Systematic Review of Depression, Anxiety, and Other Indicators of Psychological Distress Among U.S. and Canadian Medical Students

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Abstract

Purpose
To systematically review articles reporting on depression, anxiety, and burnout among U.S. and Canadian medical students.

Method
Medline and PubMed were searched to identify peer-reviewed English-language studies published between January 1980 and May 2005 reporting on depression, anxiety, and burnout among U.S. and Canadian medical students. Searches used combinations of the Medical Subject Heading terms medical student and depression, depressive disorder major, depressive disorder, professional burnout, mental health, depersonalization, distress, anxiety, or emotional exhaustion. Reference lists of retrieved articles were inspected to identify relevant additional articles. Demographic information, instruments used, prevalence data on student distress, and statistically significant associations were abstracted.

Results
The search identified 40 articles on medical student psychological distress (i.e., depression, anxiety, burnout, and related mental health problems) that met the authors’ criteria. No studies of burnout among medical students were identified. The studies suggest a high prevalence of depression and anxiety among medical students, with levels of overall psychological distress consistently higher than in the general population and age-matched peers by the later years of training. Overall, the studies suggest psychological distress may be higher among female students. Limited data were available regarding the causes of student distress and its impact on academic performance, dropout rates, and professional development.

Conclusions
Medical school is a time of significant psychological distress for physicians-in-training. Currently available information is insufficient to draw firm conclusions on the causes and consequences of student distress. Large, prospective, multicenter studies are needed to identify personal and training-related features that influence depression, anxiety, and burnout among students and explore relationships between distress and competency.


The goal of medical education is to train knowledgeable, competent, and professional physicians equipped to care for the nation’s sick, advance the science of medicine, and promote public health. Medical schools undertake an extensive selection process to identify intelligent and altruistic individuals with a strong commitment to these goals and then spend four years trying to prepare those individuals to achieve them. The U.S. and Canadian systems of medical education typically begin after candidates have achieved a bachelor’s degree that includes at least basic training in biology, chemistry, and physics, as well as training in the humanities. Applicants typically have some experience caring for patients through employment or volunteer work prior to applying to medical school and must undergo standardized examinations and a rigorous application and interview process.

In addition to identifying individuals with the necessary aptitude and commitment to pursue a career in medicine, this process is intended to identify individuals who choose to pursue a career in medicine based on significant insight into the demands, challenges, and rewards of the profession. Once enrolled, students and schools make a mutual commitment intended to prepare students for a socially useful and personally fulfilling career.1

Based on these characteristics, one may anticipate medical school would be a time of personal growth, fulfillment, and well-being despite its challenges. Unfortunately, studies suggest the current educational process may have an inadvertent negative effect on students’ mental health, with a high frequency of depression, anxiety, and stress among medical students.2–16 It has also been postulated that burnout, a measure of distress common among residents and physicians in practice,17–19 has its origin in medical school.20,21 A number of factors—including academic pressure,22 workload,2,23 financial concerns,23 sleep deprivation,23 exposure to patients’ suffering and death,24–25 student abuse,26–30 and a “hidden curriculum” of cynicism31–38—have been hypothesized to contribute to this decline in students’ mental health. Some have suggested that psychological distress among students may adversely influence their academic performance,22,39–41 contribute to academic dishonesty,42–45 and play a role in alcohol and substance abuse.13,29,46–49 Student distress has also been reported to be associated with cynicism,30–32 an unwillingness to care for the chronically ill,33,54 and decreased empathy.30,52,55 In recognition of the importance of these issues, the Association of American Medical Colleges (AAMC) report from the Ad Hoc Committee of Deans calls for the medical education system to take into account “the health and well-being of the
learners” as part of the vision for improving medical education in the United States.56

In the present report, we describe our systematic review and evaluation of studies of personal and professional distress among U.S. and Canadian medical students, which we carried out in 2005 to address the following questions:

1. What is the prevalence of medical student distress? (We use the term distress here to cover depression, anxiety, burnout, and related mental health problems.)
2. How does the prevalence of distress in medical students in these countries compare to that among an age-matched population and other graduate students?
3. What personal and curricular factors are associated with student distress?
4. What are the causes of medical student distress?
5. What are the consequences of distress among medical students?

We have attempted to synthesize the findings of a large number of studies in as focused and concise a manuscript as possible. The manuscript discusses the significance of these findings, limitations of the current research, and specific areas where future research is needed in the discussion section of the manuscript. Due to the dissimilarities between the studies, use of different instruments to measure student distress, and other methodological limitations, it was not possible to pool the available studies for a meta-analysis. As such, the results are reported qualitatively with appropriate critical review.

Method

We searched Medline and PubMed databases for peer-reviewed articles reporting primary data on medical student distress. Medical subject heading terms used were combinations of medical student and depression, depressive disorder—major, depressive disorder, professional burnout, mental health, depersonalization, distress, anxiety, or emotional exhaustion. The search was limited to articles published in English within the last 25 years (January 1980 to May 2005) and yielded a total of 248 citations. After reviewing the titles and online abstracts, articles were retrieved for full examination if inclusion in our study was likely or could not be determined. Reference lists of these articles were inspected to identify relevant additional articles. Studies conducted outside the United States and Canada were excluded due to significant differences between (1) the U.S. and Canadian student demographics (i.e., age at matriculation and prior schooling) and (2) the curricula of the U.S. and Canadian systems of medical training and these two factors in other systems around the world. Only studies that presented original, primary data on medical students separate from other learners, and that used standardized tools to assess anxiety, depression, burnout, or global mental health were included. Studies that assessed student reaction to a specific recent event (such as suicide of a colleague) or evaluated test anxiety were also excluded.

Results

Forty studies met the eligibility criteria. Thirteen studies evaluated medical student depression, one anxiety, eight general mood disorder, and ten a combination of these variables. No studies of burnout among medical students were identified. The majority of studies on anxiety and depression were small, cross-sectional surveys intended to document prevalence and associations between depression/anxiety and students’ demographic characteristics, personality attributes, academic performance, and stress. Although the studies were conducted in a variety of geographic settings, only three included students from more than one school. Sixteen longitudinal studies explored how student distress changes through the course of schooling or evaluated the effects of an intervention. Table 1 lists the studies, sample sizes, student populations, instruments used, and covariates measured in the studies we reviewed. Table 2 summarizes response rates, prevalence of distress, and other statistically significant findings. (Both tables are in the Appendix.)

Instruments used

A variety of tools to assess depression, anxiety, and overall mental health were used in the included articles. We describe these tools in detail below, both to help readers interpret our findings and also to assist other medical educators who are interested in selecting tools for their own research on student stress and related topics.

The most commonly employed tools to evaluate depression were the Beck Depression Inventory (BDI)57–59 and the Center for Epidemiological Studies Depression Scale (CES-D).60–62 followed by the depression subscale of the Hopkins Symptom Checklist (HSCL),63 the depression subscale of the SCL-90,64 and the Zung Self-Rating Depression Scale (SDS).65 The most commonly used tools to evaluate anxiety were the anxiety subscale of the SCL-90,64,66 the Symptom Checklist Anxiety Scale,66 the State-Trait Anxiety Inventory (STAI),67 the anxiety subscale of the HSCL and the tension-anxiety subscale of Profile of Mood States (POMS).68 Composite scores for the Brief Symptom Inventory (BSI),69 HSCL, SCL-90, and POMS were also used as measures of overall level of psychological distress in several studies. All of these instruments are considered standard tools that have been used in a wide variety of settings to assess mood disorders.57–82 The psychometric properties of these instruments have been described in detail elsewhere.57–82

The BDI is a well-established questionnaire used to screen for depression,57,58 which has been validated for use in nonpsychiatric patients57,70 including college students71,72 and medical students.71,72 It correlates well with a diagnosis of clinical depression in nonpsychiatric patients (mean correlation coefficient 0.60) as well as do other tools used to measure depression such as the SDS57 and the depression-dejection subscale of the POMS (mean correlation coefficient 0.71, 0.60, and 0.75, respectively). Zoccolillo and colleagues73 demonstrated concurrent validity between BDI scores and diagnosis of depression using DSM-III diagnostic criteria among medical students. While various ranges of scores have been advocated as suggesting a diagnosis of clinical depression (rather than simply “depressive symptoms”), a score of 10–18 is generally considered an indicator of mild to moderate depression, 19–29 indicates moderate to severe depression, and 30–63 indicates severe depression.57 The shorter 13-item BDI used in some
studies of medical students correlates exceptionally well \( (r = 0.96) \) with the original 21-item BDI and has a similar correlation with a diagnosis of depression \( (r = 0.61) \). On the 13-item BDI, scores of 5–7, 8–15, and \( \geq 16 \) suggest mild, moderate, and severe depression, respectively.\(^{29}\)

