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A Meta-analysis of Universal Mental Health Prevention Programs for Higher Education Students

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Abstract This meta-analysis investigated the effectiveness of universal mental health prevention programs for higher education students on a range of adjustment outcomes. A systematic literature search identified 103 controlled published and unpublished interventions involving college, graduate, or professional students. As hypothesized, skill-training programs that included a supervised practice component were significantly more effective overall (mean effect size=0.45, confidence interval (CI)=0.39 to 0.52) compared to skill-training programs without supervised practice (0.11, CI=−0.01 to 0.22) and psychoeducational (information-only) programs (0.13, CI=0.06 to 0.21). When comparisons on specific outcomes were possible, skill-training programs including supervised practice were significantly more effective than the other two groups of programs in reducing symptoms of depression, anxiety, stress, and general psychological distress, and in improving social-emotional skills, self-perceptions, and academic behaviors and performance. The magnitude of effects achieved in several outcome areas is comparable to or higher than that reported in other reviews of universal programs, suggesting that skill-training programs for higher education students that incorporate supervised practice now join the ranks of other effective preventive mental health interventions. This review offers several recommendations to improve the experimental rigor of future research.

Keywords Mental health · Meta-analysis · Promotion · Prevention · Higher education

The Importance of Mental Health Prevention in Higher Education

Higher education students should be prime targets for mental health prevention. There is extensive evidence that numerous mental health problems appear among higher education students[1] (for reviews, see Castillo and Schwartz 2013; Hunt and Eisenberg 2010) and that traditional models of mental health treatment delivery reach only a small segment of the population (Castillo and Schwartz 2013; Givens and Tjia 2002). For example, the majority of students who could benefit from some form of mental health intervention never take advantage of the services provided by various campus-based counseling centers and health clinics (Yorgason et al. 2008; Zivin et al. 2009).

Emotional distress, in the form of depression, anxiety, heightened stress, or general psychological distress, is one of the most common problems appearing in higher education populations (American College Health Association [ACHA] 2013; Bewick et al. 2008). Such problems often are associated with other negative outcomes including poor academic performance and dropping out of school (Eisenberg et al. 2009). Assets such as adaptive social and emotional skills, positive self-perceptions, and supportive interpersonal relationships can buffer higher education students from the negative effects of emotional distress (Bouteyre et al. 2007; Burris et al. 2009; Pritchard et al. 2007). Indeed, in higher education, just as in lower educational levels, skills in these intrapersonal and interpersonal domains often are associated with better adjustment (Conley 2015). For example, evidence suggests that various aspects of self-perceptions (e.g., self-esteem), social and

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[1] Throughout this report, "higher education students" refers generally to students receiving post-secondary education in 2- or 4-year colleges and universities, trade and vocational schools, or various graduate and professional programs (e.g., medical or law school).

emotional skills (e.g., adaptive coping), and interpersonal relationships (e.g., social support and social integration) predict academic success and retention, an ultimate benchmark for higher education (Eisenberg et al. 2009). However, research has demonstrated that college students experience decrements in their self-perceptions (e.g., self-esteem, self-efficacy, resilience, and life satisfaction), social-emotional skills (e.g., coping, emotion regulation, and adaptive thinking), and interpersonal relationships (e.g., relationship quality and perceived support from various significant others; Conley et al. 2014; also see ACHA 2013; Surtees et al. 2002). Thus, it is reasonable to assume that enhancing personal and interpersonal competencies can play a role in preventing various types of emotional distress and adjustment problems, and promoting students' academic performance. How best to go about doing so remains an open question, which the current meta-analytic review aims to address.

Research on Prevention Programs for Higher Education Populations

Over the last few decades, many studies of preventive mental health programs in higher education have appeared. These investigations have generally adopted two very different strategies. One strategy has been primarily psychoeducational in nature and is based on the assumption that providing students with accurate information about the potential problems or challenges they are likely to experience during their educational careers will motivate them to act judiciously and effectively to prevent or resolve these problems as they arise. For example, informing students about how to anticipate commonly encountered challenges and pressures that are likely to appear during their higher education careers and to identify useful coping strategies for these events is expected to help students reduce the level of future stress they will experience (e.g., Moss 2003; Walker and Frazier 1993). The situation is similar if the target of the intervention is specific to preventing other forms of emotional distress, such as depression and anxiety, or interpersonal problems such as loneliness or conflict. Some psychoeducational programs also offer opportunities for group discussion so that students have the chance to discuss their personal experiences, receive support or encouragement from others, and recognize that their personal experiences are not unique (e.g., Abbott 2009; Brown 2001). In sum, psychoeducational interventions rest on the premise that receiving accurate information will motivate individuals to act effectively to prevent various negative outcomes.

The second major preventive strategy that has been used with higher education students is skills training, which is based on the premise that the behavioral skills that may be instrumental in preventing negative outcomes such as stress, depression, or anxiety must be systematically taught to participants along with training on how to apply new skills. Depending on their specific aims, interventions typically emphasize procedures such as cognitive restructuring, relaxation, mindfulness, conflict resolution, various coping strategies, and effective communication (e.g., Moss 2003; Pool and Qualter 2012). These skill-training interventions often employ various behavioral or cognitive-behavioral techniques to build skills through a process that first defines the skills and explains why they are important, and then proceeds by using a repeating series of activities that teach the skill(s) through modeling, behavioral rehearsal, feedback, and more practice until mastery is achieved. In other words, providing information is a part of skill-training programs, but only as the first step in a process that emphasizes the systematic training and development of new behaviors that are considered important for preventive purposes.

There is extensive evidence in the primary prevention research literature that skill-training interventions (sometimes called competency enhancement or mental health promotion programs) have been effective in promoting positive adjustment and preventing negative adjustment in children, adolescents, and college students (Durlak 1997; Botvin and Griffin 2007; Stice et al. 2007). However, it has not been confirmed to what extent the acquisition of specific skills or what combination of skills is directly responsible for the positive results obtained in various programs. In contrast, most reviewers have concluded that psychoeducational primary prevention programs are not effective for children, adolescents, or higher education students. For example, universal psychoeducational programs for higher education samples have not been successful in preventing stress, drinking, interpersonal violence, or eating or weight problems, although there is sometimes evidence that they can improve relevant knowledge and attitudes (see Anderson and Witson 2005; Cronce and Larimer 2011; Dennhardt and Murphy 2013; Stice et al. 2007; Yager and O'Dea 2008). One review that is an exception (Van Daele et al. 2012) reported that psychoeducational programs were effective in reducing stress (d=0.27) in various groups (not limited to higher education samples). However, this review used a broad definition of what constituted psychoeducation (i.e., several included studies involved skills training), and some reviewed programs targeted distressed groups, which could have contributed to the favorable findings.

