCL-5 Scores

Note. Total sample, $N = 133$. All participants were included in the analysis. No outliers were removed. *$p < .05$. **$p < .01$.

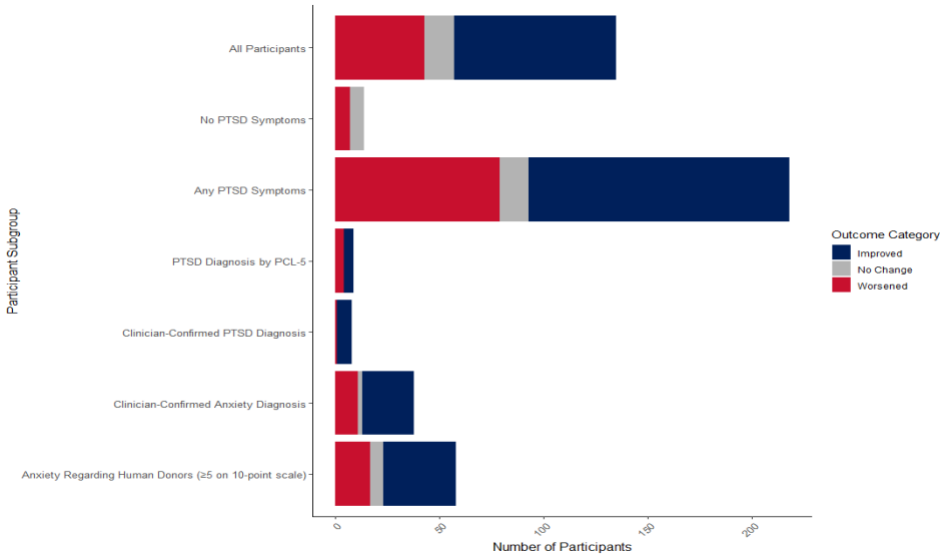


Figure 2: Proportion of Participants with Improvement, No Change, or Worsening of PCL-5 Score at the End of the Course

Note. Total sample, $N = 133$. All participants were included in the analysis. No outliers were removed. Dx = diagnosis; PCL-5 = Posttraumatic Stress Disorder Checklist for the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition; Post = after anatomy course; Pre = before anatomy course; PTSD = posttraumatic stress disorder; Re = regarding; Sx = symptoms.

Across the full sample, a numerically greater proportion of participants experienced an improvement in PCL-5 score by ≥ 10 points compared with those who had PCL-5 score improvements of < 10 points, as shown in Figure 3. Of the 10 participants with pre-PCL-5 scores ≥ 31, five had post-PCL-5 scores ≥ 31. All five of these participants' PCL-5 scores increased, and one participant's increase in PCL-5 score met the MCID. Of the 10 (7.50%) participants with post-PCL-5 scores ≥ 31, five had pre-PCL-5 scores ≥ 31. All of these participants experienced increases in PCL-5 scores during the study, and five met the MCID. Refer to Appendix B for details about these participants.

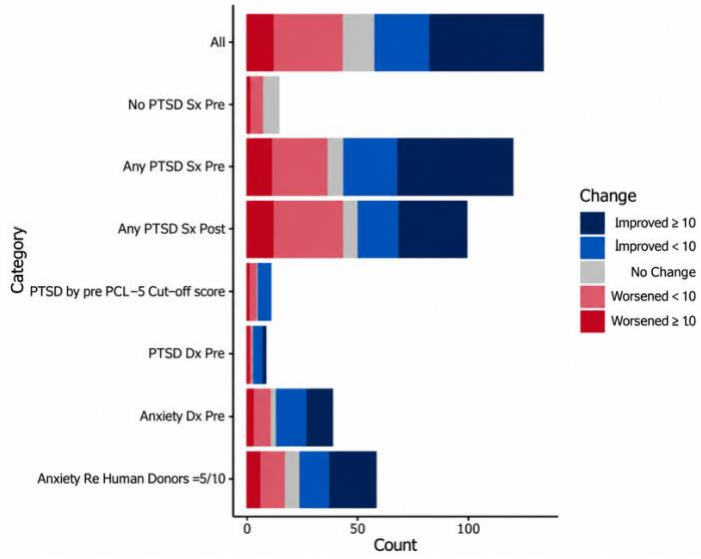


Figure 3: Proportion of Participants with Improvement or Worsening of PCL-5 Score

Note. Total sample, $N = 133$. All participants were included in the analysis. No outliers were removed. Dx = diagnosis; PCL-5 = Posttraumatic Stress Disorder Checklist for the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition; Post = after anatomy course; Pre = before anatomy course; PTSD = posttraumatic stress disorder; Re = regarding; Sx = symptoms.