The CES-D is a 20-item self-reported rating scale designed by the National Institute of Mental Health to measure depressive symptoms in the general population. This instrument has high internal consistency (0.85), adequate test-retest repeatability, and substantial concurrent and construct validity in the general population.\(^{60,61}\) A score of \( \geq 16 \) is considered indicative of depression,\(^{60,61}\) although a score of \( \geq 27 \) improves its specificity.\(^{62,76}\)

The HSCL is a 58-item tool that scores symptoms in five dimensions: somatization, obsessive-compulsive, interpersonal sensitivity, depression, and anxiety. Each dimension is scored individually but also pooled to generate a “total symptom score.” The HSCL has primarily been used in psychiatric outpatients,\(^{63}\) where the internal consistency and test-retest reliability have been 0.86 and 0.81 for the depression subscale and 0.84 and 0.75 for the anxiety subscale. The SCL-90, SCL-90-R, Symptom Checklist Anxiety Scale, and BSI are related instruments that are sequential derivations of the original HSCL tool. The SCL-90 added hostility, phobic anxiety, paranoid ideation, and psychotism.\(^{64}\) The SCL-90-R comes with an interpretive report that is based on age-appropriate nonpatient normative groups and provides an overview of a study subject’s symptoms and their intensity. The BSI is an abbreviated version of the SCL-90-R that evaluates 9 symptom dimensions; and is typically scored by the composite General Severity Index (GSI), a global index of distress,\(^{69}\) where a score of more than 63 indicates clinically relevant psychological distress.\(^{83}\) The internal consistency of the BSI ranges from 0.71 to 0.83, with a test-retest correlation of 0.9 for GSI scores among psychiatric outpatients.\(^{69}\)

The POMS measures six mood/affective states: tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia, and confusion-bewilderment. Both individual subscale scores and a total mood disturbance score (considered a global measure of affective state) are calculated. The instrument has been validated in numerous study populations\(^{68,79}\) and has good internal consistency and test-retest reliability.\(^{68}\) The POMS depression-dejection subscale correlates well with the BDI \( (r = 0.69) \) and the POMS tension-anxiety subscale correlates with the STAI trait \( (r = 0.7) \) and state \( (r = 0.72) \) score.\(^{79}\)

The SDS is a 20-item questionnaire evaluating symptoms of depression including questions regarding mood, somatic, and psychological disturbances.\(^{65}\) The SDS is considered a good discriminator between depressed and nondepressed individuals.\(^{81}\) A score of less than 50 is normal, 50–59 suggests mild depression not typically requiring medical treatment, 60–69 indicates moderate depression typical of patients receiving outpatient treatment for depression, and 70–100 indicates severe depression characteristic of patients hospitalized for treatment of depression.\(^{80}\) The reliability coefficients of the SDS is \( r = 0.88 – 0.93 \)\(^{67,81}\) and the instrument correlates with the Minnesota Multiphasic Personality Inventory (MMPI) \( (r = 0.55 – 0.70) \) and the Beck Depression Inventory \( (r = 0.52 – 0.8) \).\(^{62}\)

The STAI is a derivation of the MMPI widely used to measure anxiety. The STAI has two subscales: the A-State scale, which indicates current level of anxiousness, and the A-Trait scale, which indicates how the respondent generally feels. The internal consistency alpha coefficients are high for both subscales at 0.93 for A-State and 0.87 for A-Trait in the general population.\(^{57}\)

**Prevalence of medical student depression**

**Cross-sectional studies.** Sixteen cross-sectional studies meeting the inclusion criteria evaluated student mood/depression. Six studies evaluated medical student depression; one dealt with general mood disorder and nine dealt with a combination of these two variables. Most studies surveyed either a limited student group (e.g., first-year students) or a limited subset of students (e.g., women).

Whether or not medical students begin their training with a greater predisposition to depression than is the case for comparable nonstudent populations is unclear. Two studies suggest medical students have more symptoms of depression than the general population and age-matched peers at the time of matriculation. In a study published in 1988, Sherry et al.\(^{64}\) measured using SDS the prevalence of depressed mood among 95 first-year female medical students matriculating at two Northeastern medical schools. Mean scores were below the cutoff for depression,\(^{80}\) but were higher than age- and gender-matched population norms (mean = 40.1 ± 8.5 for medical students\(^{68}\) and mean = 34.4 ± 6.8 for 20–29-year-old women\(^{67}\)). Buchman et al.\(^{85}\) reported similar findings in a 1986–87 survey of 243 students at the University of California, San Diego, School of Medicine who completed the CES-D at the time of orientation.\(^{81,83}\)

Such findings, however, are not uniform. Lloyd et al.\(^{86}\) reported that at the time of orientation, fewer first-year students \( (n = 199) \) at the University of Texas Medical School at Houston had CES-D scores \( \geq 16 \) than did normative samples \( (n = 16, 13\%) \) among medical students versus 15–19% in the general population.\(^{60}\) Hendryx et al.\(^{87}\) reported similar findings in a questionnaire administered at the end of the first year at a private medical school in Southern California \( (n = 175; 75\% \text{ response rate}) \). Although 21 students (19%) had mild depression \( (\text{BDI} > 9) \), the mean 21-item BDI scores among medical students were lower than is true for both the general population and college student norms (mean 5.9 ± 5.8 for medical students,\(^{87}\) mean 6.8 ± 5.5 for general population,\(^{79}\) and mean 7.7 ± 5.1 for college students\(^{66}\)). Likewise, Givens et al.\(^{88}\) found 46 (24%) first- and second-year students, who completed the 13-item BDI in the spring of 1994 at the University of California, San Francisco School of Medicine, were depressed (score \( \geq 8 \)).

Three cross-sectional studies surveyed medical students in all 4 years of training.\(^{89–91}\) While it is unclear whether or not at the start of medical school the percentage of depressed students is higher than the percentage of depressed individuals in comparable nonstudent population, studies of students in the later years of training consistently suggest a greater degree of depression among
medical students. Lloyd et al. surveyed 745 students (response rate 39%) at the University of Texas Medical School at Houston near the end of the 1981–82 academic year using the HSCL and found depression subscale scores were higher than in the case in population norms (mean 1.61 ± 0.54 for medical students versus mean 1.14 ± 0.28 for the general population). A study of students at the University of Calgary Faculty of Medicine had similar findings. In 2001–02, Tjia et al. surveyed students in years one through four at a private medical school (n = 564; response rate 57%) and found moderate (13-item BDI ≥ 8) and severe depression (13-item BDI scores ≥ 16) in 49 (15%) and 7 (2%) students, respectively.

**Longitudinal studies.** Longitudinal studies assessing medical student depression have focused primarily on changes occurring during the first year of medical training. Several studies assessed medical student Longitudinal studies. Pyskoty et al. also reported that there were changes in depression during the midyear (p < .01). Pyyskoty et al. also reported that there was no change in depression scores in first-year students at one school during the 1987–88 academic year.

One prospective study followed students through the first two years of training. In 1982–83, Zoccolillo et al. invited all first- and second-year students at the Washington University School of Medicine to be prospectively monitored for depression by monthly completion of the BDI. Three hundred and four students agreed to participate (79% of eligible students) with some students followed up for one year and others followed up for two years. At each time point, students who scored above 9 on the BDI were interviewed using the Diagnostic Interview Schedule (DIS) to formally diagnose depression. After completion of the study, a sample of students who had not scored above 9 at any time point were randomly selected to be interviewed to determine if the written questionnaire tool had missed cases. Sixty-eight students (22%) scored above 9 at some time point during the study, of whom 93% were interviewed. Twenty-three (37%) of these students were diagnosed as having major depression after completing the DIS. The mean BDI score of these 23 students was 13.8 ± 6. None of the randomly selected “control” sample reported having depressive symptoms during the study period. After one year 8 of 124 (6%) first-year students and 7 of 87 (8%) second-year students were depressed. By two years 11 of 91 (12%) students were depressed. The estimated lifetime prevalence of major depression among these students was at least three times higher than the lifetime prevalence among the 18–24-year-old cohort in the Epidemiologic Catchment Area study.

Two prospective studies followed medical students through all four years of medical school. Clark et al. surveyed 116 students at six time points during the four years of training (overall participation rate 96%; response rate range for individual questionnaires (70–88%), and reported 12% (number of students varied) students experienced mild to moderate depression (21-item BDI > 14) at some time point during medical school. Mean BDI scores peaked at the end of the second year but remained higher than baseline scores throughout the duration of the study. At peak, 24 of 96 (25%) students experienced mild to moderate depression (21-item BDI scores ≥ 14). In the fall of 1987, Rosal et al. surveyed 300 students prior to matriculation and again during the middle of the second and fourth years. Only 99 students completed all three surveys due to a steady decline in response rate (88%, 65%, 48%). Similar to the findings of Clark et al., CES-D scores peaked during the second year but remained higher than baseline among fourth-year students. Forty-eight (18%) at baseline, 67 (39%) by the middle of the second year, and 39 (31%) by the middle of the fourth year had CES-D scores ≥ 80th percentile of population norms.