Previous Research Reviews

Previous reviews of prevention in higher education have taken different forms. Some have directed their attention to circumscribed problems such as drinking (e.g., Larimer and Cronce 2007), high-risk alcohol or sexual behaviors (e.g., Griffin et al. 2010), smoking (e.g., Rodgers 2012), sexual assault (e.g., Anderson and Whiston 2005), or body image

and disordered eating (Yager and O'Dea 2008). Others have focused on specific populations such as medical or nursing students (e.g., Galbraith and Brown 2011; Shiralkar et al. 2013), and still others have combined studies of students with and without pre-existing adjustment problems (i.e., both primary and indicated prevention) or have included community, medical, or clinical samples—along with student samples—in their reviews (e.g., Nicholson et al. 1988; Reavley and Jorm 2010; Regehr et al. 2013). Moreover, many of the above reviews contain a limited number of studies or have only focused on published research. Given these limitations, the current meta-analysis aims to systematically evaluate the impact of universal mental health prevention programs for all types of higher education students.

Aims of the Current Meta-analysis

This review was designed to evaluate the impact of primary prevention (i.e., universal) mental health programs for higher education students, and to offer recommendations to improve future research and practice. Although skills training was expected to be effective, during our initial inspection of intervention procedures among our reviewed studies, it was apparent that a critical feature was missing from several of the skill-training interventions: *supervised practice*. For example, the descriptions of some of the cognitive-behavioral interventions suggested that the sessions primarily consisted of presentations defining and emphasizing the potential value of a skill (e.g., identifying irrational thoughts) followed by a general discussion and possible questions from the participants, without mentioning how much time, if any, was devoted for students to practice the skill. The following sessions focused on another technique (e.g., challenging and replacing irrational thoughts) in a similar fashion. In summary, at best, in some of these interventions only a small part of each session consisted of supervised practice and there was no indication that participants practiced the same skill in later sessions or that students had any opportunity to practice how to combine or integrate separate skills. Extensive research has identified *supervised practice over multiple sessions* as an important component of successful skills training for both youth and adults (Elliott et al. 2015; Payton et al. 2000; Salas and Cannon-Bowers 2001; Taylor et al. 2005). Supervised practice is important because it couples behavioral rehearsal, or the chance to practice new skills, with supportive feedback so that participants understand that they are enacting the new skills appropriately and remain motivated to continue developing and applying these skills. Without supervised practice, it is highly unlikely that participants will be able to master new behaviors and apply them appropriately in the future. Many interventions asked students to practice targeted skills outside the session, but this strategy alone does not allow for the direct monitoring of students' performance and thus does not qualify as supervised practice. Therefore, we coded the skill-training interventions in terms of whether or not they contained supervised practice. Specifically, we assessed whether the instructor or group leader directly monitored students' practice of new skills in multiple sessions so they could provide helpful feedback and suggestions that would foster students' skill mastery.

We hypothesized that skill-training programs with supervised practice would be significantly more effective than psychoeducational programs and skill-training interventions not containing supervised practice. In terms of specific outcomes, we predicted that this hypothesis would be supported for outcomes measuring depression, anxiety, stress, general psychological distress, social-emotional skills, interpersonal relationships, and academics. We did not expect there to be significant differences for measures of self-perceptions because primary prevention psychoeducational interventions can change attitudes about the self.

In addition to evaluating this hypothesis, we also evaluated the influence of various moderators of intervention effectiveness. These included study features (i.e., publication status and country of study), design features (i.e., experimental design and attrition), participant features (i.e., sample size, ethnicity, and type of student), and intervention features (i.e., intervention format and intervention duration). We did not have specific predictions about the relative effectiveness of different strategies used in skill-training interventions (e.g., cognitive-behavioral, meditation, mindfulness, relaxation, and social skills training), but we examined differences among these intervention strategies in an exploratory fashion.

Method

Search Strategy and Report Selection

We used a three-pronged systematic search of the literature to secure a nonbiased, representative sample of published and unpublished (i.e., gray literature such as dissertations, theses, and conference presentations) investigations. First, we conducted searches of three databases, PsycINFO, ERIC, and Proquest Dissertation and Theses, for reports appearing by the end of 2012, using a combination and variants of several search terms to capture reports relevant to the intervention, outcomes, and participants (e.g., prevention, skill-training, mental health, stress, anxiety, depression, college, university). Second, we conducted manual searches of the contents of selected journals most likely to publish studies on prevention in general or interventions for college students (e.g., *College Student Journal*, *Journal of American College Health, Journal of Clinical Psychology*, *Journal of College Student Development*, and *Prevention*

Science), covering the years 2008 through the end of 2012.[2] Third, we inspected the reference lists of each included report and of previous reviews (e.g., Galbraith and Brown 2011; Nicholson et al. 1988; Reavley and Jorm 2010; Shiralkar et al. 2013; Shapiro et al. 2011; Van Daele et al. 2012). To be included in the final sample, the study had to (a) evaluate a preventive mental health intervention that lasted for more than one session; (b) be conducted with higher education students (college, graduate, or professional) without any pre-existing mental health problems; (c) include a control group; (d) contain at least one quantitative outcome measure relating to depression, anxiety, stress, general psychological distress, social and emotional skills, self-perceptions, or interpersonal relationships, for which effect sizes (ESs) could be calculated; and (e) appear in English. Programs that focused primarily on academics (e.g., learning communities) or physical health (e.g., physical exercise or nutrition interventions) were not included. We also excluded studies of substance use, sexual assault, or body image and eating disorder interventions, and of expressive writing methodology, as these topics have been the focus of previous reviews (Anderson and Whiston 2005; Frattaroli 2006; Larimer and Cronce 2007; Yager and O'Dea 2008). Finally, we excluded evaluations of technology-based interventions such as those using the Internet, mobile phones, or e-mails as the primary contact with participants, as these interventions are distinctive enough in their procedures to warrant a separate review.

Figure 1 shows the flow of sample selection and inclusion. The above search procedures identified 497 potentially relevant reports. We further screened each of these for our specific inclusion criteria and eliminated 401 because they did not meet our inclusion criteria. Among 96 eligible reports, some contained variants of the same intervention, by varying the components of the intervention or its duration. In these cases, when multiple interventions were conceptually similar, we only included the intervention that was more comprehensive (i.e., contained more elements or was longer in duration). If conceptually distinct interventions (e.g., psychoeducational and cognitive behavioral techniques; see below) were evaluated in the same report, each intervention was coded separately. Data from multiple reports on the same sample and intervention were combined into a single report (k=4). Whenever means and standard deviations were not included in the original reports or effects could not be calculated because of insufficient data (k=50), we contacted the authors to secure the missing information. After author responses and effect size (ES) estimation procedures were considered, we only had to exclude two reports for which no ESs could be estimated. This screening process yielded a final sample of 103 interventions, contained in 90 reports, appearing between 1967 and 2012.

[2] A copy of the search terms, journals searched, and coding manual used in this review is available from the first author on request.

