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REVIEW

Personal Preparation of Medical Students for the Human Dissection Experience: A Systematic Review

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Abstract

Anatomical dissection is a cause of distress for many medical students. Explicit pedagogical strategies are important in reducing student distress and supporting their personal development. A systematic review of PubMed, Ovid, PsycINFO, and Web of Science databases was conducted to examine quantitative data regarding medical school interventions to reduce the negative psychological and moral impact of anatomical dissection on medical students. Of 1189 unique abstracts, 14 papers met screening criteria. Student distress decreased with the use of educational audiovisual materials and graded exposure to donor bodies. Educational lectures, memorial ceremonies, and utilization of background music had mixed results.

Keywords Donor body · Cadaver · Anatomical dissection · Distress · Anxiety

Introduction

Anatomic dissection of human bodies has been a cornerstone of medical education for centuries and remains integral to medical education in most medical schools [1]. Human dissection offers students a unique opportunity to gain first-hand knowledge of anatomical structures, spatial relationships, and pathology. Concept acquisition and retrieval may be strengthened through perceptual and motor learning.

Beyond the learning of anatomic structures, the dissection experience is an important factor in medical students' personal formation and development. Historically considered a rite of passage, human body dissection serves as a marker for professional identity formation [2]. It begins a career-long encounter with disease and death that requires physicians to contend with personal vulnerability and mortality. Dissection provokes early professional tensions between empathy (for the donor) and dispassion (tasked use of the gifted body). Teamwork and ethical self-regulation of peers by peers to assure respectful regarding of the donor body and handling of remains are also important to professional formation.

Many medical students suffer from anxiety and mood disturbance related to the high-pressure environment of medical education [3–5]. More than a quarter of medical students experience depression or depressive symptoms due to medical school [6]. Anatomical dissection may be one significant contributory factor early in training [3, 7]. Students may experience psychological distress related to encountering death, religio-cultural distress related to handling of human remains, and moral distress from treating human bodies as specimens. If unaddressed by faculty, students may misunderstand their emotional and moral responses to be aberrant or even unprofessional, learning to dissociate rather than integrate their personal and moral selves from their professional identity. These concerns are at least partially recognized by medical students and medical school administrations, as Boeckers et al. found that 64% of students surveyed at the end of the dissection course favored psychological support at the start of anatomy dissection [7].

Practice Points
- Anatomical dissection may be a cause of moral distress for medical students and is an opportunity for personal development.
- Graded exposure techniques, including the use of prosected specimens, consistently decrease student distress.
- Video materials, live presentations, initiation ceremonies, and background music have varied effects on medical student distress.

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There are currently no published reviews assessing the range of educational interventions implemented by medical schools. The objective of this paper is to review the available literature addressing interventions to reduce medical student distress from donor body dissection [7].

Methods

Search Strategy

This systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [8]. Four databases (Embase, PubMed, Scopus, Web of Science) were queried on July 3, 2021. No date restrictions were set. Search terms were as follows: "(cadaver OR cadaveric OR donor body OR donor OR anatomy lab OR gross OR dissection OR prosection) AND (student OR trainee) AND (educat* OR teach* OR intervention OR prepare OR preparation) AND (stress OR empathy OR anxiety OR fear OR apprehension OR emotion OR psychological)."

Data Extraction and Analysis

Endnote × 9 was used to remove duplicates and screen titles and abstracts. Three authors conducted independent title and abstract screening based on the following inclusion criteria: study population of medical students, minimum sample size of 20 students, results reporting quantitative data, and study intervention occurring prior to, or concurrent with, anatomical dissection activity. Conference posters and presentations, review articles, abstracts, anecdotal articles, and articles not written in English were excluded. After screening of titles and abstracts, independent full-text reviews were conducted by three authors to create the final list of papers for data extraction; papers were included for data extraction if at least two of the three reviewing authors determined that inclusion criteria were met. A final application of search criteria to citation lists of each of these yielded no additional papers for review. The following data were extracted from each article: location/institution, sample size, intervention, assessment tool, outcome variable, and main article findings. Extracted data were compiled into one table, assigned categories based on intervention, and analyzed for themes and trends. Quality assessment was independently conducted by two of the authors using the National Institute of Health (NIH) Study Quality Assessment Tools, and final determinations were made through consensus [9].

Results

A search of all four data bases yielded a total of 1189 citations (PubMed 529, Ovid 87, PsycINFO 304, and Web of Science 269). Elimination of duplicates resulted in 1050 unique citations. Title and abstract screening yielded 83 articles (Fig. 1). Full-text screening based on inclusion and exclusion criteria yielded 14 articles. Table 1 provides a methodological overview of the included studies with the main variables extracted from each article. Table 2 provides an overview of the main findings from each paper with statistical values. Using the NIH Study Quality Assessment Tools, six studies were rated as "good," three studies were rated as "fair," and five studies were rated as "poor." Table 3 details the quality assessment ratings of the individual studies.