Predictive Models

Variables considered for multi-linear regression for both predictive models included age, race, ethnicity, gender, program, anxiety level about working with human donors, whether the participants met the criteria for the preliminary diagnosis of PTSD by cutoff score, percentage dissection performed during the course, self-reported previous anxiety diagnosis, self-reported previous PTSD diagnosis, whether they had experienced the death of a family member or friend in the previous 6 months, pre LEC-5 score, previous level of exposure to human donors, and pre PCL-5 total scores. These variables accounted for 45.00% of the variance in the linear regression model.

Post PCL-5 Score

All participants except for one outlier were included in this analysis (n = 132); the outlier was removed due to being greater than 3 standard deviations of the mean which disproportionately influenced the results. The overall model had an effect size of .48. After adjusting for age, gender, race, ethnicity, death of a loved one six months prior, and pre-

PCL-5 score, the variables of White race, Hispanic or Latino ethnicity, no death of a friend or family member in the six months prior to the study start, and pre-PCL-5 score predicted an increased post PCL-5, as presented in Table 3. The variable of woman gender predicted a decrease in post PCL-5 score ($p = .002$).

Table 3: Parameter Estimates of Variable Association with Post-PCL-5 Scores

Variable	β	95% CI	η^2	*p*
Age	–.15	–.15, .45	.03	.315
Gender				
Woman	–6.19	–10.05, –2.33	.09	.002*
Race				
White	8.01	.61, 15.41	.01	.034
Ethnicity				
Hispanic or Latino	19.86	10.17, 29.55	.04	< .001*
Experienced recent death of a friend or family member				
Recent death	6.23	2.69, 9.77	.01	< .001*
PCL-5 score				
Pre-PCL-5 score	.67	.54, .80	.46	< .001*

Note. Total $N = 132$; one outlier was removed from the dataset for this analysis.
*Statistically significant ($p \leq .05$)

Average Lab Practical Examination Scores

One participant whose mean lab practical examination score was more than 3 standard deviations below the mean was excluded from this analysis. After adjusting for age, gender, race, percent dissection performed, pre-PCL-5 score, previous anxiety diagnosis, and pre-PCL-5 score of ≥ 31, the variables of woman gender, performing 0% of the dissection, pre-PCL-5 score, and preexisting anxiety diagnosis predicted an increase in average lab practical examination score, as presented in Table 4.

Table 4: Parameter Estimates of Variable Association with Average Lab Practical Examination Scores

Variable	β	95% CI	*p*
Age	–.00	–.01, .00	.260
Gender			
Woman	.09	.02, .15	.001*
Percent of dissection performed			
0%	–.12	.05, .20	.001*

1-25%	–.01	–.10, .12	.860
26-50%	–.00	–.09, .09	.940
51-75%	.04	–.04, .12	.326
PCL-5 score			
Pre-PCL-5 score	.00	–.01, –.00	.007*
Previous anxiety diagnosis			
Yes	.08	.03, .13	.003*
PCL-5 score ≥ 31 points			
Pre-PCL-5 score	–.11	–.23, .01	.084

Note. Total $N = 132$; one outlier was removed from the dataset for this analysis.
*$p \leq .05$

DISCUSSION

A statistically significant reduction in trauma symptoms was observed in our sample of PT and OT students after exposure to human cadavers during a semester-long anatomy course. Despite the statistical improvement in PCL-5 score, the MCID of 10 points was not reached, suggesting that these student participants may not have experienced a noticeable change in trauma symptoms. Although participants experienced an overall reduction in trauma symptoms, the number of participants in our sample with trauma symptoms sufficient to reach the threshold for a preliminary diagnosis of PTSD remained at 7.5% prior to and following our study. Thus, the severity of trauma symptoms decreased in our sample, but the number of individuals with severe symptoms did not.

Our study asked participants to report any history of a PTSD diagnosis; however, we did not collect data for the timing of the diagnosis. Prior to the start of the course, a greater number of participants screened positive for PTSD than those who self-reported a previous diagnosis of PTSD. This discrepancy may indicate diagnosis underreporting or self-stigma among people diagnosed with PTSD (Bonfils et al., 2018). Additionally, undiagnosed PTSD has been identified as a significant problem among the general population and may further limit the reporting of PTSD (Gagnon-Sanschagrin et al., 2022). In our study, almost 90% of participants reported preexisting trauma symptoms, which decreased slightly to 74% by the end of the course. Of note, only a small proportion of participants screened positive for PTSD at the end of the study.