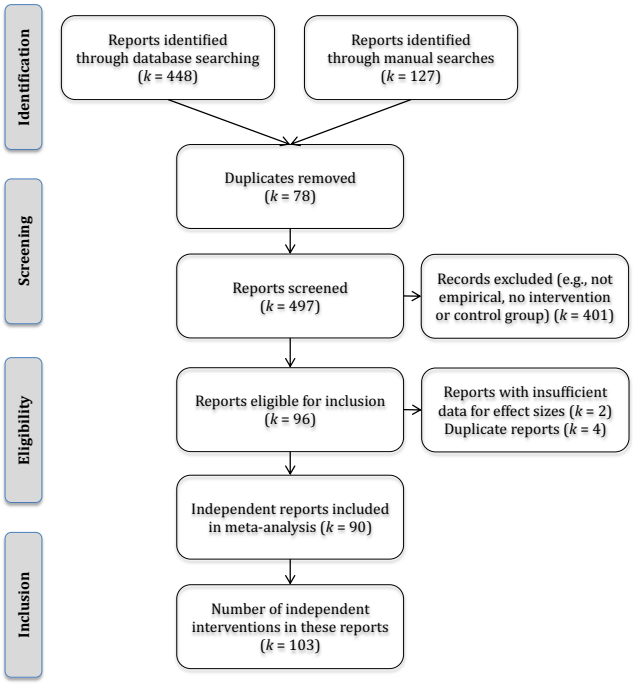

Fig. 1 Flow of information through the different phases of the review

Study Coding

Studies were coded on multiple variables in the following categories: (a) general study features (e.g., date and publication status), (b) design features (e.g., experimental design and sample attrition), (c) participant characteristics (e.g., sample size, gender, type of student, and type of school), (d) intervention features (e.g., primary intervention strategy, use of supervised skills practice, intervention format, and intervention duration), and (e) types of outcomes assessed. Most of these variables are self-explanatory, but a few deserve comment.

Intervention Strategies Although interventions can share some overlapping features or components, we were able to code each intervention into six different categories according to its major method of mental health promotion or prevention. One category was *psychoeducational*, which emphasized information and discussion on topics such as stress and coping. To offer distinctions between different forms of cognitive-behavioral and behavioral interventions, which would permit a finger-grain analysis of intervention effects, we coded as *cognitive-behavioral* those interventions that specifically focused on monitoring cognitions and using these cognitions effectively to change behaviors and emotions. We also made distinctions among *relaxation* interventions that used strategies such as progressive muscle relaxation, or guided imagery; *mindfulness* interventions that used techniques such as those developed by Kabat-Zinn (1990), to train the mind to function in a nonjudgmental and present manner; *meditation* programs, such as transcendental meditation or yoga; and *social skills*

interventions that employed various social learning techniques to improve assertiveness and communication or problem-solving skills. In addition, there was an *other* category that included one psychodrama and one behavioral contracting intervention, which did not fit into the above categories.

Each skill-training intervention was further classified as to whether it contained supervised skills practice, a critical component of successful skills training (Elliott et al. 2015; Payton et al. 2000; Salas and Cannon-Bowers 2001; Taylor et al. 2005). This coding was based on whether or not the report described the intervention as including repeated in-session opportunities for students to practice new skills and receive performance feedback from the intervention facilitator. If the report indicated that participants were only asked to practice out-of-session, but did not include direct in-session facilitator observation or feedback of target skills over multiple sessions, the intervention was not coded as containing supervised practice.

Student Outcomes Outcomes were classified into eight categories assessing (a) *depression*; (b) *anxiety*; (c) *stress*; (d) *general psychological distress*, consisting of other psychological symptoms, general mood or affect, and overall psychological or emotional adjustment; (e) *social and emotional skills*, which included different types of affective, cognitive, and social skills related to effective coping techniques, mindfulness practices, developing rational beliefs, or emotional self-awareness and regulation; (f) *self-perceptions*, consisting primarily of measures of self-efficacy or self-esteem; (g) *interpersonal relationships*, which primarily included measures of relationship satisfaction, quality, communication, or conflict, and perceived social support; and (h) *academic behaviors and performance*, which included grades as well as academic behaviors such as class attendance, academic engagement, time management, or students' self-reports of their general academic functioning and adjustment.

Reliability of Coding As a check of our classification and coding procedures, 54 studies were independently coded by two research assistants. The mean kappa statistic adjusted for chance was 89 % (CI=69 to 100 %) across the codes, and any disagreements were resolved through discussion among the coders and the first two authors.

Meta-Analytic Strategy

Effect Size Calculation and Estimation Using Comprehensive Meta Analysis Version 2 (CMA-V2; Borenstein et al. 2005), we calculated ESs for 580 outcomes at post, and 199 outcomes at follow-up, using Hedge's *g* (referred to below as ES, for effect size). This ES is calculated as the difference between intervention and control group means (at post or follow-up) divided by the pooled standard deviation, adjusted for small sample bias (Hedges and Olkin 1985). Positive ESs reflect the superiority of the intervention over the control group. When ES information was not included in the original reports or provided by authors through our solicitations, we estimated ESs using procedures described by Lipsey and Wilson (2001), and followed in CMA-V2. If more than one measure was used for any of our outcome categories (e.g., two measures of stress), the ESs were averaged to yield one effect per outcome category per intervention.

When the only information available indicated that an ES was nonsignificant, we conservatively set that ES to zero. A later analysis indicated that these zero effects were not significantly related to our three main intervention groupings (supervised practice, nonsupervised practice, and psychoeducation). Before any analyses were conducted, we identified the existence of 16 outlier ESs (ESs=1.71–3.78) and one outlier sample size (N=904), defined as values that lay beyond 3 standard deviations of their respective distributions. We reset these values at 3 standard deviations so we could retain these data without them unduly influencing the findings (Lipsey and Wilson 2001).

Whenever possible, we adjusted post and follow-up ESs for pre-intervention baseline by subtracting the pre ES from the post (or follow-up) ES, similar to other meta-analyses (Durlak et al. 2010; Wilson et al. 2001). Adjusting for pre-intervention baseline was not significantly related to effect size, Q (2, 101)=4.90, p=.086, and post effect sizes that were adjusted for pre-intervention baseline (mean ES=0.33) were higher on average than effect sizes that were not adjusted for pre-intervention baseline (mean ES=0.23). Additionally, adjusting for pre-intervention baseline was not significantly related to our three main hypothesis groups, X (2)=.92, p=.630. We used random effects modeling based on the assumption that the reviewed studies were representative of a larger population of similar studies, and so our results would be generalizable to that larger population (Lipsey and Wilson 2001). We used the .05 probability level to determine statistical significance, and calculated 95 % CIs around each obtained mean ES.

Effect Size Comparisons We followed the guidelines of Cumming and Finch (2005), wherein mean ESs whose CIs do not include zero are considered statistically significant, pairs of CIs with no overlap are statistically different at the $p<.01$ level, and CIs with less than 50 % overlap are considered statistically different at the $p<.05$ level. We also inspected I^2 values as an index of heterogeneity for group means, using the guideline of up to 25 % as a low degree of heterogeneity, 25 to 50 % as a moderate degree, and above 75 % as a high degree of heterogeneity (Higgins et al. 2003).

Results

Descriptive Information on Review Sample

Table 1 provides descriptive information about the 103 interventions included in the review. Over half of the interventions appeared since 2000 and 35 % were unpublished. A majority of the interventions (84.5 %) were conducted in the USA and used randomized designs. There was a wide range of initial sample sizes; over a third of the samples included fewer than 50 participants, and approximately a third involved more than 100 students. Some interventions targeted only first-year undergraduates, but the most common participants were undergraduates beyond the first year or from multiple years of study. Other interventions targeted graduate or professional students, or a mix of undergraduate and graduate students. Most studies were conducted at a 4-year college or university while some targeted attendees in 2-year community colleges, or graduate or professional programs.