Video Materials

Five studies assessed the effect of educational videos on lowering psychological distress associated with donor body dissection. Arraez-Aybar et al. studied students at a medical school in Spain [10]. Participants watched a 23-min video consisting of three sections: "Importance of Anatomy," "Problem of Dissection," and "The Dissection." Video material included recordings of actual donor bodies undergoing dissection. Group average anxiety was measured using the verified State-Trait Anxiety Inventory (STAI) scale. The experimental group had significantly lower anticipatory anxiety prior to first dissection session. No difference in anxiety levels was shown between groups following the first dissection session, with both groups demonstrating significant reduction of anxiety after initial exposure to dissection.

Casado et al. repeated the study conducted by Arraez-Aybar within the same medical school [10, 11]. Again, the experimental group demonstrated significantly lower anticipatory anxiety. In this study, anxiety levels in both groups trended downward after the intervention, although the change did not reach statistical significance.

In an uncontrolled study, Dosani et al. assessed a cohort of medical students in the United States (US) who viewed a documentary including images of donor bodies and recorded interviews with body donors [12]. Effects were measured using a 7-point Likert-type questionnaire, and they were assessed before and after the initial dissection session. Students who watched the documentary had a significantly more positive initial interaction with donor bodies. However, they reported an increase in negative attitudes toward dissection and an increase in negative emotional response to the dissection laboratory experience. These students were less likely to view the donor body as a person than as a specimen.

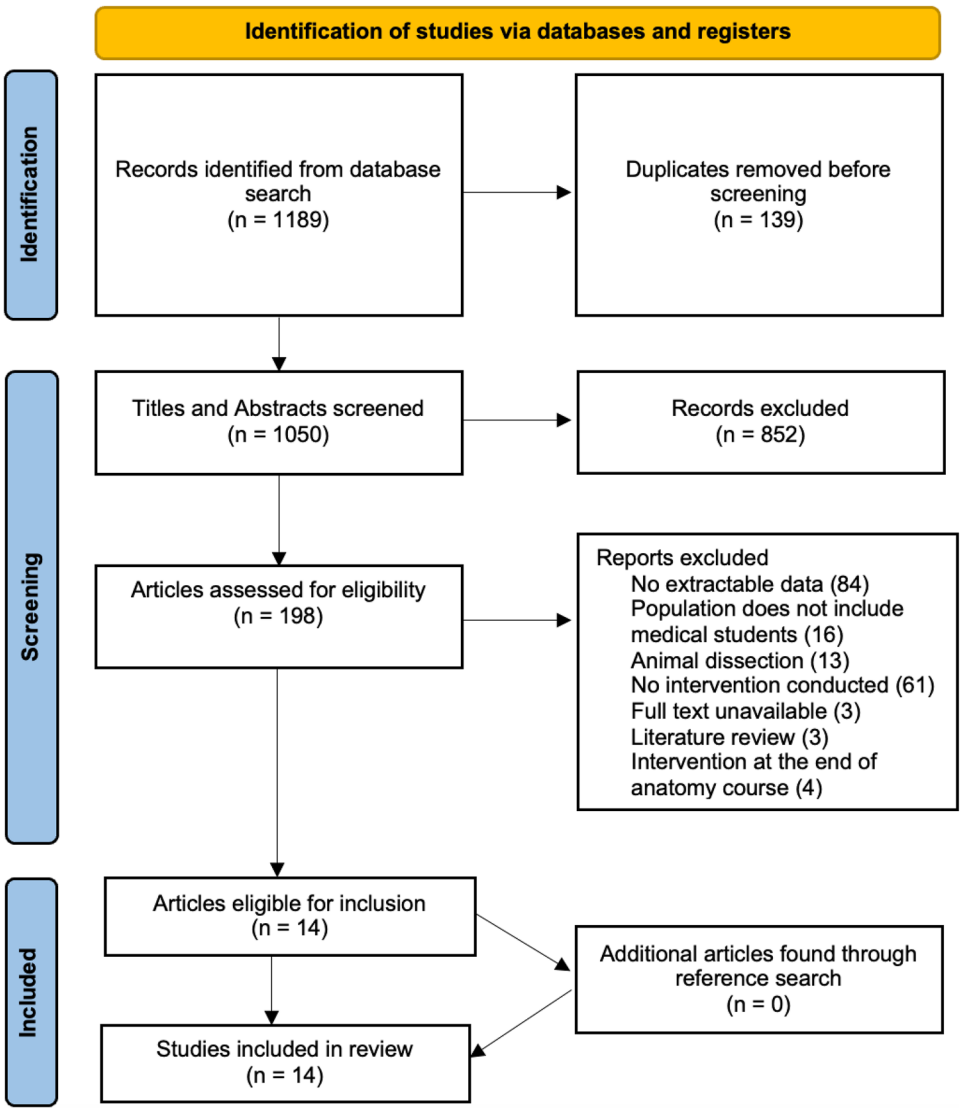

Fig. 1 PRISMA flowchart indicating article screening and application of inclusion criteria