**Prevalence of medical student anxiety**

**Cross-sectional studies.** Only three cross-sectional studies have explored medical student anxiety. In 1978, Vontver et al. administered the STAI to 349 second-year students (response rate 93%) and found mean trait anxiety scores were substantially higher than the mean score among 20–29-year-olds in the general population (mean 43 ± 3.8 for medical students versus mean 32.7 ± 7.37 for men and mean 36.85 ± 8.41 for women in the general population). Similarly, in the report by Lloyd et al., medical students in all four years had mean HSCL anxiety subscale scores more than a standard deviation higher than the norms for the general population. Hojat et al. used an abbreviated version of the Taylor Manifest Anxiety Scale and evaluated differences by gender, which are discussed below.

**Longitudinal studies.** Four longitudinal studies reported changes in anxiety through the course of schooling. Vitaliano et al. noted mean baseline anxiety scores (Symptom Checklist Anxiety Scale) among male medical students were one standard deviation higher than general population norms but did not change appreciably over the course of the first year. In contrast, mean anxiety scores among female medical students were similar to mean anxiety population norms at baseline but were one standard deviation higher than mean anxiety population norms by the end of the first year of training. Pyyskoty et al. reported no change in anxiety between the fall of the first and second years. The other 2 longitudinal studies focused on evaluating differences by gender and are discussed below.
those for population norms.\textsuperscript{101} In a survey of 703 first- and second-year students at the University of Washington School of Medicine conducted in the spring annually between 1980 and 1983 (response rate 86%),\textsuperscript{100} 151 (25%) students had SCL-90 scores above the 98\textsuperscript{th} percentile of nonpatient norms. Lloyd et al.\textsuperscript{90} and Henning et al.\textsuperscript{83} reported similar findings.

Minimal longitudinal information is available on global mental health among medical students and have primarily focused on gender or analysis by intervention (please see below).\textsuperscript{95,96,102}

### Distress among medical and nonmedical students

Four studies meeting the inclusion criteria investigated whether increased distress is unique to physician training or is a characteristic of professional/graduate school training in general. In the spring of 1996, Henning et al.\textsuperscript{83} surveyed 988 medical (n = 221), dental (n = 102), pharmacy (n = 72), and nursing (n = 82) students at the Medical University of South Carolina College of Medicine using the BSI (overall response rate 48%). The mean gender-normed GSI scores were 54.7 ± 10.2 for medical students, 56.9 ± 10.2 for dental students, and 62.3 ± 8.8 for pharmacy students, with pharmacy students being more distressed than medical and dental students, whose levels of distress were the same (p < .05). Thirty-six (50%) pharmacy students had clinical psychological distress (GSI T-score ≥ 63) in comparison to 46 (21%) medical students and 30 (29.7%) dental students (p < .001). While these students were similar in age, pharmacy students were dramatically more likely to be women (56 pharmacy students [78%], 103 medical students [47%], 28 dental students [27%]) and to have had prior treatment for mental health problems (16 pharmacy students [22%], 26 medical students [12%], 8 dental students [8%]). No effort was made to control for these variables, confounding interpretation of the results.

In the two studies of students at the University of Calgary,\textsuperscript{91,99} Toews et al. compared SCL-90 and SCL-90-R scores of medical students, residents, and graduate science students. In the 1991–92 study,\textsuperscript{91} graduate students had the highest scores on all the SCL-90-R indices, with the composite scores (GSI) being statistically different between graduate students and residents (p < .05). Medical students scored lower than graduate students but higher than residents on the depression and anxiety subscales and had a higher composite score. In the 1994–95 study,\textsuperscript{99} scores on the depression and anxiety subscales and composite score differed between graduate students, residents, and medical students (p < .001). Graduate students had the highest depression and anxiety subscale scores as well as the highest composite score, and medical students had greater anxiety subscores than did residents. Male medical students had higher depression and composite scores than did male residents, but female residents had higher depression and composite scores than did female medical students. Kellner et al.\textsuperscript{103} surveyed 60 first- and third-year medical students and 60 first- and third-year law students at the University of New Mexico during the second semester using the HSCL. Although they reported medical students had lower depression subscales scores than did law students,\textsuperscript{103} methodological issues (including sample size, methods of student recruitment, and response rate) limit interpretation and generalizability of the results.

### Distress and demographic variables

**Gender.** Women in the general population have a higher lifetime risk of depression\textsuperscript{104–106} and anxiety\textsuperscript{106,107} than men do. Comparisons of depressive symptoms by gender among medical students have yield mixed findings, with 4 of 5 cross-sectional studies\textsuperscript{85,86,89,98} and 3 of 7 longitudinal studies\textsuperscript{92,93,96} reporting no difference in depression scores by gender. Lloyd et al.\textsuperscript{96} reported that female first- to fourth-year students at the University of Texas Medical School at Houston scored higher on the HSCL depression subscale than did male students (p < .01; response rate 39%). Camp et al.\textsuperscript{108} found that despite similar SDS scores at baseline among 275 first-year medical students at Bowman Gray School of Medicine (now Wake Forest University School of Medicine), female medical students were 2.68 times more likely than males to have an increased SDS scores by November of the first year. Similarly, Zoccolillo et al.\textsuperscript{72} also reported more female than male medical students (10 of 64 female students [16%] versus 16 of 240 male students [7%]; p < .05) became depressed during the first 2 years of schooling. Although variation in response rate (range 60% to 93%) somewhat confounds results, Lloyd et al.\textsuperscript{96} reported a greater increase in depressive symptoms midyear among female than among male medical students (p < .01) that persisted only at a trend level (p < .06) by the end of the first year. The two four-year longitudinal studies exploring the effect of gender came to different conclusions, with no difference in the likelihood of becoming depressed based on gender in the study by Clark et al.\textsuperscript{7} and female students having higher mean depression scores (CES-D) at the end of both the second and fourth years in the study by Rosal et al.\textsuperscript{8}

Five studies reported on differences in anxiety by gender.\textsuperscript{90,92,93,96,98} In the previously mentioned cross-sectional study by Lloyd et al.\textsuperscript{96} female medical students reported higher anxiety than their male colleagues did (p < .05). In 1999, Hojat et al.\textsuperscript{96} reported similar findings. In the three longitudinal studies, baseline anxiety scores were similar among men and women; however, women developed higher anxiety levels through the course of the first year than their male counterparts did. This increase demonstrated a trend toward significance in the first study (p < .10),\textsuperscript{93} was significant in the second study (p = .001),\textsuperscript{92} and was present only midyear in the third study (p < .01) with no differences by gender at the end of the year.\textsuperscript{96}

Four of the ten studies assessing students’ global psychological state reported results by gender, with all studies demonstrating higher psychological distress among female medical students.\textsuperscript{90,96,99,100} In the cross-sectional survey of 745 first- to fourth-year students at the University of Texas Medical School at Houston, mean total HSCL scores were 87.2 for male students and 98.2 for female students (p < .01).\textsuperscript{90} Similarly, both Vitaliano et al.\textsuperscript{100} and Toews et al.\textsuperscript{99} noted higher SCL-90 scores among female students. Only one longitudinal study reported global mental health by gender.\textsuperscript{96} Lloyd et al.\textsuperscript{96} found HSCL scores were generally stable for men over the course of the first year (84.2, 85.5, and 85.4) but increase for women (85.4, 92.9, and 93.9). The midyear increase in total symptom score for female medical students was statistically significant (p < .05).
Marriage and children. In 1996, approximately 4,272 (32.4%) of medical students were married and another 1,525 (11.6%) were engaged or partnered by the time of graduation.109 Lower stress has been found among married students relative to their single counterparts. A longitudinal study of 61 medical students110 attending a private East Coast medical school measured stress by attrition rates, a nonvalidated Likert scale, and interviews (participation rate not reported). Six of 7 students who withdrew were married and 17 (33%) married students, in comparison to 44 (43%) unmarried students, had considered withdrawing from medical school. At the conclusion of the first, second, and third years, mean stress scores were higher among unmarried students (p < .05). When students married, they reported a decrease in stress over the subsequent year (p < .05).

Interview sessions supported the hypothesis that marital partners provide emotional support to their spouses. Katz et al.111 recruited married medical students and their spouses from a large Southeastern medical school to explore effects of stress on marital satisfaction and depressive symptoms. Fifty of these married students were screened and asked to invite their spouses to participate. Out of 100 possible individuals, 71 completed the questionnaires (41 medical students and 30 spouses). Both stress and marital support correlated with depression (p < .001), with predicted values for depression (BDI score) differing as a linear function of perceived support among high-stress medical students. Among married students with high stress scores on the Perceived Stress Scale,112 those who reported high marital support had lower BDI scores than did those who reported low marital support. Perceived marital support also inversely correlated with medical students’ BDI scores (r = −0.47, p < .01).113 Despite methodological limitations, both these studies suggest that the supportive quality of the marriage relationship rather than marriage itself may modulate the experience of stress.110,111 Henning et al.83 also noted less psychological distress (BSI) among married students (r = −0.15, p < .05); however the correlation coefficient was small, calling into question the importance of this finding.