Predictors of Trauma Symptoms

This study identified that preexisting trauma symptoms, as measured by PCL-5 score, were predicted by White race, Hispanic or Latino ethnicity, and not experiencing a recent death of a friend or family member among all participants and participants with trauma symptoms. Our findings align with previous research indicating that White individuals are more likely to experience internalizing disorders, such as anxiety and depression, compared with Black individuals (Breslau et al., 2006). However, Harnett et al. (2023) recently reported that racial/ethnic groups show similar rates of PTSD symptoms within three months after a traumatic experience. These patterns demonstrate the complex and

multifactorial interplay between race, ethnicity, and trauma, and suggest the need for these questions to be studied in diverse samples of graduate students.

Interestingly, identifying as a woman predicted a decrease in trauma symptoms, contrasting with previous research indicating that women are more likely to report adverse psychological effects from human donor dissection (Sándor et al., 2015) and trauma symptoms in general (Cusack et al., 2019). Further, trauma involving interpersonal violence, such as sexual trauma, is more prevalent among women and presents the greatest risk for developing PTSD (Kessler et al., 2017). Despite this, preexisting trauma exposure as measured by the LEC-5 was not a predictive variable in our study.

In our study, experiencing the death of a family member or close friend within six months of the start of an anatomy course was associated with decreased trauma symptoms. A possible explanation for our results is that some students have developed resilience mechanisms, which is a concept related to student success (Ali et al., 2024). Given the variability in the literature regarding the impact of a recent death of a family member or friend on anatomy students (Druce & Johnson, 1994; Quince et al., 2011), future studies exploring resilience, recent loss, and anatomy experiences may prove informative.

Predictors of Academic Performance

In this study, the strongest predictor of academic performance was not performing dissection, which differs from previous studies that show increased levels of participation in dissection improve student practical examination scores (Thompson & Marshall, 2020). Our sample included OT students whose lab experience was limited to prosections and represents all participants in our sample who did not perform any dissection. In contrast, DPT students performed full-body dissection, which is a typical difference between OT and PT anatomy courses at many universities (Milian et al., 2024; Veazey & Robertson, 2023). Although these program differences may have contributed to variation in academic performance, the program of study was not a variable included in our models. Thus, while not performing dissection was associated with academic performance in our model, broader program differences may have influenced this association.

Identifying as a woman was associated with improved academic performance in our sample. Other literature evaluating PT and OT anatomy students demonstrates that gender does not predict academic success (Harmon et al., 2023); one reason for this discrepancy with our study may be due to differences in instructional methods. Additionally, study skills and time management may have been factors in our study, as Harmon et al. (2023) found that women students had better self-regulation skills and were more likely to utilize academic resources than men students during an anatomy course. Future analyses of gender interactions with academic success, specifically in cadaver dissection-based instruction, are warranted.

Self-reported preexisting anxiety was a predictor of academic success. This finding was unexpected, as previous studies have shown that stress or anxiety levels are associated with decreased academic performance in anatomy or show no correlation (Flowers & Bernard, 2020; Lai et al., 2020). Although our study did not evaluate perfectionism, previous research indicates that anxiety symptoms may contribute to perfectionistic traits among graduate students in health professions programs (Humphrey & Causey-Upton, 2024). As perfectionism is associated with high levels of academic achievement (Witcher

et al., 2007), these factors may have contributed to the results we observed. The interplay of anxiety, perfectionism, and academic performance may be an important consideration for future research. Like anxiety, the presence of preexisting trauma symptoms was a significant, but not a strong, predictor of improved academic performance in our sample. Again, this was an unexpected finding, as trauma can negatively impact learning (Amirian et al., 2022). Overall, these findings suggest that academic performance is multifactorial and illuminate the difficulty of predicting student performance.

Implications

Findings from our study suggest that demographic factors are important predictors of trauma symptoms and academic performance in cadaver-based anatomy courses. These results underscore the need for more cultural and identity-based student support in anatomy education. As trauma-informed educational approaches are associated with positive student feedback (Bosse et al., 2021) and improved academic performance (Patton & Caffrey, 2023), anatomy educators should consider incorporating similar frameworks in their courses.