The most common intervention strategies were cognitive-behavioral. Although 78 of the interventions were skill-training programs, 17 of these did not employ supervised skills practice. The majority of interventions were delivered either as a full college course or as a small group intervention; a few delivered interventions individually through some other means (e.g., one-on-one instruction or using self-help instructional materials). The average duration of all interventions was fairly brief (range 1 to 46 h; median=10 h).

Effectiveness of Interventions at Post

Overall Effectiveness of Interventions Table 2 provides general information about the 103 reviewed interventions. We first averaged the ESs across all the outcomes within each intervention to yield one intervention-level effect. The average intervention ES ranged from a small negative effect of −0.26 to a large positive effect of 1.67 and yielded a statistically significant overall positive effect at post (ES=0.29; 95 % CI=0.25 to 0.33; $p<.001$) across all 103 interventions. There were only 12 negative study-level intervention effects, but none yielded a statistically significant iatrogenic effect. The overall sample had moderate between-intervention heterogeneity, $I^2=56.32$; Q (102)=233.51, $p<.001$, suggesting the existence of variables that might moderate outcomes. Application of Duval and Tweedie's (2000) Trim and Fill technique, which can be considered a sensitivity analysis in that it adjusts for possible publication bias and missing studies, yielded an identical overall intervention effect (ES=0.29, CI=0.25 to 0.33; $p<.001$).

Hypothesis Testing: Supervised Skills Practice As presented in Table 3, the overall mean ESs for interventions with supervised practice (ES=0.45, CI=0.39 to 0.52; $k=61$; $p<.001$)

Table 1 Descriptive characteristics of 103 universal prevention interventions for higher education students

	k	%
General study features		
Date of report		
1967–1979	4	3.9 %
1980–1989	17	16.5 %
1990–1999	29	28.2 %
2000–2009	31	30.1 %
2010–2012	22	21.4 %
Publication status		
Published	67	65.0 %
Unpublished[a]	36	35.0 %
Country		
Inside the USA	87	84.5 %
Outside the USA[b]	16	15.5 %
Design features		
Experimental design		
Randomized	53	51.4 %
Quasi-experimental	50	48.5 %
Sample attrition[c]		
Mean (standard deviation)	12.8 %	(14.2 %)
Median (range)	10.1 %	(0–70 %)
Participant characteristics		
Initial sample size (intervention+control)[c]		
Mean (standard deviation)	99.26	(113.96)
Median (range)	63.00	(14–904)
0–50	38	39.6 %
51–100	25	26.0 %
101+	33	34.3 %
Gender of sample (percentage female)		
Mean (standard deviation)	66.6 %	(20.2 %)
Median (range)	64.5 %	(0–100 %)
Ethnicity (percentage minority)[c]		
Mean (standard deviation)	35.43 %	(29.42 %)
Median (range)	32.10 %	(0–100 %)
Type of student		
First-year undergraduates	20	19.4 %
Other (e.g., second-year) or mixed undergraduates	62	60.2 %
Mixed undergraduates and graduates	9	8.7 %
Graduate or professional students	11	10.7 %
Other	1	1.0 %
Type of school		
Four-year college or university	83	80.6 %
Two-year community college	8	7.8 %
Trade/vocational school	1	1.0 %
Graduate or professional school	11	10.7 %

Table 1 (continued)

	k	%
Intervention features		
Primary intervention strategy		
Psychoeducation	25	24.3 %
Cognitive-behavioral	37	35.9 %
Meditation	10	9.7 %
Mindfulness	9	8.7 %
Relaxation	17	16.5 %
Social Skills	3	2.9 %
Other	2	1.9 %
Use of supervised skill practice		
Supervised skills practice	61	59.2 %
No supervised skills practice	17	16.5 %
Psychoeducation only	25	24.3 %
Intervention format		
Small group	65	63.1 %
Class	32	31.1 %
Individual	6	5.8 %
Duration of intervention (in hours)[c]		
Mean (standard deviation)	13.51	(10.56)
Median (range)	10.00	(1–46)

[a] Unpublished interventions included 34 dissertations, 1 master's thesis, and 1 conference presentation

[b] Countries include Belgium, Canada, England, Japan, Korea, Spain, Thailand, Turkey, and the UK

[c] *k*s (number of reports) do not always add to 103 due to missing data in some reports. The most missing data was for ethnicity (total percentage of participants from all ethnic minority groups), which was only reported for 35 (34 % of the) interventions

and for psychoeducational interventions (ES=0.13, CI=0.06 to 0.21; k=25; p<.001) differed significantly from zero, but those without supervised practice did not (ES=0.11, CI=−0.01 to 0.22; k=17). Furthermore, in support of our hypothesis, the mean ES for interventions with supervised practice was significantly different from, and three to four times greater in magnitude than, the mean ESs for nonsupervised skills and psychoeducational interventions. The I^2 within values for psychoeducational interventions and skill-training interventions without supervised skill practice indicated little to no heterogeneity (I^2=4.42 and 0.00 %, respectively) although there was moderate heterogeneity for interventions with supervised skills practice, I^2=59.67 %.

Next, we calculated one ES for each outcome category examined in an intervention, collapsing multiple ESs within an outcome type into one intervention-level effect per outcome category (see Table 3). Several of these analyses are limited because of small sample sizes, and thus we focus our attention only on cells with at least five interventions assessing that outcome type.

Effects for Different Outcome Categories As shown in Table 3, interventions with supervised skills practice yielded significant effects for all seven outcome categories evaluated in at least five interventions (mean ESs ranged from 0.30 to 0.55). In contrast, only one of the six outcome categories (with $k\geq5$), anxiety, yielded significant ESs for skill-training interventions without supervised practice (ES=0.17). Psychoeducational interventions yielded significant effects for anxiety, stress, general psychological distress, self-perceptions, and academics (ESs>0.13), but not for depression, social and emotional skills, or interpersonal relationships (ESs of −0.07, 0.16, and 0.15, respectively).

To test the hypothesis that supervised skills practice would produce better effects in each outcome category except for self-perceptions, ESs from the above three major study groups were compared for cells with at least five interventions. These comparisons consistently favored interventions with supervised practice over the two intervention groups. For example, for depression, anxiety, stress, and general psychological distress, the mean effects for interventions with supervised skills practice were significantly greater than the mean effects obtained by skill-training interventions without supervised practice and by psychoeducational interventions.

Here it is worth noting important findings for both self-report and physiological assessments of stress. Although stress was usually assessed via self-reports (k=36), seven interventions involving supervised practice utilized various physiological indices such as cortisol levels, heart rate, systolic and diastolic blood pressure, or electromyography. The mean effect on physiological measures for the two interventions without supervised practice was zero, and none of the psychoeducational interventions collected physiological data. However, interventions with a supervised skills practice component yielded significant positive effects on stress outcomes, as reflected in both self-report (mean ES=0.48) and physiological assessments (mean ES=0.61).

Returning to Table 3, continuing the same pattern of results, interventions with supervised skills practice obtained significantly better effects on both social and emotional skills and self-perceptions, than either of the other two intervention groups. Interventions with supervised skills practice also obtained significantly better academic-related outcomes than psychoeducational interventions. Skill-training interventions without supervised practice did not have sufficient numbers to compare here. The only significant difference between psychoeducational interventions and those without a supervised practice component occurred on self-perceptions, and favored the former group.