Not all researchers have found that marriage is associated with reduced distress. In a longitudinal study by Rosal et al.8 married students had higher depression scores (CES-D scores) at the start of medical school (p = .04), and marital status did not predict second-year CES-D scores or the magnitude of the change in CES-D scores between the first and second years.

Although marriage is relatively common among medical students, according to the AAMC’s Graduation Questionnaire, in 1995, 1,678 (13%) students had children by the time of graduation.113 (1995 was the last year this question was administered.) While childbirth and childrearing are typically considered positive life events, children add a level of complexity to students’ lives,114,115 and little is known about the mental health consequences of pregnancy or childrearing during medical school. Only one study examined the mental health impact of childrearing among medical students. Rosal et al.8 found that depression scores (CES-D) scores at the start of medical school were higher among students of both sexes who had children (p = .06). In the bivariate analysis, having a child was also associated with higher second-year CES-D scores among women (p = .008) but not men. Similarly, women with children had a greater increase in their CES-D scores between the first and second years of medical school than did women without children (p = .001), while a difference was not found between men with or without children. Although this study suggests that the mental health impact of having a child during medical school may be gender-specific,8 further studies are needed.

Stressful personal life events. Besides the rigors of training, medical students face major personal life events (illnesses, deaths of family members, marriages, births of children, etc.) common to individuals their age. Such personal life events are known to contribute to depression, anxiety, and substance use in the general population.116–121 Among first- and second-year students at the Jefferson Medical College of Thomas Jefferson University, 175 (15%) had experienced the death of a family member, 297 (25%) had experienced a personal illness or injury, 420 (36%) had experienced a change of health in a relative, and 491 (42%) had experienced financial problems in the last 12 months.120 Despite the frequency of these events, Vitaliano et al.121 found no correlation between the experience of a stressful life event (engagement/marriage, pregnancy/birth, death of family member or friend, physical illness/injury, or serious illness in family member) and student distress.

Ethnicity. The education of a diverse group of learners is a stated priority in the physician workforce by accepting and training minority medical students, increased rates of attrition (e.g., dismissal or withdrawal) among minority students limit the effectiveness of such efforts.122–128 Little is known about how the mental health of minority students relates to their higher rate of attrition.130 In a one-year longitudinal study of 184 first-year medical students at a state medical college in 1987 (response rate 86%: 90 whites, 19 blacks, and 17 Hispanics), no differences in mental health were observed by race or ethnicity.94 All the underrepresented minority students in this study attended a prematriculation program for minority students, making the generalizability of the results to other medical schools nearly two decades later uncertain. Camp et al.108 found no association between depression and race among 238 white and 39 nonwhite students, while Henning et al.83 reported slightly lower distress among minority students (r = −0.14, p < .05). In Tjia et al.'s89 cross-sectional study of first- through fourth-year students (208 whites, 62 Asians, 29 Hispanics, 17 blacks, and six other), Hispanic students were 3.4 times more likely to be depressed (BDI ≥ 8) than were non-Hispanic students.

Distress and other variables

Personality. Based on research suggesting that personality traits influence an individual’s perception of stress,111,112 achievement in medical school,133–136 and transition from suicidal ideation to suicide planning,137 a number of investigators have studied the relationship between medical student distress and personality.7–9,11,83,85,86,92,93,108,135,138–141 These studies suggest the traits of self-actualization, self-awareness, and sense of fulfillment may lower the risk of depression,108 while maladaptive...
perfectionism, and socially prescribed perfectionism (perception that others expect a great deal of you). Type A personality and anger suppression may increase the risk of depression.

**Stress.** Some degree of stress is typically considered a normal and unavoidable aspect of both medical training and the practice of medicine. While measuring stress was not the focus of any of the studies identified, several studies suggest stress varies over time and peaks in the second year of medical school. Toews and Notman et al. identified the volume of information to learn, time constraints, examinations (and other forms of evaluation), competition, intimate relationships, money, family concerns, and feelings of self-doubt as self-reported stressors for medical students. Others have suggested an unstructured learning environment, long on-duty assignments, abuse, ethical challenges, and exposure to human suffering as additional sources of distress.

Stress may motivate some but not all students. Several studies explored the relationship between level of perceived stress and student depression/anxiety. Perceptions of stress were found to correlate with depression (p < .001), anxiety, somatic symptoms (p < .001), and health problems, and to predict future risk of depression (p < .001). The lack of a validated instrument to assess stress in the vast majority of these studies is a major limiting factor.

How students cope with stress may influence their adjustment to medical school and whether or not stress detrimentally affects their quality of life. Limited evidence suggests coping strategies, such as cognitive restructuring and problem solving, may protect against symptoms of depression, while disengagement strategies, such as problem avoidance and social withdrawal, appear to increase the risk of depression. Vitaliano et al. found that first-year students decrease their reliance on engagement coping strategies and use more disengagement coping strategies as the first year progresses, which temporally coincides with an increase in depression during the first year.

**Curricular factors.** While calls for curricular changes to address sources of distress attributable to the training experience have been made, little is known about how the curriculum contributes to distress, how it should be changed, and what effects could be expected. Only three of the identified studies investigated the relationship between the curriculum or training process and psychological well-being. Vontrve et al. randomized 40 volunteers from the second-year class of 349 students to pelvic exam instruction from a professional patient or control group and found no difference in the pre- or postintervention STAI scores between groups. Camp et al. evaluated first-year medical students assigned either to a problem-based learning (PBL) curriculum or to a traditional lecture-based curriculum (LBL). There were no differences in SDS scores at baseline, and the weak relationship between curriculum type and follow-up SDS scores (p = .074) disappeared after adjusting for other variables. Not surprisingly, Ball et al. found a moderate association between first-year students' mid-term satisfaction with their education (reported on a seven-point Likert scale) and their depression severity (r = −0.47, p < .001). However, issues with cause-effect cloud interpretation. Further studies are necessary to detect what curricular factors play a role in student distress.

**Consequences of student distress**

Despite the prevalence of student distress detailed above, little research has been done on the consequences of depression and anxiety among medical students. Although both Givens et al. and Tjia et al. documented that few students (22% to 27%) with mental health problems access counseling services, only Clark et al. investigated the relationship between mood and academic performance. In their four-year longitudinal study first- and second-year grade point averages did not correlate with BDI scores, although students with severe dysphoria (BDI scores ≥ 21) at any time point during medical school had lower first-year grades. BDI scores in April of both the first and second years inversely correlated with the National Board of Medical Examiners Part I exam scores (r = −0.21 and −0.22, p = .04 and .03, respectively), although the students with the lowest BDI scores also had the highest undergraduate grade point average, making the basis of this association uncertain. Students with severe dysphoria were more likely to quit medical school despite being in good academic standing at the time of departure. Although the reasons for attrition from medical school have not been well documented, medical schools report that poor academic standing is the culprit less than half of the time. In one study, Fogelman et al. found that psychological morbidity was second to academic performance as the reason for temporary or permanent withdrawals among 818 students attending the University of Tennessee Health Science Center College of Medicine between 1974 and 1977.

Anxiety, stress, and tension are also cited as common reasons for alcohol consumption among medical students. Although problematic alcohol consumption is common in both age-related peers and medical students, up to 20% of first-year medical students have admitted to excessive alcohol intake. Persistent high alcohol use throughout training parallels student distress. Only Clark et al. have explored the relationship between alcohol consumption and mood. In their longitudinal study, severe dysphoria (BDI scores ≥ 21) at any time point during medical school was not associated with abuse of alcohol or other drugs during medical school, but did correlate with drinking less alcohol in the second and third years of school (p = .009 and p = .04).

**Interventions to prevent distress**

Three studies explored the outcome of an intervention on depression, and overall mental health. Among approximately one-third of the first-year students at the Indiana University School of Medicine, neither receiving written feedback on depressive symptoms and alcohol usage (n = 29) nor attending a one and a half hour lecture and discussion group on self-care (n = 23) affected future depression scores or alcohol use. In 1980, Mitchell et al. randomized 99 first-year students (participation rate 29%) at Creighton University School of Medicine to support groups, a lecture on stress management, or no intervention. No differences in STAI or BDI scores were found among...
the groups; however, the small sample size and major problems with methodological design and response rate (only 24 participants’ information included in analysis) confound interpretation.