Iaconisi et al. assessed the effect of a 26-min video on the psychological stress among medical students attending a medical school in Germany by utilizing a multiple, passive cohort control design [13]. The video consisted of interviews with upper-class students and body donors. Stress levels were measured using the Global Severity Index of the Brief Symptom Inventory (GSI-BSI) questionnaire, with higher scores indicating increased psychological distress [13]. One intervention group viewed the material and took part in a 30-min group discussion 1 day prior to beginning the dissection course. A second intervention group viewed the material on day 60 of the course. Measurements were taken at four timepoints: before watching the video, after watching the video and immediately before beginning dissection, 60 days after beginning dissection, and 120 days after beginning dissection. GSI-BSI scores in the control and interventional groups decreased from the first to the second timepoints and increased until the third and fourth timepoints. There were no significant differences between the control and interventional groups in any of the assessments.

Lastly, Attardi et al. conducted a study in the US and created a YouTube video based on a needs assessment completed by upper-class medical students [14]. The video content covered the anatomy curriculum, body donors, memorial ceremony, student academic and social services, and other related topics. Student anxiety levels were assessed via the STAI questionnaire after students were instructed to watch the video but before beginning dissection. Outcomes in the interventional group were compared to a passive control group and to a prior academic year's cohort, both of which did not watch the video prior to dissection. However, no difference was found between groups in anxiety levels. Of note, students with prior anatomy exposure experienced significantly less anxiety compared to their peers without prior exposure.

Table 1 Methodological overview of studies investigating personal preparation of medical students for anatomy dissection

Author, year, and journal	Setting	Sample size	Controlled study	Intervention	Outcome and assessment tool
Attardi et al. 2021, *Anatomical Sciences Education* [14]	Oakland University William Beaumony School of Medicine, USA	238	Yes	Educational video	Anxiety, STAI
Anyanwu et al. 2015, *Advances in Physiology Education* [22]	College of Medicine of the University of Nigeria, Nigeria	253 (medical and dental)	Yes	Background Music	Psychological stress, PSM-9
Arráez-Aybar et al. 2004, *The Anatomical Record* [10]	Faculty of Medicine of the Complutense University, Spain	236	No	Educational video	Anxiety; STAI
Bellier et al. 2020, *Anatomical Sciences Education* [23]	Grenoble Medical School, France	187	Yes	Background Music	Anxiety; STAI
Bockers et al. 2012, *Medical Education* [18]	University of Louisiana Monroe Medical School, USA	320	Yes	Pre-dissection orientation course	Mental distress, 10-cm VAS and a 5-point Likert Scale (0 = No, not at all correct; 4 = Yes, definitively correct)
Casado et al. 2012, *Advances in Health Sciences Education* [11]	Faculty of Medicine of the Complutense University, Spain	303	Yes	Educational video	Anxiety; STAI
Chiou et al. 2017, *BMC Research Notes* [20]	Medical university (unspecified), Taiwan	158	No	Initiation Ceremony	Emotional reactions and attitudes; ATD, LAI, ERTCS
Crow et al. 2012, *Teaching and Learning in Medicine* [21]	University of Oklamoha College of Medicine, USA	157	Yes	Donor Luncheon	Perceptions; Human Dissection Questionnaire
Dosani et al. 2016, *Anatomical Sciences Education* [12]	University of Central Florida Medical School, USA	77	No	Educational video	Emotional reactions and attitudes; Questionnaire with 7-point Likert scale
González-Pinillaet al. 2020, *International Journal of Morphology* [15]	Faculty of Medicine of the Complutense University, Spain	336	Yes	Lectures	Stress-related symptoms; Questionnaire
Houwink et al. 2004, *Clinical Anatomy* [19]	Mayo Clinic/Mayo Medical School, USA	74	No	Peer mentorship during first dissection	Stress-related symptoms; Questionnaire with a 5-point Likert scale
Iaconisi et al. 2019, *Anatomical Sciences Education* [13]	Ulm University, Germany	77	Yes	Educational video	Stress; GSI-BSI
Javadnia et al. 2006, *Pakistan Journal of Medical Sciences* [17]	Jundi Shapur University of Medical Sciences, Iran	68	Yes	Lecture	Anxiety; BAI
Saylam et al. 2005, *Surgical and Radiologic Anatomy* [16]	Ege University Medical School, Turkey	242	Yes	Lecture	Anxiety; STAI