Educators may consider implementing SAMHSA's Trauma-Informed Approach through an identity-responsive perspective (SAMHSA, 2014). Within this framework, educators should recognize that the experiences and manifestations of trauma often vary among individuals of different races, ethnicities, and genders (Böckers et al., 2012; Marshall et al., 2009). Responses to these differences may include peer-led group reflection sessions (Zuo et al., 2017) or faculty professional development on cultural humility (Tervalon & Murray-García, 1998). Finally, providing clear expectations of course content in advance, encouraging students to share their concerns about the course material, and empowering students to take a break from the lab session, if necessary, may be beneficial actions for educators to prevent student retraumatization (Li et al., 2019).

Limitations and Future Studies

It is important to consider some limitations of this study. The relative homogeneity of gender, ethnicity, and race, as well as the small sample size, may have impacted the stability of our models and thus limit the generalizability of these results to samples of similar composition. We acknowledge that combining data for participants of diverse racial groups into a broad category and excluding gender-diverse participants may have masked important distinctions in the expression of trauma symptoms between different races or genders. Future studies should explore larger, more demographically representative samples of PT and OT students in the United States, as well as the diversity desired in health professions.

Our study relied on self-reported anxiety diagnoses rather than objective measures of anxiety, which, while practical for data collection, may introduce recall bias and underreporting. Furthermore, the LEC-5 and PCL-5 tools used in this study measured lifetime trauma and trauma experienced within the past month, respectively, at the start of the course, and trauma experienced during the semester at the end of the course. As these tools captured different time scopes, the observed changes may not reflect true changes in trauma symptoms. Additionally, confounding factors, such as stress from other courses,

clinical exposure, life events, test or career anxiety, differences between anatomy courses, and counseling or medication use among participants who did not report a new diagnosis of PTSD or anxiety may have influenced changes in trauma symptoms and course performance. Studies that incorporate multivariate controls and a comparison group may more clearly isolate the effects of anatomy coursework on trauma and academic outcomes.

Finally, to utilize all data available, no entries were held out for testing. As the lack of a separate test may limit the ability to assess predictive performance, future analyses that implement prediction for additional participants are warranted.

CONCLUSION

In this exploratory study, most participants entered their anatomy courses with preexisting trauma symptoms. While trauma symptoms declined overall, a subset of participants experienced new and/or worsening trauma symptoms, with a small number reaching the threshold for a preliminary diagnosis of PTSD. Demographic factors, including White race and Hispanic or Latino ethnicity, not experiencing the death of a family member or close friend, and preexisting trauma symptoms, were the most strongly associated factors with trauma symptoms. Notably, identifying as a woman predicted reduced trauma symptoms, contrary to prior assumptions. Unexpectedly, previous anxiety diagnosis, preexisting trauma symptoms, not performing dissection, and identifying as a woman were associated with improved academic performance.

The presence of trauma symptoms among students amplifies the importance of faculty recognition of trauma and its wide-ranging effects, the basic signs and symptoms of trauma, prevention of retraumatization, and considerations for the potential impact of trauma on the student experience and learning. Implementation of trauma-informed education may increase as PT and OT programs successfully recruit more diverse classes to make these professions reflect the demographics of the general population.

ACKNOWLEDGEMENTS

The authors would like to thank Belmont University, School of Occupational Therapy faculty, Natalie Michaels, LaRae Murray, and Katy Schmidt for access to their students and guidance about anatomy in occupational therapy education.

REFERENCES

Ali, F., Khan, R. A., & Arooj, M. (2024). Resilience and academic performance: Exploring the link in dental students. *Journal of the Pakistan Medical Association*, *74*(3), 566–569. https://doi.org/10.47391/JPMA.10198

American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders* (5th ed., text rev.). https://doi.org/10.1176/appi.books.9780890425787

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). https://doi.org/10.1176/appi.books.9780890425596

Amirian, M. R., Hajebi, M. Z., & Mirzahosseini, H. (2022). An academic achievement model for students with post-traumatic stress disorder (Kermanshah earthquake) based on cognitive ability and difficulty in emotion regulation. *Journal of Rescue and Relief*,

14(1), 66–75. https://doi.org/10.32592/jorar.2022.14.1.8

Asante, E. A., Maalman, R. S., Ali, M. A., Donkor, Y. O., & Korpisah, J. K. (2021). Perception and attitude of medical students towards cadaveric dissection in anatomical science education. *Ethiopian Journal of Health Sciences*, *31*(4), 867–874. https://doi.org/10.4314/ejhs.v31i4.22