Rosenzweig et al.102 evaluated the effect of an elective seminar on mindful-based stress-reduction (MBSR) techniques intended to foster concentration, insight, and relaxation through nonjudgmental awareness of current events on student mood disorder using the POMS. All second-year students at the Jefferson Medical College of Thomas Jefferson University were offered a participation in this seminar from 1996–2000 with approximately 40 students (18%) from each class participating. Among the 302 students who completed the questionnaire, 140 had participated in the MBSR seminars (response rate among participants 87.5%), and 162 had not participated (response rate among nonparticipants 22%). Instruction in stress-reduction (MBSR) techniques intended to foster concentration, insight, and relaxation through nonjudgmental awareness of current events on student mood disorder using the POMS. All second-year students at the Jefferson Medical College of Thomas Jefferson University were offered a participation in this seminar from 1996–2000 with approximately 40 students (18%) from each class participating. Among the 302 students who completed the questionnaire, 140 had participated in the MBSR seminars (response rate among participants 87.5%), and 162 had not participated (response rate among nonparticipants 22%). Instruction in stress reduction appeared to reduce the adverse impact of stress on mental health; however, selection bias and response bias were major confounders.

Discussion
As stated earlier, medical school training is intended to prepare graduates for a personally rewarding and socially meaningful career promoting health and caring for the sick. Unfortunately, as the reports we have described show, this is a time of great personal distress for physicians-in-training. Despite the fact that most studies to date have been single-center, cross-sectional studies, the existing literature consistently demonstrates higher overall psychological distress among U.S. and Canadian medical students relative to both the general population and age-matched peers. Whether or not distress among medical students is comparable, higher, or worse than distress among other professional students cannot be conclusively ascertained from the available studies. Regardless, the importance of such comparisons is debatable, since distress among any of the groups should not be disregarded, no matter how the groups’ distress levels compare.

Studies of medical students in other parts of the world under a wide range of systems of medical training have also identified a high frequency of distress.5–14, 164–171 In a longitudinal study from the United Kingdom, 63 (37%) of students had poor mental health (GHQ-12 score greater than 3) by the middle of the first year, and 48 (31%) and 34 (22%) had poor mental health in the fourth year and fifth year, respectively.2,5 Another U.K. study of first-year students found the incidence of poor mental health doubled over the course of the first year, increasing from 48 (25%) to 108 (52%).3 In 2001, Aktekin et al.4 reported a similar worsening in global mental health, depression, and anxiety between the first-year orientation and the beginning of the second year among Turkish medical students. Dahlin et al.171 recently reported 40 (13%) Swedish medical students were depressed in comparison to 48 persons (7.8%) in an age- and gender-matched population sample (p < .05), with approximately one third of the students reporting thoughts of suicide during the course of training. Tyssen et al.14 also reported a high prevalence of suicidal thoughts among senior Norwegian medical students, with 33 (6%) having made a plan to commit suicide during medical school.

Despite the strikingly high prevalence of distress, little is known about how demographic variables, personality characteristics, and stressful life events relate to student distress. Overall, the studies suggest that psychological distress may be higher among female students than their male colleagues. Although some may attribute this difference to similar trends in the general population, a number of studies found no difference in anxiety and depression among male and female medical students at the start of medical school but greater increases in distress among female students through the course of training.52,93,96,168 This finding suggests that the differences observed by gender in several studies may have other origins and warrant further investigation. Minimal information is available regarding unique challenges faced by other student populations such as minority students and students with children, and additional research in this area would also be useful.

No studies on burnout among U.S. or Canadian medical students were identified in our systematic review, despite speculation that residents’ burnout has its origin in medical school.20,22 Studies of recent medical school graduates suggest burnout may adversely impact professionalism17,18,172 and patient care17,18, exploration of burnout among medical students would lead to useful insights into this problem.

Student distress may influence professional development8,22,23,54,173–177 and appears to adversely impact academic performance,7,2,9,39–41,178–180 contribute to academic dishonesty42–45 and substance abuse,13,29,46–49 and play a role in attrition from medical school.7,155 The increase in cynicism,50–52 decline in humanitarian attitudes,53,54 and decline in empathy50,52,55 documented during the four years of medical school parallel the incidence of student distress, suggesting a possible relationship between these variables. Studies of recent medical school graduates also suggest that distress may negatively affect quality of patient care,17 patient safety,17 and professionalism.181 On a personal level, distress can be devastating to the individual student by contributing to substance abuse,56,49,159 broken relationships,143 decline in physical health, poor self-care (e.g., lack of exercise, poor diet),13,161 and even suicide.137

Widespread distress among medical students has now been recognized for several decades. Future studies are needed to explore causes, consequences, and solutions for this problem rather than simply chronicling the problem. A great deal of research and work is still needed to determine how academic training programs can structure their curricula, systems of evaluation, and support systems to reduce student distress and identify and support struggling students. Whether opportunities for shared reflection,182,183 training in stress management,184–188 or promotion of self-care/coping strategies5,9,150,164 can reduce student distress is not established and is worthy of investigation. The potential for enhanced well-being to enhance student and physician professionalism is largely unexplored.

Hypothesis-driven, prospective, multicenter studies are desperately needed to provide valid, generalizable information on this issue. Historically, institutional support and funding for such studies have been limited,189 and this problem must be remedied.
Additional research to improve our understanding of the causes and consequences of medical student distress, and to investigate potential solutions, is likely to benefit not only the affected individuals, but also the patients for whom they provide care.

References


Toews JA, Lockyer JM, Dobson DJ, Brownell AK. Stress among residents, medical students, and graduate science (MSc/PhD) students. Acad Med. 1993;68 (10 suppl):S46–54.


## Table 1

### Demographic and Methodologies Employed in 40 Studies Examining Medical Student Depression and Anxiety*

<table>
<thead>
<tr>
<th>Source</th>
<th>Sample size</th>
<th>Period of study</th>
<th>Medical student population</th>
<th>Study design</th>
<th>Tool†</th>
<th>Covariates measured†</th>
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<tr>
<td><strong>Depression</strong></td>
<td></td>
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<tr>
<td>Zoccollilo et al., 14 1986</td>
<td>304</td>
<td>1982-83, 1983-84</td>
<td>1st- and 2nd-year students, Washington University School of Medicine</td>
<td>Longitudinal survey, beginning of academic year with monthly surveys up to 2 years</td>
<td>BD</td>
<td>FH of psychiatric illness; PMH of psychiatric treatment</td>
</tr>
<tr>
<td>Clark et al., 7 1988; see also Zeldow et al., 138 1987; Zeldow et al., 159 1988; Clark et al., 152 1988</td>
<td>121</td>
<td>NR</td>
<td>Midwestern Medical College</td>
<td>Longitudinal survey, September and April of 1st year, November and April of 2nd year, and December of 3rd and 4th year</td>
<td>21-item BDI</td>
<td>Rosenberg Self-Esteem Scale, Pleasure Capacity Scale, Self Confidence Scale, Social Network Inventory, Humanistic Scale, Neuroticism Scale, Perceived Stress Scale, Locus of Control, Personal Attributes Questionnaire, FH of Major Depression, alcohol and drug use</td>
</tr>
<tr>
<td>Katz et al., 111 2000</td>
<td>100</td>
<td>NR</td>
<td>Married medical students, a Southeastern medical university, and their spouses</td>
<td>Cross-sectional survey</td>
<td>21-item BDI</td>
<td>Dynamic Adjustment Scale, Perceived Stress Scale, spousal support</td>
</tr>
<tr>
<td>Enns et al., 135 2001</td>
<td>96</td>
<td>NR (published 2001)</td>
<td>1st-, 2nd-, and 3rd-year students</td>
<td>Longitudinal survey, baseline and 6 months</td>
<td>13-item BDI</td>
<td>Multidimensional Perfectionism Scale, Neuroticism and Conscientiousness scales from the NEO Five-Factor Inventory, Beck Hopelessness Scale, Suicidal Ideation Questionnaire, self-report of academic measures</td>
</tr>
<tr>
<td>Ball et al., 13 2002</td>
<td>64</td>
<td>NR (published 2002)</td>
<td>Convenience sample of 1st-year students, Indiana University School of Medicine</td>
<td>Interventional study, 29 students in feedback group, 23 in lecture group, and 19 controls</td>
<td>21-item BDI</td>
<td>AUDIT, Epworth Sleepiness Scale, health habits, satisfaction with various aspects of life within and outside of medical school</td>
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<tr>
<td>Givens et al., 6 2002</td>
<td>194</td>
<td>1994</td>
<td>1st- and 2nd-year students, University of California, San Francisco, School of Medicine</td>
<td>Cross-sectional survey, spring</td>
<td>13-item BDI</td>
<td>Self-reported use of counseling services, barriers to use, suicidal ideation</td>
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<tr>
<td>Tjia et al., 89 2005</td>
<td>564</td>
<td>2001-02</td>
<td>1st- through 4th-year students, private U.S. medical school</td>
<td>Cross-sectional survey</td>
<td>13-item BDI</td>
<td>Self-reported use of counseling services, barriers to use, use of antidepressants, suicidal ideation, PMH or FH of depression</td>
</tr>
<tr>
<td>Richman et al., 140 1987; see also Richman et al., 141 1985</td>
<td>211</td>
<td>1984</td>
<td>1st-year students, University of Illinois College of Medicine</td>
<td>Longitudinal survey, fall and 7 months later</td>
<td>CES-D</td>
<td>Demographics, Social Support Network Inventory, Parental Bonding Instrument, locus of control, interpersonal dependency, flexibility, self-esteem</td>
</tr>
<tr>
<td>Buchman et al., 153 1991</td>
<td>243</td>
<td>1986-87</td>
<td>1st-year students, University of California, San Diego, School of Medicine</td>
<td>Cross-sectional survey, orientation</td>
<td>CES-D</td>
<td>Bortner Short Rating Scale, State-Trait Anger Scale, Anger Expression Self-Analysis Questionnaire</td>
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* Table continues...
## Table 1
(Continued)