Testing for Alternative Outcome Moderators Because other variables could explain the above effects, we assessed whether or not each of nine possible variables was significantly related to the obtained ESs from the 103 interventions. For these analyses, we aggregated all outcomes for each intervention. Mean ESs and between-group Q values were compared for the

Table 2 Selected characteristics of 103 universal prevention programs for higher education students

Study	Sample size and participants[a]	Experimental design	Type of intervention	Number and average length of sessions	Intervention format	Study-level effect size (Hedges' g)
Abbott (2009)	128 undergraduates	Random	Psychoeducation[b]	12, 1-h sessions	Small group	0.02 (0.18)
Abel et al. (2012)	101 graduate students	Quasi-experimental	CBT (SP)	12, 2-h sessions	Class	1.67 (0.23)**
Ando (2011)	300 undergraduates	Quasi-experimental	CBT (SP)	11, 90-min sessions	Class	0.16 (0.15)
Anshel (1996)	30 male undergraduates	Random	*Progressive relaxation program:* Relaxation (NSP)	2, 1-hr sessions	Individual	0.64 (0.39)
Archer (1986)	102 undergraduates	Quasi-experimental	CBT (SP)	15, 2-h sessions	Class	0.31 (0.22)
Astin (1997)	28 undergraduates	Random	Mindfulness (SP)	8, 2-h sessions	Small group	1.24 (0.50)*
Baker (2012)	55 undergraduates	Random	*Coherent breathing:* Relaxation (SP)	4, 150-min sessions	Small group	1.55 (0.46)**
			Meditation: Meditation/Yoga (SP)	4, 150-min sessions	Small group	1.52 (0.46)**
Bradley and McCanne (1981)	48 male undergraduates	Random	*Progressive relaxation:* Relaxation (NSP)	4 sessions, of unspecified duration	Individual/ Small group	0.00 (0.27)
			Relaxation response: Meditation/yoga (NSP)	4 sessions, of unspecified duration	Individual/ Small group	0.00 (0.27)
Breso et al. (2011)	50 undergraduates	Quasi-experimental	CBT (SP)	5, 2-h sessions	Individual	0.91 (0.34)**
Brown (2001)	240 undergraduates and graduates	Quasi-experimental	*Stress management:* Psychoeducation	45, 50-min sessions	Class	0.21 (0.16)
			Mental health skills: CBT (SP)	30, 90-min sessions	Class	0.27 (0.22)
Charlesworth et al. (1981)	18 undergraduate nursing students	Quasi-experimental	Relaxation (SP)	10, 1-h sessions	Small group	−0.06 (0.46)
Deckro et al. (2002)	128 undergraduates and graduates	Random	CBT (SP)	6, 90-min sessions	Small group	0.43 (0.20)*
Dickinson (2006)	207 undergraduates	Random	Psychoeducation	3, 20-min sessions	Individual	−0.08 (0.21)
Fabis (2005)	109 undergraduates	Quasi-experimental	*Resiliency training:* Psychoeducation	39, 1-h sessions (full course)	Class	0.30 (0.28)
			Stress management: CBT (NSP)	39, 1-h sessions (full course)	Class	0.36 (0.26)
Finkelstein et al. (2007)	72 second-year medical graduate students	Quasi-experimental	Meditation/yoga (NSP)	10, 2-h sessions	Class	0.53 (0.28)
Flinchbaugh et al. (2012)	55 undergraduate business students	Quasi-experimental	Relaxation (SP)	12, 6 min sessions	Small group	0.38 (0.28)
Foley and Stone (1988)	24 first-year nursing students	Random	*Full stress inoculation training:* CBT (NSP)	4, 1-h sessions	Small group	0.00 (0.27)
Fontana et al. (1999)	36 undergraduates	Random	CBT (SP)	6, 45-min sessions	Small group	0.34 (0.33)
Fulton (1990)	62 undergraduates	Random	*Relaxation training:* Relaxation (SP)	6, 90-min sessions	Small group	0.17 (0.33)
			Meditation: Meditation/Yoga (SP)	6, 90-min sessions	Small group	0.13 (0.34)
Godin (2010)	42 undergraduates	Random	Psychoeducation	3, 2-h sessions	Small group	0.09 (0.35)
Grimm (1996)	240 undergraduates	Quasi-experimental	*Knowledge only:* Psychoeducation	10 weeks, 200-min sessions	Class	−0.05 (0.19)
			Knowledge plus behavioral contract: Other: Behavioral Contracting (NSP)	10 weeks, 200-min sessions	Class	0.28 (0.23)
Heaman (1995)	40 female junior (undergraduate) nursing students	Random	Relaxation (NSP)	5, 90-min sessions	Small group	0.93 (0.32)**
Hill et al. (1981)	299 undergraduates	Random	Psychoeducation	3, self-guided 20-min sessions	Individual (self-help packets)	0.17 (0.12)
Hirokawa et al. (2002)	189 undergraduate social work students	Quasi-experimental	CBT (SP)	14, 90-min sessions	Class	0.08 (0.25)
Hoffmann Gurka (2005)	123 undergraduates and graduates	Quasi-experimental	Mindfulness (SP)	4, 1-h sessions	Small group	0.06 (0.21)
Holzworth-Munroe et al. (1985)	40 first- and second-year medical graduate students	Random	CBT (NSP)	6, 1-h sessions	Small group	0.07 (0.28)
Johansson (1991)	76 undergraduate nursing students	Random	CBT (SP)	6, 50-min sessions	Small group	0.92 (0.24)**
Jones (2004)	60 undergraduate Black women	Random	Psychoeducation	8, 90-min sessions	Small group	0.39 (0.26)
Kanji et al. (2006)	93 undergraduate nursing students	Random	Relaxation (SP)	8, 1-h sessions	Small group	0.42 (0.30)

Table 2 (continued)