Blevins, C. A., Weathers, F. W., Davis, M. T., Witte, T. K., & Domino, J. L. (2015). The posttraumatic stress disorder checklist for DSM-5 (PCL-5): Development and initial psychometric evaluation. *Journal of Traumatic Stress*, *28*(6), 489–498. https://doi.org/10.1002/jts.22059

Böckers, A., Baader, C., Fassnacht, U. K., Ochsner, W., & Böckers, T. M. (2012). Reduction of mental distress in the dissection course by introducing the body donor experience through anatomical demonstrations of organ systems. *Anatomical Sciences Education*, *5*(6), 321–329. https://doi.org/10.1002/ase.1292

Bonfils, K. A., Lysaker, P. H., Yanos, P. T., Siegel, A., Leonhardt, B. L., James, A. V., Brustuen, B., Luedtke, B., & Davis, L. W. (2018). Self-stigma in PTSD: Prevalence and correlates. *Psychiatry Research*, *265*, 7–12. https://doi.org/10.1016/j.psychres.2018.04.004

Bosse, J. D., Clark, K. D., & Arnold, S. (2021). Implementing trauma-informed education practices in undergraduate mental health nursing education. *Journal of Nursing Education*, *60*(12), 707–711. https://doi.org/10.3928/01484834-20211103-02

Bovin, M. J., Marx, B. P., Weathers, F. W., Gallagher, M. W., Rodriguez, P., Schnurr, P. P., & Keane, T. M. (2016). Psychometric properties of the PTSD Checklist for Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition (PCL-5) in veterans. *Psychological Assessment*, *28*(11), 1379–1391. https://doi.org/10.1037/pas0000254

Breslau, J., Aguilar-Gaxiola, S., Kendler, K. S., Su, M., Williams, D., & Kessler, R. C. (2006). Specifying race-ethnic differences in risk for psychiatric disorder in a USA national sample. *Psychological Medicine*, *36*(1), 57–68. https://doi.org/10.1017/S0033291705006161

Cheverko, C. M., Flores, C., Hamidi, S., Simpson, J., Yurich, H., & Wilson, A. B. (2025). Current trends in anatomy course characteristics across US physician assistant programs. *Anatomical Sciences Education*, *18*(5), 485–495. https://doi.org/10.1002/ase.70029

Curfman, S., Austin, G., & Nicholas, J. (2018). Post-traumatic stress and academic performance among entry-level doctoral physical therapy students in a human anatomy cadaver dissection course. *Internet Journal of Allied Health Sciences and Practice*, *16*(3), Article 1. https://doi.org/10.46743/1540-580X/2018.1750

Cusack, S. E., Hicks, T. A., Bourdon, J., Sheerin, C. M., Overstreet, C. M., Kendler, K. S., Dick, D. M., & Amstadter, A. B. (2019). Prevalence and predictors of PTSD among a college sample. *Journal of American College Health*, *67*(2), 123–131. https://doi.org/10.1080/07448481.2018.1462824

Dobkin, C., Gil, R., & Marion, J. (2010). Skipping class in college and exam performance: Evidence from a regression discontinuity classroom experiment. *Economics of Education Review*, *29*(4), 566–575. https://doi.org/10.1016/j.econedurev.2009.09.004

Dobson, A. J., & Barnett, A. G. (2018). *An introduction to generalized linear models,* (4th ed.). CRC Press.

Druce, M., & Johnson, M. H. (1994). Human dissection and attitudes of preclinical students to death and bereavement. *Clinical Anatomy*, *7*(1), 42–49. https://doi.org/10.1002/CA.980070108

Flowers, D., & Bernard, A. (2020). Make changes early! High stress levels predict lower academic performance in first-year physical therapy students: A pilot study. *Internet Journal of Allied Health Sciences and Practice*, *18*(4), Article 15. https://doi.org/10.46743/1540-580x/2020.1895

Forkus, S. R., Raudales, A. M., Rafiuddin, H. S., Weiss, N. H., Messman, B. A., & Contractor, A. A. (2023). The posttraumatic stress disorder (PTSD) Checklist for DSM-5: A systematic review of existing psychometric evidence. *Clinical Psychology*, *30*(1), 110–121. https://doi.org/10.1037/cps0000111