<table>
<thead>
<tr>
<th>Source</th>
<th>Sample size</th>
<th>Period of study</th>
<th>Medical student population</th>
<th>Study design</th>
<th>Tool†</th>
<th>Covariates measured†</th>
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<tr>
<td>Mosley et al.,9 1994</td>
<td>69</td>
<td>1992-93</td>
<td>3rd-year students, University of Mississippi School of Medicine</td>
<td>Cross-sectional survey, completion of a psychiatry rotation</td>
<td>CES-D</td>
<td>Medical Education Hassles Scale-R, Coping Strategies Inventory, Wahler Physical Symptoms Inventory</td>
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<td>Lloyd et al.86 1997</td>
<td>199</td>
<td>NR</td>
<td>1st-year students, University of Texas Medical School at Houston</td>
<td>Cross-sectional survey, orientation</td>
<td>CES-D</td>
<td>Parental Bonding Instrument, Rosenberg Self-Esteem Scale, visual analog rating of Miller and Ingham for depression</td>
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<tr>
<td>Rosal et al.8 1997</td>
<td>300</td>
<td>1987-89</td>
<td>University of Massachusetts Medical School</td>
<td>Longitudinal survey, 4 weeks prior to start of medical school and middle of the 2nd and 4th year</td>
<td>CES-D</td>
<td>Bortner Type A Behavior Scale, Spielberger Trait Anger Scale, Spielberger Anger Expression Scale, stress, demographics, social-life</td>
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<tr>
<td>Camp et al.108 1994</td>
<td>324</td>
<td>1991-1993</td>
<td>Convenience sample, 1st-year students, Bowman Gray School of Medicine (now Wake Forest University School of Medicine)</td>
<td>Interventional study. 60 students in problem-based learning curriculum and 264 in lecture-based curriculum. Longitudinal survey, August and November</td>
<td>SDS</td>
<td>Self-actualization scale of the California Psychological Inventory</td>
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<tr>
<td>Vontver et al.27 1980</td>
<td>349</td>
<td>1978-79</td>
<td>2nd-year students, University of Washington School of Medicine</td>
<td>Cross-sectional survey, winter, 22 students randomly assigned to standardized patient instruction and 18 in control group</td>
<td>STAI</td>
<td>Impact of 2 pelvic examination instructional methods on heart rate and anxiety</td>
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</table>

### Anxiety

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<tr>
<th>Whitehouse et al.,35 1996</th>
<th>110 (35 in intervention group)</th>
<th>NR (published 1996)</th>
<th>Convenience sample of 1st-year students</th>
<th>Interventional study but results collapsed for reporting. Longitudinal survey, orientation, 13 weeks, prior to final exam, and at the end of midyear break.</th>
<th>POMS</th>
<th>Fourteen 90-minute sessions of self-hypnosis training throughout the 1st semester. Brief Symptom Inventory, UCLA Loneliness Scale, blood samples for immune measures, Harvard Group Scale of Hypnotic Susceptibility, daily diaries on sleep, mood, medications, and problems experienced</th>
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<tr>
<td>Rosenzweig et al.102 2003</td>
<td>302 (140 in intervention group)</td>
<td>1996-2000</td>
<td>2nd-year students, Jefferson Medical College of Thomas Jefferson University</td>
<td>Interventional study, experimental convenience sample</td>
<td>POMS</td>
<td>90-minute Mindfulness-based Stress Reduction Seminar (MBSR) once per week for 10 weeks</td>
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<tr>
<td>Henning et al.53 1998</td>
<td>988 Sample included medical, dental, pharmacy and nursing students</td>
<td>1996</td>
<td>221 medical students, Medical University of South Carolina College of Medicine</td>
<td>Cross-sectional survey, spring semester</td>
<td>BSI</td>
<td>Multidimensional Perfectionism Scale, Clance’s Imposter Phenomenon Scale</td>
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<tr>
<td>Lloyd et al.96 1981</td>
<td>159</td>
<td>1978-79</td>
<td>1st-year students, University of Texas Medical School at Houston</td>
<td>Longitudinal survey, orientation in September, January, and end of the academic year</td>
<td>HSCL</td>
<td>Ego-Resiliency-Subtle Scale, questions on positive psychological status, role conflict, role support, demographics</td>
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Table 1
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<tr>
<th>Source</th>
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<th>Covariates measured†</th>
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<tr>
<td>Lloyd et al.,90 1984</td>
<td>745</td>
<td>1982</td>
<td>1st- through 4th-year students, University of Texas Medical School, Houston</td>
<td>Cross-sectional survey, near the end of the academic year</td>
<td>HSCL</td>
<td>Stress, social support, support services</td>
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<tr>
<td>Kellner et al.,103 1986</td>
<td>120</td>
<td>NR (published 1986)</td>
<td>60 1st- and 3rd-year medical students and 60 1st- and 3rd-year law students, University of New Mexico Albuquerque</td>
<td>Cross-sectional survey, 2nd semester</td>
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<td>Symptom Questionnaire, Illness Behavior Questionnaire, Illness Attitude Scales</td>
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<tr>
<td>Toews et al.,91 1993</td>
<td>216</td>
<td>1991-92</td>
<td>1st- through 4th-year students, University of Calgary Faculty of Medicine</td>
<td>Cross-sectional survey</td>
<td>SCL-90-R</td>
<td>Social Readjustment Rating Scale</td>
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<tr>
<td>Toews et al.,99 1997</td>
<td>3628 Sample included medical students, residents, and graduate science students</td>
<td>1994-95</td>
<td>1st- through 4th-year students, 4 medical schools in Canada</td>
<td>Cross-sectional survey</td>
<td>SCL-90</td>
<td>Stress, Social Readjustment Rating Scale</td>
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<td>Mitchell et al.,163 1983</td>
<td>99</td>
<td>1980-81</td>
<td>1st-year students, Creighton University School of Medicine</td>
<td>Interventional study, 29 students randomly selected to support group and/or lecture on stress management or control</td>
<td>BDI, STAI</td>
<td>MMPI</td>
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<tr>
<td>Notman et al.,142 1984</td>
<td>NR</td>
<td>1984</td>
<td>2 samples of entering students at Harvard and Tufts medical schools</td>
<td>Cross-sectional survey, orientation</td>
<td>SDS, SAS</td>
<td>Demographics, stressful life events, stress, Cornell Medical Index</td>
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<tr>
<td>Vitaliano et al.,130,148 1984; see also Vitaliano et al.,190 1987</td>
<td>703</td>
<td>1980-83</td>
<td>1st- and 2nd-year students, University of Washington School of Medicine</td>
<td>Cross-sectional survey, 1 week before spring exams</td>
<td>SCL-9013-item BDI</td>
<td>School pressures, Ways of Coping Checklist</td>
</tr>
<tr>
<td>Sherry et al.,84 1988</td>
<td>95</td>
<td>NR (published 1988)</td>
<td>Female 1st-year students, 2 urban Northeastern medical schools</td>
<td>Cross-sectional survey, orientation</td>
<td>SDS, SAS</td>
<td>Self-reported measures of physical health, menstrual symptoms</td>
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<tr>
<td>Vitaliano et al.,92 1989; see also Vitaliano et al.,111 1988, Vitaliano et al.,147 1989</td>
<td>350</td>
<td>1984-85; 1985-86</td>
<td>1st-year students, University of Washington School of Medicine</td>
<td>Longitudinal survey, September and May</td>
<td>13-item BDI</td>
<td>Life Experiences Survey, Framingham Type A Behavior Pattern Scale and Anger Expression Scale, Social Network List, Ways of Coping Checklist, Stress</td>
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(Table continues)
### Table 1