STAI State-Trait Anxiety Inventory, *PSM-9* Psychological Stress Measure-9, *VAS* Visual Analog Scale, *ATD* Attitude Towards Death, *LAI* Life Attitude Inventory, *ERTCS* Emotional Response Towards Cadavers Scale, *GSI-BSI* Global Severity Index - Brief Symptom Inventory, *BAI* Beck Anxiety Inventory

Table 2 Main findings from studies investigating personal preparation of medical students for anatomy dissection

Author, year, and journal	Main findings
Attardi et al. 2020, *Anatomical Sciences Education* [14]	Prior to beginning dissection, statistical equivalence was found in anxiety levels between the 2018 matriculants (38.81 ± 10.782), the 2019 non-video watchers (39.98 ± 12.220), and the 2019 video watchers (41.40 ± 11.909, $p = 0.495$). Students with prior anatomy experience had significantly less anxiety compared to their peers who did not have exposure (37.75 ± 10.186 vs 43.12 ± 12.569, $p = 0.006$).
Anyanwu et al. 2015, *Advances in Physiology Education* [22]	Average cohort stress level, measured with the PSM-9 questionnaire, significantly decreased from 42.7 ± 0.9 before the introduction of background music to 29.4 ± 0.6 after the introduction of background music during anatomy dissection ($p < 0.001$). Although a control group was included, no formal analysis was conducted.
Arráez-Aybar et al. 2004, *The Anatomical Record* [10]	Anxiety level in the experimental group before the first dissection was significantly lower than the average anxiety level of the control group (23.82 vs 26.82, $p = 0.034$). After the first dissection, anxiety significantly decreased in the experimental group (23.82 to 15.26; $p < 0.001$), and in the control group (26.83 to 13.55; $p < 0.001$). After the first dissection session, anxiety levels were not significantly different between the two groups ($p = 0.17$).
Bellier et al. 2020, *Anatomical Sciences Education* [23]	A significantly lower percentage of students experienced acute anxiety in the music intervention group than in the control group (40.4% vs 60.2%; $p = 0.0215$). There was a 58% relative decrease in acute anxiety in the experimental group (OR = 0.423; 0.160, 0.710).
Bockers et al. 2012, *Medical Education* [18]	Attendees of the educational course, in contrast to the control group, experienced significantly reduced mental stress, measured on a 10-cm VAS, from before to immediately after their first encounter with a donor body (3.12 ± 2.17 to 1.98 ± 1.74; $p < 0.001$). Significant reductions in mental stress were also observed when the experimental group was analyzed based on subgroups. The "infrequent" group decreased from 3.12 ± 2.17 to 2.23 ± 1.89, $p < 0.001$, and the "frequent" subgroup decreased from 3.12 ± 2.17 to 1.85 ± 1.64, $p < 0.001$. When asked if their first encounter with the body donor was "better" than expected the "frequent" subgroup significantly differed from the "infrequent" subgroup (3.27 ± 1.11 vs 2.89 ± 1.34, $p = 0.046$), measured on a 5-point Likert scale. One day before the start of the dissection course, attendees felt less often that anatomical dissection is an additional stress factor, as compared to the control group (1.57 ± 1.28 vs 2.48 ± 1.19, $p < 0.001$). They were also less likely to report a sense of disgust when thinking about donor bodies (0.65 ± 0.86 vs 0.77 ± 0.80, $p = 0.022$).
Casado 2012, *Advances in Health Sciences Education* [11]	Before the first dissection, anxiety levels, measured using STAI, in the experimental group were significantly lower than in the control group (18.6 ± 9.37 vs 24.77 ± 9.59; $p < 0.001$). After the first dissection session, anxiety levels decreased in the experimental group (18.6 ± 9.37 to 14.07 ± 8.72) and in the control group (24.77 ± 9.59 to 16.79 ± 9.00; $p = 0.45$). The groups did not significantly differ in anxiety levels after the first dissection.
Chiou et al. 2017, *BMC Research Notes* [20]	Students were surveyed prior to the ceremony (T1), immediately after during the first phase of the course (T2), and 3 months into the course (T3). Attitudes Toward Death (ATD) increased from 4.77 ± .54 at T1 to 5.04 ± 0.85 at T2 ($p < 0.001$). Negative emotions toward donor bodies decreased from 2.98 ± 0.94 at T1 to 2.52 ± 0.95 at T2 ($p < 0.001$). The LEGALS score showed no significant difference before and after the ceremony: 5.65 ± 1.04 T1 to 5.53 ± 1.10 at T2 ($p = 0.132$). The three-month follow-up (T3) showed ATD remained increased at 5.10 ± 0.75 ($p < 0.001$) in comparison to T1. Negative emotions remained decreased 2.34 ± 1.04 ($p < 0.001$) and the LEGALS score significantly increased from 5.84 ± 0.95 ($p < 0.001$).