Gagnon-Sanschagrin, P., Schein, J., Urganus, A., Serra, E., Liang, Y., Musingarimi, P., Cloutier, M., Guérin, A., & Davis, L. L. (2022). Identifying individuals with undiagnosed post-traumatic stress disorder in a large United States civilian population - a machine learning approach. *BMC Psychiatry*, *22*(1), Article 630. https://doi.org/10.1186/s12888-022-04267-6

Gray, M. J., Litz, B. T., Hsu, J. L., & Lombardo, T. W. (2004). Psychometric properties of the life events checklist. *Assessment*, *11*(4), 330–341. https://doi.org/10.1177/1073191104269954

Harmon, D. J., Attardi, S. M., Waite, J. G., Topp, K. S., Smoot, B. J., & Farkas, G. J. (2023). Predictive factors of academic success in neuromusculoskeletal anatomy among doctor of physical therapy students. *Anatomical Sciences Education*, *16*(2), 323–333. https://doi.org/10.1002/ase.2202

Harnett, N. G., Dumornay, N. M., Delity, M., Sanchez, L. D., Mohiuddin, K., Musey, P. I., Jr, Seamon, M. J., McLean, S. A., Kessler, R. C., Koenen, K. C., Beaudoin, F. L., Lebois, L. A. M., van Rooij, S. J. H., Sampson, N. A., Michopoulos, V., Maples-Keller, J. L., Haran, J. P., Storrow, A. B., Lewandowski, C., & Ressler, K. J. (2023). Prior differences in previous trauma exposure primarily drive the observed racial/ethnic differences in posttrauma depression and anxiety following a recent trauma. *Psychological Medicine*, *53*(6), 2553–2562. https://doi.org/10.1017/S0033291721004475

SAMHSA. (2014). *SAMHSA's concept of trauma and guidance for a trauma-informed approach.* https://library.samhsa.gov/sites/default/files/sma14-4884.pdf

Humphrey, C., & Causey-Upton, R. (2024). Perfectionism in OT, SLP, and PT students on psychosocial outcomes: A pilot study. *Occupational Therapy in Mental Health*, *40*(3), 261–274. https://doi.org/10.1080/0164212X.2023.2245970

Hussein, I. H., Dany, M., Forbes, W., Thompson, M., & Jurjus, A. (2016). Perceptions of human cadaver dissection by medical students: a highly valued experience. *Italian Journal of Anatomy and Embryology*, *120*(3), 162–171. https://doi.org/10.13128/IJAE-17811

Kessler, R. C., Aguilar-Gaxiola, S., Alonso, J., Benjet, C., Bromet, E. J., Cardoso, G., Degenhardt, L., de Girolamo, G., Dinolova, R. V., Ferry, F., Florescu, S., Gureje, O., Haro, J. M., Huang, Y., Karam, E. G., Kawakami, N., Lee, S., Lepine, J.-P., Levinson, D., & Koenen, K. C. (2017). Trauma and PTSD in the WHO World Mental Health surveys. *European Journal of Psychotraumatology*, *8*(Suppl. 5), Article 1353383. https://doi.org/10.1080/20008198.2017.1353383

Kubany, E. S., Haynes, S. N., Leisen, M. B., Owens, J. A., Kaplan, A. S., Watson, S. B., & Burns, K. (2000). Development and preliminary validation of a brief broad-spectrum measure of trauma exposure: The Traumatic Life Events Questionnaire. *Psychological Assessment*, *12*(2), 210–224. https://doi.org/10.1037//1040-3590.12.2.210

Lai, H.-L., Lee, Y.-F., & Lai, K.-C. (2020). The influence of humanised anatomical pedagogy on psychophysiological responses and academic achievement in nursing students. *Journal of Professional Nursing*, *36*(4), 245–250. https://doi.org/10.1016/j.profnurs.2019.11.005

Letica-Crepulja, M., Stevanović, A., Protuđer, M., Grahovac Juretić, T., Rebić, J., & Frančišković, T. (2020). Complex PTSD among treatment-seeking veterans with PTSD. *European Journal of Psychotraumatology*, *11*(1), Article 1716593. https://doi.org/10.1080/20008198.2020.1716593

Li, Y., Cannon, L. M., Coolidge, E. M., Darling-Fisher, C. S., Pardee, M., & Kuzma, E. K. (2019). Current state of trauma-informed education in the health sciences: Lessons for nursing. *The Journal of Nursing Education*, *58*(2), 93–101. https://doi.org/10.3928/01484834-20190122-06