Study	Sample size and participants[a]	Experimental design	Type of intervention	Number and average length of sessions	Intervention format	Study-level effect size (Hedges' g)
Kelly et al. (1982)	48 medical graduate students	Quasi-experimental	CBT (SP)	6, 60- to 90-min sessions	Small group	1.13 (0.35)**
Kiecolt-Glaser et al. (1986)	35 medical graduate students	Random	Relaxation (SP)	10, 40-min sessions	Small group	0.27 (0.33)
Kim et al. (2011)	70 female undergraduates	Quasi-experimental	CBT (SP)	8, 1-h sessions	Small group	0.62 (0.26)*
Kindlon (1983)	35 undergraduates	Random	Meditation/yoga (SP)	8 group & 5 individual sessions, of unknown duration	Small group[c]	0.43 (0.34)
Kovtun (2011)	44 first-year undergraduate international students	Quasi-experimental	Psychoeducation	30, 75-min sessions	Class	0.43 (0.31)
Lamothe et al. (1995)	55 first-year undergraduates	Random	Psychoeducation	6, 90-min sessions	Small group	0.40 (0.27)
Lee (2009)	14 Asian American undergraduates	Random	CBT (NSP)	10, 110-min sessions	Class	0.09 (0.50)
Leggett (2010)	85 first-year undergraduate nursing students	Random	Mindfulness (SP)	3, 90-min sessions	Small group	−0.19 (0.22)
Lindquist and Lowe (1978)	158 first-year undergraduates	Random	Psychoeducation	9, 90-min sessions	Small group	0.01 (0.28)
Lynch et al. (2011)	23 undergraduates	Quasi-experimental	Mindfulness (SP)	9, 107 min-sessions	Small group	0.14 (0.46)
Lyons and Lufkin (1967)	233 female undergraduates	Quasi-experimental	*Tension control:* Relaxation (SP)	10, 50-min sessions	Small group	1.17 (0.15)**
MacLeod et al. (2008)	66 undergraduates and adults[d]	Quasi-experimental	Psychoeducation	3, 1-h sessions	Small group	0.47 (0.25)
Mattanah et al. (2010)	171 first-year undergraduates	Random	Psychoeducation	9, 90-min sessions	Small group	0.10 (0.17)
McEntee and Halgin (1999)	40 undergraduates	Random	*Cognitive group therapy:* CBT (SP)	6, 75-min sessions	Small group	0.93 (0.35)**
McGee (1998)	167 undergraduates	Quasi-experimental	Psychoeducation	Unknown (full course, schedule unspecified)	Class	0.31 (0.20)
McWhirter et al. (1995)	334 undergraduates	Quasi-experimental	CBT (NSP)	Unknown (5-week course module)	Class	−0.02 (0.11)
Mitchell et al. (1983)[c]	16 first-year medical graduate students	Random	*Support:* Psychoeducation	8, 50-min sessions	Small group	0.00 (0.27)
Moss (2003)	213 undergraduates	Quasi-experimental	*Cognitive behavioral therapy:* CBT (SP)	8, 1-h sessions	Small group	0.00 (0.27)
			Stress education: Psychoeducation	8, 1-h sessions	Small group	0.00 (0.27)
			Yoga: Meditation/Yoga (SP)	8, 1-h sessions	Small group	0.00 (0.27)
			Meditation: Mediation/Yoga (SP)	8, 1-h sessions	Small group	0.00 (0.27)
Mullins (1994)	59 undergraduates	Quasi-experimental	*Eclectic method:* Relaxation (SP)	12, 30-min sessions	Small group	−0.06 (0.26)
Nathan et al. (1987)	96 first-year medical graduate students	Random	Psychoeducation	8, 50-min sessions	Class	0.00 (0.27)
Nelis et al. (2009)	37 undergraduates	Quasi-experimental	CBT (SP)	4, 150-min sessions	Small group	0.47 (0.33)
Nicholson et al., (1989)	56 undergraduates and graduates[d]	Quasi-experimental	Relaxation (NSP)	3, 2-h sessions	Small group	−0.26 (0.31)
Oppenheimer (1984)[c]	55 first-year undergraduates	Random	*Focused:* Psychoeducation	6, 1-h sessions	Small group	−0.25 (0.29)
Ostaniewicz (1999)	111 first-year undergraduates	Quasi-experimental	Psychoeducation	7, 90-min sessions	Small group	−0.03 (0.20)
Owens (1991)	40 first-year undergraduates	Random	*Integrative intervention:* CBT (SP)	10, 50-min sessions	Small group	0.11 (0.31)
Perna et al. (1998)	34 undergraduate athletes (rowers)	Random	CBT (SP)	7, 45-min sessions	Small group	1.00 (0.41)*
Pool and Qualter (2012)	134 mixed undergraduates[e]	Quasi-experimental	CBT (SP)	11, 2-h sessions	Class	0.55 (0.21)**
Porter and Johnson (2008)	29 second-year paramedic students (undergraduate)	Random	CBT (SP)	14 sessions, of unspecified duration	Small group	0.24 (0.42)
Pratt et al. (2000)	110 first-year undergraduates	Random	Psychoeducation	9, 80-min sessions	Small group	0.27 (0.21)
Price (1998)	123 undergraduates	Quasi-experimental	CBT (SP)	Unknown (2-credit course, schedule unspecified)	Class	0.26 (0.18)*
Ratanasiripong et al. (2012)		Random	Relaxation (SP)	2 session, of unknown duration	Individual	0.72 (0.26)**

Table 2 (continued)

Study	Sample size and participants[a]	Experimental design	Type of intervention	Number and average length of sessions	Intervention format	Study-level effect size (Hedges' g)
	60 second-year undergraduate nursing students[e]					
Reynolds et al. (2011)	73 first-year undergraduates	Random	CBT (SP)	14, 2-h sessions	Class	−0.16 (0.24)
Rose and Veiga (1984)	48 undergraduate business students	Random	CBT (SP)	6, 2-h sessions (1-credit course, schedule unspecified)	Class	1.31 (0.32)**
Rosenzweig et al. (2003)	302 second-year medical graduate students	Quasi-experimental	Mindfulness (SP)	10, 90-min sessions	Class	0.46 (0.12)**
Russler (1991)	38 undergraduate nursing students	Random	CBT (NSP)	2, 8-h sessions	Small group	0.00 (0.27)
Schrader and Brown (2008)	904 first-year undergraduates	Quasi-experimental	Psychoeducation	15, 1-h sessions	Class	0.09 (0.08)
Sears and Kraus (2009)	25 undergraduates	Quasi-experimental	*Combined meditation group:* Mindfulness (SP)	7, 2-h sessions	Class	0.08 (0.39)
Shapiro et al. (1998)	78 premedical undergraduates and medical graduate students	Random	Mindfulness (SP)	7, 150 min sessions	Class	0.58 (0.24)*
Sharpiro et al. (2007)	64 counseling psychology graduate students	Quasi-experimental	Mindfulness (SP)	10, 3-h sessions	Class	0.80 (0.28)**
Shapiro et al. (2008) and Oman et al. (2008)	47 undergraduates	Random	Mindfulness (SP)	8, 90-min sessions	Small group	0.17 (0.29)
Sheehy and Horan (2004)	22 first-year law graduate students	Random	CBT (SP)	4, 90-min sessions	Small group	0.52 (0.42)
Shestopal (1998)	69 undergraduates	Quasi-experimental	*Yoga:* Meditation/Yoga (NSP)	Unknown (full course, schedule unspecified)	Class	0.00 (0.27)
Sirridge (2010)	193 first-year undergraduates	Random	*Problem solving:* Psychoeducation	2 sessions, of unknown duration (one class period)	Small group	−0.02 (0.21)
			Role-play: Other - Psychodrama (NSP)	2 sessions, of unknown duration (one class period)	Small group	−0.06 (0.21)
Somers (1991)	90 undergraduates and graduates	Quasi-experimental	CBT (SP)	6, 1-h sessions	Small group	0.39 (0.23)
Steinhardt and Dolbier (2008)	64 undergraduates and graduates	Random	CBT (SP)	4, 2-h sessions	Small group	0.56 (0.27)*
Sullivan (2010)	448 first-year undergraduates	Quasi-experimental	Psychoeducation	15, 1-h sessions	Class	0.27 (0.18)
Swafford (1992)	122 first-year nursing undergraduates	Quasi-experimental	CBT (NSP)	8, 1-h sessions	Small group	0.11 (0.26)
Tardd (1987)	78 undergraduates	Quasi-experimental	CBT (SP)	Unknown (individually paced self-help materials)	Class	1.33 (0.26)**
Tavakoli et al. (2009)	60 undergraduate and graduate international students	Random	Social skills training (NSP)	2, 90-min sessions	Small group	0.27 (0.26)
Tieu (2008)	148 first-year undergraduates	Quasi-experimental	Psychoeducation	9, 80-min sessions	Small group	0.17 (0.24)
Türküm (2007)	19 Turkish undergraduates	Random	*Counselling:* CBT (SP)	8, 90-min sessions	Small group	0.70 (0.47)
Turner (1991)	341 undergraduates	Quasi-experimental	Relaxation (SP)	50-h total, number of sessions unknown	Class	0.49 (0.11)**
Utz (1994)	24 undergraduate nursing students	Random	Relaxation (SP)	3, 20-min sessions	Individual	0.29 (0.46)
Waldo (1982)	215 undergraduates	Quasi-experimental	Social skills training (SP)	12-h workshop, number of sessions unknown	Small group	0.46 (0.14)**
Walker and Frazier (1993)	171 undergraduates	Quasi-experimental	Psychoeducation	6, 50-min sessions	Small group	0.39 (0.23)
Walters (1991)	60 male undergraduates	Random	CBT (SP)	9, 1-h sessions	Small group	0.29 (0.26)
Wang et al. (2012)	210 first-year undergraduates[e]	Quasi-experimental	*Cohort 1:* CBT (SP)	30, 1-h sessions	Class	0.32 (0.28)
			Cohort 2: CBT (SP)	30, 1-h sessions	Class	0.23 (0.26)
			Cohort 3: CBT (SP)	30, 1-h sessions	Class	0.25 (0.22)
Whitehouse et al. (1996)	35 first-year medical students	Random	Relaxation (SP)	14, 90-min sessions	Small group	0.36 (0.32)