Table 2 (continued)

Author, year, and journal	Main findings
Crow et al.2012, *Teaching and Learning in Medicine* [21]	Anatomy course (T1), 6 weeks later (T2), and at the conclusion of the course (T3). Compared to T1, students in interventional group assessed at T2 had a decreased perception of the donor as a person [2.94 ± 0.19 (T1) vs 2.51 ± 0.19 (T2), $p < 0.001$], improved perceptions of the dissection process [3.75 ± 0.24 (T1) vs 4.33 ± 0.18 (T2), $p < 0.001$], and increased perception of the donor as a patient [3.73 ± 0.23 (T1) vs 4 ± 0.17 (T2), $p < 0.001$]. No significant difference was found in students' overall "emotions toward cadaver" [3.79 ± 0.2 (T1) vs 4.05 ± 0.15 (T2), $p = 0.055$], or perceptions of hurting the donor [4.52 ± 0.2 (T1) vs 4.75 ± 0.13 (T2), $p = 0.299$].
Dosani et al. 2016, *Anatomical Sciences Education* [12]	After viewing the video, negative attitudes toward dissection increased from 2.911 ± 1.397 to 3.217 ± 1.274 ($p = 0.01$) and the likelihood of seeing the donor as a person decreased from 4.234 ± 0.903 to 4.059 ± 0.915 (p 0.008). However, negative emotional response to anatomy experience decreased from 2.923 ± 1.087 to 2.655 ± 1.003 ($p < 0.001$) and positive initial reactions increased from 4.456 ± 1.316 to 4.767 ± 1.2 ($p = 0.039$).
González-Pinilla et al. 2020, *International Journal of Morphology* [15]	The experimental group showed a significantly higher number of stress symptoms in comparison to the control group (5.98 ± 4.11 vs 3.40 ± 3.16, $p < 0.01$). The experimental group was more likely to experience nausea and/or vomiting ($p < 0.01$), neck and shoulder pain ($p = 0.038$), diarrhea ($p = 0.024$), irritability ($p = 0.047$), and indigestion ($p = 0.019$). Experimental and control groups exhibited similar symptoms after the first dissection session. Both groups had increases in headaches ($p < 0.01$), neck and shoulder pain ($p < 0.001$ in control, $p = 0.038$ in experimental), and loss of appetite ($p = 0.005$ in control, $p < 0.001$ in experimental). Both groups experienced decreases in worrying thoughts ($p < 0.001$). The control group had a significant decrease in nervousness ($p < 0.001$) and heart palpitations ($p < 0.001$) while the experimental group had insignificant changes. After the dissection experience, the control group showed a reduction in stress symptoms, but the experimental group reported a higher rate of symptomatology.
Houwink et al. 2004, *Clinical Anatomy* [19]	On average, first-year students reported fewer symptoms than second-year students (1.55 vs 2.32). While 64% of first-year students reported symptoms, 88% of the second-year students reported symptoms ($p < 0.02$). First-year students, in comparison to second-year students, had lower incidence of anxiety (23% vs 48%, $p = 0.07$), headache (14% vs 36%, $p = 0.01$), light-headedness (11% vs 24%, no p-value reported), and disgust (9% vs 20%, no p-value reported). First-years were also more likely to report the smell of the laboratory to be better than expected in comparison to second-year students (92% vs 48%, $p < 0.05$).
Iaconisi et al. 2019, *Anatomical Sciences Education* [13]	Students were assessed at four timepoints: Immediately before watching the film, after watching the film 1 day before dissection, 60 days after the start of dissection, and 120 days after the start of dissection at the end of the course. Baseline BSI significantly decreased in all groups from the first to the second timepoint. GSI-BSI scores increased from the second to the third and fourth timepoints ($p < 0.001$). GSI scores in the control group were higher than the interventional groups, but without significance ($p = 0.54$).
Javadnia et al. 2006, *Pakistan Journal of Medical Sciences* [17]	The experimental group had significantly lower anxiety scores at the initial visit to the dissection laboratory ($p < 0.01$). In the control group, anxiety declined significantly ($p < 0.08$) over the study period and ultimately there was no statistically significant difference in anxiety rates between experimental and control groups at the 6-week mark.

Table 2 (continued)

Author, year, and journal	Main findings
Saylam et al. 2005, *Surgical and Radiologic Anatomy* [16]	Anxiety was measured using two STAI scales at two timepoints: before orientation and after dissection. In the experimental group, STAI Trait anxiety increased from 41.31 ± 9.06 at the first timepoint to 42.42 ± 7.51 at the second timepoint. STAI State anxiety decreased in the experimental group from 42.39 ± 8.29 to 41.44 ± 7.63. In the control group, STAI Trait anxiety increased from 40.14 ± 10.67 to 41.48 ± 9.32. STAI State anxiety increased in the control group from 42.67 ± 10.44 to 43.55 ± 11.28. None of the differences reached significance.