Madgwick, J., Anderson, L., & Cornwall, J. (2024). Medical students' initial experiences of the dissection room and interaction with body donors: A qualitative study of professional identity formation, educational benefits, and the experience of Pasifika students. *Anatomical Sciences Education*. Advance online publication. https://doi.org/10.1002/ase.2504

Marsella, A. J. (2010). Ethnocultural aspects of PTSD: An overview of concepts, issues, and treatments. *Traumatology*, *16*(4), 17–26. https://doi.org/10.1177/1534765610388062

Marshall, G. N., Schell, T. L., & Miles, J. N. V. (2009). Ethnic differences in posttraumatic distress: Hispanics' symptoms differ in kind and degree. *Journal of Consulting and Clinical Psychology*, *77*(6), 1169–1178. https://doi.org/10.1037/a0017721

Mayer, K. A., Linehan, K. J., & MacMillan, N. K. (2022). Student perspectives on potential sources of trauma exposure during nursing school. *Nursing Forum*, *57*(5), 833–842. https://doi.org/10.1111/nuf.12728

Mayer, K., Rothacker-Peyton, S., & Wilson-Anderson, K. (2023). Trauma-informed educational practices within the undergraduate nursing classroom: A pilot study. *Trauma Care*, *3*(3), 114–125. https://doi.org/10.3390/traumacare3030012

McDonald, S. D., & Calhoun, P. S. (2010). The diagnostic accuracy of the PTSD checklist: a critical review. *Clinical Psychology Review*, *30*(8), 976–987. https://doi.org/10.1016/j.cpr.2010.06.012

Milian, E. K., Smith, B. A., Costas, A., Wong, M. L., Ravelo, D., & Hartley, G. W. (2024). The current state of anatomy education in United States doctor of physical therapy programs. *Anatomical Sciences Education*, *17*(2), 343–350. https://doi.org/10.1002/ase.2355

Newman, K., & Ruehter, V. (2025). Frequency, impact and response to pharmacy students experiencing distressing APPE-related events. *Currents in Pharmacy Teaching & Learning*, *17*(5), 102233. https://doi.org/10.1016/j.cptl.2024.102233

Nolan, H. A., & Roberts, L. (2021). Medical educators' views and experiences of trigger warnings in teaching sensitive content. *Medical Education*, *55*(11), 1273–1283.

https://doi.org/10.1111/medu.14576

Nolting, I. K. L., Morina, N., Hoppen, T. H., Tam, K.-P., & Kip, A. (2025). A meta-analysis on gender differences in prevalence estimates of mental disorders following exposure to natural hazards. *European Journal of Psychotraumatology*, *16*(1), 2476809. https://doi: 10.1080/20008066.2025.2476809

Patton, J. D., & Caffrey, T. (2023). Hispanic students in higher education: A case for trauma informed approaches. *Journal of Human Behavior in the Social Environment*, *33*(5), 711–723. https://doi.org/10.1080/10911359.2022.2089311

Quince, T. A., Barclay, S. I. G., Spear, M., Parker, R. A., & Wood, D. F. (2011). Student attitudes toward cadaveric dissection at a UK medical school. *Anatomical Sciences Education*, *4*(4), 200–207. https://doi.org/10.1002/ase.237

Romo-Barrientos, C., Criado-Álvarez, J. J., González-González, J., Ubeda-Bañon, I., Flores-Cuadrado, A., Saiz-Sánchez, D., Viñuela, A., Martin-Conty, J. L., Simón, T., Martinez-Marcos, A., & Mohedano-Moriano, A. (2020). Anxiety levels among health sciences students during their first visit to the dissection room. *BMC Medical Education*, *20*(1), 109. https://doi.org/10.1186/s12909-020-02027-2

Sándor, I., Birkás, E., & Győrffy, Z. (2015). The effects of dissection-room experiences and related coping strategies among Hungarian medical students. *BMC Medical Education*, *15*(1), Article 73. https://doi.org/10.1186/s12909-015-0355-9

Sbayeh, A., Qaedi Choo, M. A., Quane, K. A., Finucane, P., McGrath, D., O'Flynn, S., O'Mahony, S. M., & O'Tuathaigh, C. M. P. (2016). Relevance of anatomy to medical education and clinical practice: perspectives of medical students, clinicians, and educators. *Perspectives on Medical Education*, *5*(6), 338–346. https://doi.org/10.1007/s40037-016-0310-4