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<table>
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<tr>
<th>Source</th>
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<tbody>
<tr>
<td>Richman et al., 93 1990</td>
<td>210</td>
<td>1985</td>
<td>1st-year students, a state college of medicine</td>
<td>Longitudinal survey, start of medical school and 7 months later</td>
<td>CES-D, ta-POMS</td>
<td>Parental Bonding Instrument, Locus of Control, and items from the Aggressiveness Scale of the Million Clinical Multiaxial Inventory, Emotional Reliance on Another Person, Rosenberg Self-Esteem Scale, Wheaton’s Flexibility Scale, Social Support Network Inventory, alcohol use</td>
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<td>Pyskoty et al., 94 1990</td>
<td>184</td>
<td>1987</td>
<td>1st-year students, a state medical college</td>
<td>Longitudinal survey, start of medical school and fall of 2nd year</td>
<td>CES-D, ta-POMS</td>
<td>Social Support Network Inventory, Rosenberg Self-Esteem Scale, Locus of Control using items from the Rotter Internal-External Scale, hostility dimension of SCL-90-R, school stressors</td>
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<tr>
<td>Hendryx et al., 87 1991</td>
<td>147</td>
<td>NR (published 1991)</td>
<td>1st-year students, private medical school in Southern California</td>
<td>Cross-sectional survey, last week of 1st year</td>
<td>21-item BDISTAI</td>
<td>Toronto Alexithymia Scale</td>
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<tr>
<td>Richman et al., 28 1992</td>
<td>184</td>
<td>1987</td>
<td>1st-year students, a state college of medicine</td>
<td>Longitudinal survey, start of medical school and during the winters of the 2nd, 3rd, and 4th years</td>
<td>CES-D, ta-POMS</td>
<td>Hostility subscale of SCL-90-R, Michigan Alcoholism Screening Test, motives for drinking, masculinity and femininity subscales of Personal Attributes Questionnaire, experience of abuse</td>
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<tr>
<td>Hojat et al., 98 1999</td>
<td>1361</td>
<td>1988, 1992-96</td>
<td>1st- and 2nd-year students, Jefferson Medical College of Thomas Jefferson University</td>
<td>Cross-sectional survey, orientation for 1st-year students (1992-96) and during class for 2nd-year students (1988)</td>
<td>13-item BDI Elements of TMAS</td>
<td>Components of scales assessing loneliness, test anxiety, neuroticism, extraversion, self-esteem, locus of control; perception of general health, stressful life events, and relationship with mother looking for gender differences</td>
</tr>
</tbody>
</table>

* The authors searched the literature for peer-reviewed English-language studies published between January 1980 and May 2005. They found 40 studies on medical student depression and anxiety that met their selection criteria (see the text for details).

† Abbreviations: BDI = Beck Depression Inventory; DIS = NIMH Diagnostic Interview Schedule; FH = Family History; PMH = Past Medical History; NR = Not Reported; STAI = State-Trait Anxiety Inventory; TMAS = Taylor Manifest Anxiety Scale; AUDIT = Alcohol Use Disorders Identification Test; CES-D, Center for Epidemiological Studies Depression Scale; ta-POMS, tension-anxiety factor of POMS; POMS, Profile of Mood States; SDS Zung Self-Rating Depression Scale; SAS, Zung Self-Rating Anxiety Scale; BSI, Brief Symptom Inventory; HSCL, 58-item Hopkins Symptoms Checklist.
### Table 2
**Findings from 40 Studies Examining Medical Student Depression and Anxiety**

<table>
<thead>
<tr>
<th>Source</th>
<th>Response rate (%)</th>
<th>Prevalence of mood disorder†</th>
<th>Statistically significant findings (p &lt; .05)†</th>
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<tbody>
<tr>
<td><strong>Depression</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zoccolillo et al.,74 1986</td>
<td>64–79%</td>
<td>BD1: 68 (22%) had depression (BDI &gt; 9) during the study. DIS: The 2-year prevalence of depression was 12% with the 1-year prevalence of depression 6% and 8% for the 1st- and 2nd-year classes, respectively. Estimated lifetime prevalence of depression was 15%.</td>
<td>More women than men were depressed. PMH or FH of depression was more common among depressed students.</td>
</tr>
<tr>
<td>Clark et al.,7 1988; see also Zeldow et al.,138 1987; Zeldow et al.,132 1988; Clark et al.,152 1988</td>
<td>70–96%</td>
<td>4% of students had mild to moderate depression at orientation (BDI &gt; 14) with &gt;12% of students having depression on subsequent assessments. The prevalence of depression peaked at 25%. Moderate to severe depression (BDI &gt; 21) was present in 1% of students at orientation and ranged from 2-8% on subsequent assessments.</td>
<td>BDI scores increased after start of MS and did not return to baseline by completion of medical school. No gender difference in BDI scores. BDI scores &gt; 21 was associated with quitting medical school and having lower 1st-year grades but had no association with alcohol or drug abuse, FH of depression, or lower NBME Part 1 scores. Lower BDI scores were associated with higher NBME Part 1 scores. BDI scores correlated with masculinity-femininity.138 intimacy and power.139</td>
</tr>
<tr>
<td>Katz et al.,111 2000</td>
<td>NR 71% of those recruited participated.</td>
<td>NR</td>
<td>Spousal BDI score (r = 0.67), stress (r = 0.54), and marital support (r = −0.37) predicted medical student BDI score.</td>
</tr>
<tr>
<td>Enns et al.,135 2001</td>
<td>46–60%</td>
<td>Mean BDI score was 3.04. Time 2 BDI scores not reported.</td>
<td>Maladaptive perfectionism was correlated with depression at baseline and predicted time-2 BDI scores.</td>
</tr>
<tr>
<td>Ball et al.,13 2002</td>
<td>Participation rate approximately 33%, response rate 74–84% among participants.</td>
<td>Mean BDI scores increased from baseline (6.19 ± 6.32) to midterm (8.02 ± 6.53) but return to baseline at the end of the 1st semester. 3.8%, 7.4%, 7.4%, and 0% of students had moderate to severe depression (BDI &gt; 20) at start of medical school, midterm, end of 1st semester, and end of 2nd semester.</td>
<td>Interventions did not influence future depressive symptoms or alcohol use. Mean AUDIT scores doubled over the first semester with 20% of students at risk for problematic alcohol use. Higher alcohol consumption was sustained over the 1st year.</td>
</tr>
<tr>
<td>Givens et al.,6 2002</td>
<td>93%</td>
<td>46 (24%) of students had depression (BDI &gt; 8).</td>
<td>10 (22%) of students with depression (BDI scores&gt;8) used mental health services.</td>
</tr>
<tr>
<td>Tija et al.,89 2005</td>
<td>57.1%</td>
<td>49 (15%) students were depressed (BDI &gt; 8). Of the students with depression, 10 (20%) reported suicidal ideation during medical school and 13 (26%) reported getting psychological treatment.</td>
<td>No difference in depression by gender, age, year in school, or FH of depression. Students with depression (BDI &gt; 8) were more likely to have a personal history of depression or be Hispanic.</td>
</tr>
<tr>
<td>Richman et al.,140 1987; see also Richman et al.,141 1985</td>
<td>65–73%</td>
<td>NR</td>
<td>Correlations: Time 1 CES-D score and external locus of control (r = 0.2); Time 2 CES-D scores and maternal overprotection (r = 0.31) and paternal overprotection (r = 0.21).</td>
</tr>
<tr>
<td>Buchman et al.,85 1991</td>
<td>85%</td>
<td>Mean CES-D scores 10.5 in women and 10.3 in men.</td>
<td>No gender difference in CES-D scores.</td>
</tr>
<tr>
<td>Mosley et al.,9 1994</td>
<td>NR</td>
<td>Mean CES-D score 11.48</td>
<td>While both coping strategies and frequency of stressors correlated with CES-D scores, coping strategies had the greatest contribution to variance in CES-D scores. Engagement coping strategies negatively correlated with symptoms of depression, while disengagement strategies were positively associated.</td>
</tr>
<tr>
<td>Lloyd et al.,86 1997</td>
<td>62%</td>
<td>Mean CES-D scores 8.3 among all students; 13% of students had depression (CES-D &gt; 16).</td>
<td>No differences in CES-D scores by gender. Maternal care and overprotection correlated with CES-D scores among male medical students.</td>
</tr>
</tbody>
</table>

(Table continues)
Table 2  
(Continued)

<table>
<thead>
<tr>
<th>Source</th>
<th>Response rate (%)</th>
<th>Prevalence of mood disorder†</th>
<th>Statistically significant findings (p &lt; .05)†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rosal et al., 8 1997</td>
<td>48–88%</td>
<td>Mean CES-D score was 10.4 at baseline, 14.5 in the 2nd year, and 12.5 in the 4th year.</td>
<td>No difference in CES-D scores by gender at baseline, but women had higher scores during both the 2nd and 4th years. Married medical students and medical students with children had higher CES-D scores.</td>
</tr>
<tr>
<td>Camp et al., 108 1994</td>
<td>85%–91%</td>
<td>From start of 1st year to November of 1st year the prevalence of mild depression (SDS 50-59) increased from 10 (4.3%) to 26 (11.2%), and moderate depression (SDS &gt; 60) increased from 4 (1.7%) to 16 (6.9%).</td>
<td>No statistically significant relationship between SDS score and type of curriculum (problem-based learning vs. lecture-based learning). Female medical students reported more depressive symptoms. No relationship between SDS scores and race (Caucasian versus non-Caucasian). Strong relationship between SDS scores and self-actualization score.</td>
</tr>
</tbody>
</table>

Anxiety

| Vontver et al., 97 1980     | 92.8% (Intervention participation rate 11.5%) | Mean STAI score 43.03. | No difference in STAI score between groups before or after the intervention. |