STAI State-Trait Anxiety Inventory *PSM-9* Psychological Stress Measure-9, *VAS* Visual Analog Scale, *ATD* Attitude Towards Death, *GSI-BSI* Global Severity Index—Brief Symptom Inventory

Lecture-Based Presentations

González-Pinilla et al. assessed the impact of three, 50-min lectures about death and dying on stress among medical students in a medical school in Spain prior to a 6-week dissection course [15]. The first lecture addressed the mystery of death and difficulty of determining the moment of death, the second lecture focused on the philosophy that death gives meaning to life, and the third lecture gave a brief overview of history of anatomic dissection. The lectures were accompanied by small discussion groups. The control group did not attend the three lectures or discussion. Students completed a 4-point Likert-type questionnaire with a self-assessment checklist of eighteen stress-related symptoms and were assessed before beginning dissection and after the 6-week dissection course. In the control group, students had a similar number of stress-related symptoms before beginning and after completing the dissection course, with a significant increase in the frequency of three symptoms and a significant decrease in the frequency of three other symptoms. In the experimental group, six stress-related symptoms increased in frequency while two symptoms decreased in frequency after the dissection course compared to before the intervention. The experimental group, when compared to the control group, exhibited a significantly higher frequency of six stress-related symptoms after the dissection course: nervousness, indigestion, heart palpitations, worry thoughts, irritability, and neck and shoulder pain.

Saylam et al. developed an interactive orientation lesson to prepare medical students in Turkey for anatomical dissection [16]. The orientation included information about body donors, importance of anatomical dissection to medical education, and the historical development of the study of anatomy. Coping mechanisms were openly discussed, and students shared thoughts and feelings. Participants were assessed using the STAI questionnaire before orientation and after dissection, and a control group that did not attend the orientation lesson was used for comparison. The control and experimental groups, each compared to itself before the orientation, exhibited slightly increased anxiety levels but without significance. When comparing the experimental group to the control group, there was no significant difference in anxiety levels before orientation and after dissection.

Javadnia et al. assessed the impact of an educational lecture on anxiety levels among medical students in Iran [17]. Students were randomly assigned to experimental or passive control groups. Students in the experimental group received information on the source of donor bodies, the embalmment process, burial or final disposition of the bodies, and the training benefits of using dissection to understand anatomical variations. Students in the control group did not receive the intervention. A modified and abbreviated Beck Anxiety Inventory (BAI) was administered to assess self-reported anxiety-related symptoms of nausea, dizziness, weakness, fear, restlessness, and lack of concentration using a 5-point Likert scale. Students were assessed immediately after the initial visit to the dissection laboratory and again 6 weeks later. Compared to the control group, the experimental group reported significantly lower anxiety scores after the initial visit to the dissection laboratory. There was also no significant difference in anxiety levels between the control and interventional groups 6 weeks after the start of the course.

Graded Exposure

Bockers et al. explored the impact of a four-part educational course, entitled "Anatomical Demonstrations of Organ Systems," on mental distress among students attending a medical school in Germany [18]. Prior to anatomical dissection, students in the interventional group attended all four sessions of the course, which involved studying prosected human specimens intended to provide stepwise exposure to human anatomical material. Two subgroups were formed for students who attended some, but not all, sessions. The "frequent" subgroup attended three of the four sessions, and the "infrequent" subgroup attended two of the sessions. The control group did not attend any of the sessions. Self-reported stress levels were measured using a questionnaire

Table 3 Quality assessment rating of studies

Author and year	Described as randomized	Randomization method Adequate	Intervention group allocation concealed	Participants blinded	Assessors blinded	Group similarity	Drop-out rate < 20%	Drop-out rate < 15%	Intervention adherence	Other interventions avoided	Outcome assessment tool	Sample size power calculation	Prespecified outcomes	Analyzed in original groups	Final rating
Attardi et al. 2021 [14]	N	N	Y	N	N	Y	N	N	Y	Y	Y	N	Y	Y	**Good**
Anyanwu et al. 2015 [22]	Y	Y	Y	N	N	Y	N	N	Y	Y	Y	N	N	Y	**Poor**
Arráez-Aybar et al. 2004 [10]	Y	Y	Y	N	N	Y	N	N	Y	Y	Y	N	Y	Y	**Good**
Bellier et al. 2020 [23]	Y	Y	Y	N	N	Y	N	N	Y	Y	Y	N	Y	Y	**Good**
Bockers et al. 2012 [18]	N	N	Y	N	N	Y	N	N	Y	Y	Y	N	Y	Y	**Good**
Casado etl al. 2012 [11]	Y	Y	Y	N	N	Y	N	N	Y	Y	Y	N	Y	Y	**Good**
Chiou et al. 2017 [20]	N	N	Y	N	N	Y	N	N	Y	Y	Y	N	Y	Y	**Poor**
Crow et al. 2012 [21]	Y	Y	Y	N	N	Y	N	N	Y	Y	N	N	Y	Y	**Fair**
Dosani et al. 2016 [12]	N	N	Y	N	N	Y	N	N	Y	Y	Y	N	Y	Y	**Poor**
González-Pinilla et al. 2020 [15]	Y	Y	Y	N	N	Y	N	N	Y	Y	N	N	Y	Y	**Fair**
Houwink et al. 2004 [19]	N	N	Y	N	N	Y	N	N	Y	Y	N	N	N	Y	**Poor**
Iaconisi et al. 2019 [13]	Y	Y	Y	N	N	Y	N	N	Y	Y	Y	N	Y	Y	**Good**
Javadnia et al. 2006 [17]	Y	Y	Y	N	N	Y	N	N	Y	Y	Y	N	Y	Y	**Poor**
Saylam et al. 2005 [16]	Y	Y	Y	N	N	Y	N	N	Y	Y	Y	N	Y	Y	**Fair**