Table 2 (continued)

Study	Sample size and participants[a]	Experimental design	Type of intervention	Number and average length of sessions	Intervention format	Study-level effect size (Hedges' g)
Winzelberg and Luskin (1999)	21 senior undergraduates	Random	Meditation/yoga (SP)	4, 45-min sessions	Small group	0.27 (0.45)
Zavertnick et al. (2010)	41 undergraduate nursing students	Quasi-experimental	Social skills training (SP)	3, 70-min sessions	Small group	0.35 (0.31)
Zuroff and Schwarz (1978)	60 undergraduates	Random	Relaxation (SP)	6, 1-h sessions	Small group[f]	0.37 (0.31)
			Meditation/yoga (SP)	6, 1-h sessions	Small group[f]	0.27 (0.31)

In cases when a study presents more than one intervention, we also list the original researchers' unique terms for the intervention conditions

SP supervised skills practice, *NSP* nonsupervised skills practice, *CBT* cognitive-behavioral techniques

$^*p<.05$; $^{**}p<.01$

[a] *N* is the initial sample size for the designated intervention(s) and its corresponding control condition

[b] By nature, all psychoeducational interventions were primarily didactic in nature and thus did not contain any supervised skills practice

[c] Intervention was delivered primarily in small groups, with some individual sessions (with facilitator) as well

[d] The MacLeod et al. (2008) sample included 10 (15 %) adults; the Nicholson et al. (1989) sample was 93 % students (undergraduate and graduate), and 7 % faculty/staff. A sensitivity analysis revealed that meta-analytic results did not change when these two studies were excluded

[e] This is the final sample size as initial sample size in unknown

[f] Also included one individual consultation

dichotomous variables, and correlations were computed for the continuous variables to determine which variables were significantly related to effect size. As shown in Table 4, experimental design, country of study (i.e., within or outside the USA), sample attrition, and intervention format were not significantly related to intervention impact. The other five features were associated with better intervention effects at posttest in the following ways: Studies that were published, involved smaller sample sizes, contained interventions that were longer in duration, included a greater proportion of ethnic minority students, or were targeted at students beyond their first year yielded higher effects.

However, follow-up tests indicated that among these five variables, only sample size and type of student were differentially related to the three skill-practice study groupings. In addition, these two moderators were related. Elaborating on these relationships helps clarify some of the current findings. Overall, interventions for first-year students had larger sample sizes (M=166.39 participants) than those for students in other years (M=84.14 participants), and psychoeducational interventions were more likely to target students in their first year (e.g., 50 % of psychoeducational programs, vs 6.5 % of programs with supervised skills practice, targeted first-year students exclusively). Notably, psychoeducational interventions had significantly higher initial sample sizes (M=170.67) compared to skill-training interventions with and without supervised skills practice, which were comparable (M=76.69 and 73.79, respectively). Furthermore, whereas interventions targeted at first-year students were effective overall (mean ES=0.11, I^2=0 %), when separated by skill practice groupings, it is notable that as a subgroup, the 11 psychoeducational interventions were significantly effective (mean ES=0.11, SE=0.05, CI=0.01 to 0.21, I^2=0 %) whereas skill-training interventions with supervised practice (k=6) were not (mean ES=0.12, SE=0.10, CI=−0.08 to 0.32, I^2=0 %); there were too few skill-training interventions without supervised practice (k=3) to analyze. It is important to note the similarly modest effect sizes for the other two categories and recognize that the limited numbers of interventions warrant caution in interpreting these results. In sum, interventions for first-year students tended to have larger sample sizes than programs that were not specifically targeted for this population (e.g., programs for mixed undergraduates, upper-class undergraduates, and/or graduate and professional students), but were only modestly successful in changing students' adjustment regardless of the major features of the intervention.

Exploratory Analysis on Specific Intervention Strategies We conducted additional analyses comparing results for different intervention strategies. Because the cell sizes for several outcome categories were small, these analyses were conducted by averaging the effects across all outcome categories. Further, as interventions that incorporate supervised skills practice and

Table 3 Intervention mean post effect sizes (Hedge's g, SE, confidence interval), within-group Q statistics, and I^2 values for interventions and outcome categories