Global mental health

| Whitehouse et al., 96 1996 | NR                | GSI Mean 55.43 at orientation. Results collapsed across treatment conditions | Depression and anxiety subscales (BSI) and total mood disturbance (POMS) were highest immediately prior to test taking. |
| Rosenzweig et al., 102 2003 | NR                | Mean total mood disturbance increased from 28 to 38.6 in control group. Mean total mood disturbance decreased from 38.7 to 31.8 in the intervention group. | Overall psychological distress decreased 18% in the intervention group and increased 38% in the control group. |
| Henning et al., 83 1998    | 48% overall       | Mean gender normed GSI T-scores 54.7 for medical students. 21.1% of medical students had clinically relevant levels of psychological distress (GSI T-scores > 63). | GSI T-scores decreased by academic year \( (r = -0.18) \). Non-Caucasian medical students had lower GSI T-scores than Caucasian medical students did. Married medical students reported lower GSI T-scores than unmarried students did. Strongest predictors of medical student GSI-T scores were perfectionism \( (r = 0.38) \) and imposter scale \( (r = 0.55) \). Pharmacy students had the highest GSI-T scores. |
| Lloyd et al., 96 1981      | 60–93%            | HSCL mean total score at 3 time-points during 1st year were 84.25, 85.49, and 85.38 for men and 85.41, 92.89, and 93.87 for women. The mean HSCL Depression subscale scores were 15.77, 14.74, and 14.79 for men and 16.4, 17.86, and 17.13 for women. The mean HSCL Anxiety subscale scores were 9.09, 10.02, 10.47 for men and 10.19, 11.04, 11.43 for women. | There were no differences in HSCL scores by gender at baseline. HSCL total symptom score, depression subscale score, and anxiety subscale score increased more for women than men by mid-year; however, this gender difference became non-statistically significant by the end of the 1st year. |
| Lloyd et al., 90 1984      | 39%               | Mean HSCL total score 87.2 for men and 98.2 for women | Women had higher total HSCL scores and Depression and Anxiety subscale scores. HSCL scores were lowest among 4th-year students, and highest in the 2nd-year students, but differences by year were not statistically significant. HSCL scores correlated positively with perceived stress. Mean scores compared between general population, medical patients, and psychiatric patients. |
| Kellner et al., 103 1986   | 80%               | Depression and anxiety subscales higher in 3rd-year students than 1st-year students and were also higher in women. | HSCL Depression subscale score higher among law students than medical students. |

(Table continues)
### Table 2
(Continued)

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<tbody>
<tr>
<td>Toews et al., 1993</td>
<td>69%</td>
<td>SCL-90-R Depression and Anxiety subscale scores higher among medical students than norms. Total scores higher among students than norms.</td>
<td>Graduate students had highest depression and anxiety subscale scores and overall psychological distress. Medical students had higher depression and anxiety subscale scores and more overall psychological distress (GSI) than residents did. Greatest reported stressors included examination/evaluation, volume of work, time pressures, and self-expectation.</td>
</tr>
<tr>
<td>Toews et al., 1997</td>
<td>46% overall, 48% among medical students.</td>
<td>SCL-90 mean raw scores for Depression and Anxiety subscales 0.801 and 0.481 respectively for women and 0.754 and 0.442, respectively, for men. GSI score for women 0.485; men 0.490.</td>
<td>Women had higher depression and anxiety subscale scores than men did. Graduate students had highest depression and anxiety subscale scores and composite score (GSI). Medical students had greater anxiety subscale scores than residents did. Male medical students had higher depression and composite scores than did male residents. Female residents had higher depression and composite scores than did female students.</td>
</tr>
</tbody>
</table>

**Combination**

<table>
<thead>
<tr>
<th>Source</th>
<th>Participation rate</th>
<th>NR</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitchell et al., 1983</td>
<td>29%. Note: results from 5 students were randomly deleted.</td>
<td>NR</td>
<td>Total number of reported stressors correlated with SDS score (r = 0.28), SAS score (r = 0.31), and reported health problems (r = 0.37). Total perceived stress correlated with SDS score (r = 0.40), SAS (r = 0.37), and reported health problems (r = 0.43).</td>
</tr>
<tr>
<td>Notman et al., 1984</td>
<td>69.5% at Harvard and 94.5% at Tufts</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Vitaliano et al., 1987</td>
<td>86%</td>
<td>25% of students had SCL-90 scores above the 99th percentile of non-patient norms, and 34% of students had anxiety scores greater than the median for outpatient psychiatric patients. In a subgroup of 185 1st- and 2nd-year students, 35% had no depression (BDI 0-4), 21% had mild depression (BDI 5-7), 14% moderate depression (BDI 8-15), and 1% had severe depression (BDI &gt; 16) Mean BDI was 3.7.</td>
<td>Female medical students had higher SCL-90 scores. Threat, mastering knowledge, and control of one’s life contributed to a prediction model of anxiety and depression. BDI scores inversely correlated with problem focused coping (r = −0.21) and positively correlated with wishful thinking (r = 0.38), avoidance (r = 0.34), and self-blame (r = 0.34).</td>
</tr>
<tr>
<td>Sherry et al., 1988</td>
<td>86%</td>
<td>Mean SDS was 40.1 among matriculating female medical students.</td>
<td>Mean SDS and SAS scores were higher than age matched norms</td>
</tr>
<tr>
<td>Vitaliano et al., 1989; see also Vitaliano et al., 1989</td>
<td>89%</td>
<td>During 1st year, prevalence of depression (BDI &gt; 8) increased from 3.6% to 6.6% among men and 6.4% to 11.9% among women. Anxiety was 1 standard deviation worse than population norms by end of the year.</td>
<td>BDI scores and stress increased significantly over the course of the 1st year for both men and women, while anxiety scores increased only for women. High stress level in May was associated with greater depression and anxiety. Students whose stress scores increased or remained high had higher depression and anxiety scores than did students who had a persistently low level of stress or whose stress declined.</td>
</tr>
</tbody>
</table>

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<tr>
<td>Richman et al.,93 1990</td>
<td>93%</td>
<td>Over 7-month interval mean CES-D scores increased from 9.98 to 13.84 for women and 10.72 to 12.51 for men.</td>
<td>No differences in CES-D by gender at either time point. No gender differences in POMS score at baseline, but women had greater anxiety than men at follow-up. Paternal overprotection and perceived medical school stress contributed to time 2 depression among men and women. Maternal overprotection also contributed to time 2 depression in men, while paternal affectivity contributed to time 2 anxiety among women.</td>
</tr>
<tr>
<td>Pyskoty et al.,94 1990</td>
<td>86–91%</td>
<td>Mean CES-D score 13.1 to 14.78 for whites, 10.36 to 13.9 for blacks, and 10.11 to 13.65 for Hispanics at times 1 and 2.</td>
<td>No statistically significant differences in CES-D, tension-anxiety, or hostility scores between ethnic groups at baseline or during follow-up. No significant change in CES-D, tension-anxiety, or hostility scores within ethnic groups over time.</td>
</tr>
<tr>
<td>Hendryx et al.,87 1991</td>
<td>74.8%</td>
<td>21 (19%) of students were depressed (BDI &gt; 9).</td>
<td>Depression was associated with difficulty identifying and describing feelings, one domain of alexithymia.</td>
</tr>
<tr>
<td>Richman et al.,28 1992</td>
<td>75–91%</td>
<td>NR</td>
<td>Reporting one or more episodes of abuse during medical school was associated with increased risk of depressive symptoms and report of drinking alcohol to “escape.” Personality traits correlated with reporting episodes of abuse on the survey.</td>
</tr>
<tr>
<td>Hojat et al.,98 1999</td>
<td>85%</td>
<td>Mean BDI 1.7 for men and 1.8 for women.</td>
<td>No gender difference in BDI scores. Women had higher anxiety.</td>
</tr>
</tbody>
</table>

*The authors searched the literature for peer-reviewed English-language studies published between January 1980 and May 2005. They found 40 studies on medical student depression and anxiety that met their selection criteria (see the text and Figure 1 for details). The table’s data suggest a high prevalence of depression and anxiety among medical students, with levels of overall psychological distress consistently higher than in the general population and age-matched peers by the later years of training.

† Abbreviations: BDI = Beck Depression Inventory; PMH = Past Medical History; FH = Family History; DIS, NIMH Diagnostic Interview Schedule; NBME, National Board of Medical Examiners; NR, Not reported; AUDIT = Alcohol Use Disorders Identification Test; CES-D, Center for Epidemiological Studies Depression Scale; POMS, Profile of Mood States; SDS, Zung Self-Rating Depression Scale; SAS, Zung Self-Rating Anxiety Scale; STAI= State-Trait Anxiety Inventory; GSI, Global Severity Index from Brief Symptom Inventory; HSCL, 58-item Hopkins Symptoms Checklist; STAI, State-Trait Anxiety Inventory.