Strauss, T., Rottstädt, F., Sailer, U., Schellong, J., Hamilton, J. P., Raue, C., Weidner, K., & Croy, I. (2019). Touch aversion in patients with interpersonal traumatization. *Depression and Anxiety*, *36*(7), 635–646. https://doi.org/10.1002/da.22914

Tervalon, M., & Murray-García, J. (1998). Cultural humility versus cultural competence: a critical distinction in defining physician training outcomes in multicultural education. *Journal of Health Care for the Poor and Underserved*, *9*(2), 117–125. https://doi.org/10.1353/hpu.2010.0233

Thompson, A. R., & Marshall, A. M. (2020). Participation in dissection affects student performance on gross anatomy practical and written examinations: Results of a four-year comparative study. *Anatomical Sciences Education*, *13*(1), 30–36. https://doi.org/10.1002/ase.1859

Veazey, K., & Robertson, E. M. (2023). How human anatomy is being taught in entry-level occupational therapy programs in the United States. *Anatomical Sciences Education*, *16*(2), 305–322. https://doi.org/10.1002/ase.2226

Weathers, F. W., Blake, D. D., Schnurr, P. P., Kaloupek, D. G., Marx, B. P., & Keane, T. M. (2013a). *The Life Events Checklist for DSM-5 (LEC-5)* [Measurement instrument]. https://www.ptsd.va.gov/professional/assessment/temeasures/life_events_checklist.asp

Weathers, F. W., Litz, B. T., Keane, T. M., Palmieri, P. A., Marx, B. P., & Schnurr, P. P. (2013b). The PTSD Checklist for DSM-5 (PCL-5). [Measurement instrument]. https://www.ptsd.va.gov/professional/assessment/adult-sr/ptsd-checklist.asp

Weis, C. N., Webb, E. K., Stevens, S. K., Larson, C. L., & deRoon-Cassini, T. A. (2022).

Scoring the Life Events Checklist: Comparison of three scoring methods. *Psychological Trauma: Theory, Research, Practice and Policy*, *14*(4), 714–720. https://doi.org/10.1037/tra0001049

Witcher, L. A., Alexander, E. S., Onwuegbuzie, A. J., Collins, K. M. T., & Witcher, A. E. (2007). The relationship between psychology students' levels of perfectionism and achievement in a graduate-level research methodology course. *Personality and Individual Differences*, *43*(6), 1396–1405. https://doi.org/10.1016/j.paid.2007.04.016

Zubair, A., Waheed, S., & Shuja, F. (2021). Psychological impact of cadaveric dissection on first-year medical students. *The Journal of the Royal College of Physicians of Edinburgh*, *51*(2), 173–176. https://doi.org/10.4997/JRCPE.2021.219

Zuo, S. W., Cichowitz, C., Shochet, R., & Venkatesan, A. (2017). Peer-led, postanatomy reflection exercise in dissection teams: Curriculum and training materials. *MedEdPORTAL : The Journal of Teaching and Learning Resources*, *13*(1), Article 10565. https://doi.org/10.15766/mep_2374-8265.10565

SUE E. CURFMAN, PT, DHSc, OCS, is a Professor in the School of Physical Therapy at Belmont University. Her primary research interests focus on teaching and learning in anatomy education, particularly the influence of psychosocial factors and spatial skills on student learning and academic success, and pain neuroscience education among healthcare students, faculty, and educators.

RYAN C. MCCONNELL, PT, DPT, DSc, OCS, COMT, FAAOMPT®, is an Associate Professor and Vice Chair in the School of Physical Therapy at Belmont University. His research interests include the influence of psychosocial factors on clinical outcomes, pain neuroscience education, and evidence-based management of musculoskeletal conditions, with particular emphasis on dry needling.

ROSANNE M. THOMAS, PT, PhD is an Associate Professor and Program Director of Physical Therapy in the School of Rehabilitation and Performance Sciences at Northern Illinois University. Her primary research interests focus on educational best-practice, pedagogy, and student success. She also continues to investigate admission and academic predictors of success on the National Physical Therapy Examination (NPTE) for licensure post-graduation.

WILL J. BEST, PhD, is an Assistant Professor of Statistics at Belmont University. His major research interests lie in statistical modeling, biostatistics, and interdisciplinary applications of data science.

GARY P. AUSTIN, PT, PhD, OCS, FAAOMPT®, FAFS is a Professor of Physical Therapy in the School of Physical Therapy at Belmont University. His primary research interests include teaching and learning, pain neuroscience education, and orthopedic manual physical therapy.