developed by the authors consisting of 30 nonvalidated questions, which assessed demographic data, quantity and quality of the students' participation in the teaching project, the effectiveness of the teaching project, and the students' attitudes toward anatomical dissection and expected psychological distress. Students answered the questionnaire by marking their answers on a visual analog scale and a 5-point Likert scale. The questionnaire was first administered immediately after exposure to prosected specimens in the educational course but before beginning dissection (Q1), and it was administered a second time at the end of the first day of gross anatomy dissection (Q2). There was no significant difference in mental distress levels at Q1 and Q2 between the "frequent," "infrequent," and control groups due to high standard deviations. However, when comparing each group to itself, there was a significant decrease in mental distress in the "frequent" and "infrequent" subgroups from Q1 to Q2, but the same was not true for the control group. Of note, the interventional group was significantly less likely to report mental distress from dissection and less likely to report disgust when thinking of cadavers compared to the control group from Q1 to Q2.

Houwink et al. assessed the effect of third-year medical student assistance on first-year students' emotional and physical reactions to anatomy dissection during their first day of anatomy course on medical students in the US [19]. The second-year medical student class had not received this intervention and served as a comparison group reporting retrospectively on their dissection experience at the end of their first year. Using a Likert-type questionnaire, first-year students reported less stress-related symptoms than second-year students. First-year students reported a lower incidence of anxiety, headache, light-headedness, and feeling of disgust, and they were more likely to report the smell of the anatomy laboratory to be better than expected.

Celebrations of Donors' Lives

Chiou et al. investigated the role of a "silent mentor" initiation ceremony at a medical school in Taiwan in affecting students' attitudes toward life, death, and stress [20]. Medical students read summaries of each donor's life, met with family members who shared personal memories and stories, and laid a ceremonial wreath on their donor's body. The study assessed perceptions toward life and death using the Attitudes Towards Death (ATD) questionnaire, a 7-point Likert-type subscale of the validated Life Attitude Inventory (LAI), in which a higher score indicates a more mature attitude toward death. Students were surveyed prior to the ceremony, during the first phase of the dissection course after the ceremony, and 3 months after the start of the course. No control group was included. Compared to themselves before the ceremony, participants after the ceremony had significantly higher levels of ATD and significantly lower levels of negative emotions toward donor bodies. The 3-month follow-up showed ATD remained increased and negative emotions remained decreased compared to immediately before the ceremony.

Crow et al. investigated the impact of a memorial luncheon on US medical students during which students met with families of body donors to learn about the donors' lives [21]. A 5-point Likert-type questionnaire designed by the authors was used to measure student perceptions of donor body dissection. The instrument was administered at three points in time: 2 weeks after the start of the course (T1), 8 weeks after the start of the course (T2), and at the course conclusion (T3). The control group comprised of students who attended the luncheon but did not have a family donor present. When comparing each group to itself, both the interventional and control groups exhibited significantly decreased perception of the donor as a person, improved outlook toward the dissection process, and increased perception of the donor as a patient from T1 to T2. When compared to the control group, the interventional group had significantly decreased perception of the donor as a person and increased perception of the donor as a patient.

Background Music

Two studies assessed the impact of background music on stress during dissection. In an uncontrolled study, Anyanwu et al. conducted a study in a medical school in Nigeria utilizing background music during anatomical dissection [22]. The first phase of the study involved 8 weeks of anatomical dissection without background music, and the second phase included the subsequent 3 weeks of the course in which background music was played for the duration of the dissection sessions. Psychological stress was assessed using the verified Psychological Stress Measure (PSM-9) questionnaire before and after the introduction of background music. The entire cohort at the end of the second phase was compared to itself after the first phase, as there was no control group included. With the introduction of background music, the level of stress associated with the dissection experience significantly reduced by nearly a third in the cohort. Of note, there was no baseline measurement of stress before the dissection course.

Bellier et al. conducted a cluster-randomized study on students in a medical school in France partaking in a dissection course comprised of 4 sessions [23]. Students were placed into six balanced and randomized clusters, three of which dissected with background music while the remaining three served as controls and dissected without background music. Group average anxiety was measured using the verified STAI scale and students were assessed initially during the first dissection session and once again during the

remaining three sessions. A significantly smaller proportion of students in the experimental group than in the control group experienced acute anxiety.

Discussion

Surprisingly few studies report interventions for personal preparation of medical students before anatomical dissection. Nonetheless, we found a range of approaches aimed at mitigating student distress and promoting positive attitudes that contribute to professional development.

Graded exposure was a theme among interventions that decreased student distress. Prior staged exposure to prosected organ systems within a supportive educational environment lowered stress and disgust and promoted positive attitudes [18]. Presence of upper-class medical students during initial encounters with donor bodies similarly reduced anxiety levels by offering guidance and advice based on personal experience [19]. Viewing anatomy dissection videos, followed by reflective discussion, was observed to alleviate, or at least not increase, distress among students prior to dissection [10, 12, 13]. These techniques were likely effective by promoting coping mechanisms. Studying videos and images of donor bodies prior to dissection aided in habituation [11]. Engaging directly with concepts of death and dying, and humanizing the dissection through learning about the lives of donors, may remove much of the taboo associated with human remains that causes distress and anxiety [11].

Other interventions had varied impact on distress. Informative lectures were observed to increase, decrease, or have no effect on distress in separate studies [15–17]. These mixed results are likely due to the varied quality, content, and method of presentation of the lecture and the cultural context of the audience. Initiation ceremonies are intended to humanize the experience of anatomical dissection and to build respect for the donor body by learning about their life, interacting with the donor's family, or meeting future body donors [20, 21]. However, the humanization of donor bodies may interfere with formation of coping mechanisms, such as intellectualization [21].

Educators must exercise caution when endorsing a particular psychological perspective on the donor body. In a qualitative study not included in our review, Goss et al. described a natural toggling between both "person" and "specimen" views of the donor body, possibly similar to the adaptive way that clinicians toggle between empathy and dispassion. The "person" view emphasizes the humanity of the donor body, and the "specimen" perspective involves objectively interacting with the donor body as a learning tool [24, 25]. Respect, gratitude, and honoring donor wishes can be expressed from either view. Supporting this kind of self-regulation and promoting tolerance of ambiguity may be more effective at reducing distress by affirming students' own coping styles, thereby better preparing students for clinical practice.

Most studies in our review used constructs of anxiety and stress as primary outcomes when measuring the psychological and emotional impact of interventions on students. However, stress is a problematic term. Its strict definition means a response to a real or perceived threat, but appears employed broadly to variously include distress, anxiety, and mood disturbances. The response to donor body dissection is multidimensional and more nuanced measurements would discriminate among psychophysiological stress response, anxiety, mood disturbance, and moral distress.

There are several limitations in this study. Studies assessing non-medical student populations, such as dental students or nursing students, were excluded since the dissections conducted are often limited and may not have the same impact as complete dissections conducted by medical students. The quality of studies also varied greatly, with some studies neglecting to include control groups. This review of quantitative studies excluded the many qualitative studies assessing the impact of narrative interventions through analysis of themes from student interviews and written reflections. The relative paucity of data in this field was made evident, with fewer than twenty papers meeting criteria. Finally, there was wide range of assessment measures that included the following: non-standardized Likert and visual analog scale questionnaires, State-Trait Anxiety Inventory (STAI), Beck Anxiety Inventory (BAI), Global Severity Index of the Brief Symptom Inventory (GSI-BSI) questionnaire, Attitudes Towards Death (ATD), and Psychological Stress Measure (PSM-9). This heterogeneity precluded meta-analysis.

Conclusion

While medical schools have reported a range of educational interventions to reduce distress associated with donor body dissection, data are limited. Our review found that graded exposure to the donor body may be an effective method. Educational interventions that endorse humanistic regard of the donor body should not interrupt students' ability to self-regulate by cognitively toggling between person and specimen views. Expanding an understanding of dissection as rite of passage to one of professional formation may create additional opportunities for promoting emotional and moral resilience by fostering positive team practices and peer-to-peer social support [2, 26]. Future studies should discriminate various categories of distress that include cognitive, emotional, social, and moral domains. Standardization of assessment using verified tools would support generalizability of findings and enable future meta-analysis to better

determine best practices for reducing medical student distress related to anatomical dissection.

Declarations

Competing Interest The authors declare no competing interests.

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