		All outcomes combined	Depression	Anxiety	Stress	General psychological distress	Social-emotional skills	Self-perceptions	Interpersonal relationships	Academic behaviors and performance
All interventions	ES (SE)	**0.29** (0.02)**	0.20 (0.05)**	0.40 (0.03)**	0.32 (0.04)**	0.23 (0.04)**	0.25 (0.04)**	0.20 (0.04)**	0.20 (0.06)**	0.18 (0.04)**
	CI	0.25–0.33	0.11–0.30	0.33–0.46	0.25–0.40	0.16–0.30	0.17–0.34	0.12–0.28	0.07–0.32	0.10–0.27
	k	**103**	25	58	43	44	31	34	14	22
	Q	233.51**	62.55**	159.36**	135.37**	73.38**	45.94*	77.92**	13.40	30.79
	I^2	56.32 %	61.63 %	64.23 %	68.98 %	41.40 %	34.69 %	57.65 %	2.98 %	31.79 %
Skill-training interventions										
With supervised practice[a]	ES (SE)	**0.45**[c] (0.03)**	0.39[c] (0.06)**	0.55[c] (0.04)**	0.55[c] (0.06)**	0.32[c] (0.05)**	0.37[c] (0.06)**	0.35[c] (0.07)**	–	0.30[c] (0.09)**
	CI	0.39–0.52	0.27–0.52	0.46–0.63	0.44–0.66	0.22–0.42	0.26–0.48	0.21–0.48	–	0.12–0.49
	k	61	13	36	26	24	20	15	–	9
	Q	148.78**	27.31**	81.50**	97.83**	53.27**	26.85	47.60**	–	18.41*
	I^2	59.67 %	56.06 %	57.05 %	74.45 %	56.82 %	29.23 %	70.59 %	–	56.55 %
No supervised practice	ES (SE)	**0.11**[d] (0.06)	0.03[d] (0.13)	0.17[d] (0.07)*	0.11[d] (0.10)	0.04[d] (0.10)	0.04[d] (0.09)	0.03[d] (0.09)	–	–
	CI	−0.01–0.22	−0.22–0.27	0.04–0.30	−0.08–0.30	−0.16–0.24	−0.14–0.22	−0.14–0.19	–	–
	k	17	6	13	8	8	5	6	–	–
	Q	16.74	1.43	29.11**	4.66	6.61	2.02	0.28	–	–
	I^2	4.42 %	0.00 %	58.78 %	0.00 %	0.00 %	0.00 %	0.00 %	–	–
Psychoeducation-only interventions[a]										
	ES (SE)	**0.13**[d] (0.04)**	−0.07[d] (0.09)	0.25[d] (0.07)**	0.13[d] (0.07)*	0.18[d] (0.06)**	0.16[d] (0.10)	0.18[e] (0.06)**	0.15 (0.08)	0.15[d] (0.05)**
	CI	0.06–0.21	−0.24–0.10	0.11–0.38	0.00–0.26[b]	0.06–0.29	−0.04–0.37	0.06–0.30	−0.00–0.30	0.06–0.25
	k	25	6	9	9	12	6	13	8	11
	Q	14.74	12.86*	20.33**	2.86	5.85	6.64	21.20*	3.69	9.88
	I^2	0.00 %	61.11 %	60.64 %	0.00 % %	0.00 %	24.72 %	43.40 %	0.00 %	0.00 %

Empty cells had fewer than five studies assessing that outcome type, and thus, overall effects were not calculated. k denotes the number of intervention in each cell. Q refers to within-group heterogeneity.

SE standard error, *CI* 95 % confidence interval for the reported effect size (ES)

*$p < .05$; **$p < .01$

[a] Comparing effectiveness of different intervention strategies overall: relaxation (0.55, CI = 0.41 to 0.68; $k = 17$)^{w}, cognitive-behavioral (0.49, CI = 0.40 to 0.58; $k = 37$)^{x}, mindfulness (0.34, CI = 0.19 to 0.49; $k = 9$)^{x,y}, meditation (0.25, CI = 0.02 to 0.53; $k = 10$)^{y,z}, psychoeducational (0.13, CI = 0.06 to 0.21; $k = 25$)^{z}. Intervention strategies that do not have matching superscript letters (w, x, y, z) differ significantly from each other at $p < .05$

[b] Despite rounding to 0.00, value of confidence interval exceeds zero and this mean effect is statistically significant

Effect sizes in the same column that are denoted with different superscripts[(c, d, e)] differ significantly from each other at $p < .05$

Table 4 The impact of various methodological, participant, and intervention characteristics on intervention outcomes

	Impact on Intervention		Sub-group effects		
	Q (df)	*p*	ES (SE)	CI	k
Publication status	4.28 (1)	.038			
Published			0.32 (0.03)**	0.27–0.38	67
Unpublished			0.23 (0.04)**	0.16–0.30	36
Experimentald design	2.17 (1)	.140			
Randomized			0.25 (0.04)**	0.17–0.32	53
Quasi-experimental			0.31 (0.03)**	0.26–0.37	50
Country	0.60	.440			
Inside the USA			0.28 (0.02)**	0.24–0.34	87
Outside the USA			0.34 (0.07)**	0.21–0.46	16
Sample attrition (pre to post)	1.61 (1)	.204			
Initial sample size (intervention+ control)	8.36 (1)	.004			
0−50 (frequency: 39.6 %)			0.39 (0.06)**	0.28–0.51	38
51−100 (frequency: 26.0 %)			0.36 (0.05)**	0.26–0.46	26
Over 100 (frequency: 34.4 %)			0.23 (0.03)**	0.17–0.28	33
Ethnicity (percentage minority)[a]	24.34 (1)	<.001			
Type of student	31.52 (4)	<.001			
First-year undergraduate			0.11 (0.04)*	0.02–0.19	20
Other or mixed undergraduate			0.33 (0.03)**	0.28–0.39	62
Mixed undergraduate & graduate			0.29 (0.09)**	0.12–0.46	9
Graduate or professional			0.53 (0.07)**	0.39–0.67	11
Other			0.47 (.25)	−0.03–0.96	1
Intervention format	2.57 (3)	.462			
Full class			0.30 (0.03)**	0.24–0.37	32
Small group			0.27 (0.03)**	0.21–0.34	63
Individual			0.25 (0.09)**	0.08–0.42	6
Individual/small group			0.00 (0.20)	−0.39–0.39	2
Intervention duration (hours)	48.16 (1)	<.001			

*p<.05; **p<.01

[a] Only 35 of the 103 reports (34 %) provided sufficient data on this variable

psychoeducational interventions were the only groups to demonstrate significant effects, skill-training interventions that did not incorporate supervised skills practice were omitted from these analyses. As indicated in Table 3, the intervention strategies in order of effectiveness were relaxation (significantly outperformed all others), then cognitive-behavioral (outperformed meditation and psychoeducation, but not mindfulness), mindfulness (outperformed psychoeducation, but not meditation), meditation (no better than psychoeducation), and, lastly, psychoeducation. There were insufficient numbers of social skills or "other" interventions to compare.

Effectiveness of Interventions at Follow-up

Only 30 of the 103 interventions assessed outcomes at any follow-up period (range=1 to 104 weeks; median=12 weeks; M=23.11; SD=24.54). Averaged across all types of outcomes, interventions with supervised skills practice (ES=0.28, CI=0.16 to 0.40; k=16) produced a significant positive effect at follow-up, whereas psychoeducational interventions did not (ES=0.08, CI=−0.04 to 0.21; k=10). The mean ES for the four studies of skill-training interventions without supervised practice also was not significant at follow-up (ES=0.13, CI=−0.14 to 0.39). However, comparisons between the effects achieved by the different intervention categories are not meaningful due to the small number of follow-up investigations, and the differences in the range and mean of their follow-up periods (mean months of follow-up for supervised skills practice=25.93, SD=32.62, range=1–104; for nonsupervised skill programs=9.75, SD=3.30, range=5–12; and for psychoeducational interventions=14.90, SD=9.77, range=4–39). Across all interventions combined, duration of follow-up was negatively related to ES, Q

(1)=236.20, $p<.001$, such that longer follow-up periods were associated with poorer outcomes.

Discussion

This review makes an important contribution to research on universal mental health preventive interventions for higher education students. Previous reviews have typically focused on specific subgroups of students, examined only published research, or offered very limited conclusions based on a small number of evaluated studies. The current review has many more controlled universal mental health studies than any of the previous reviews, included both published and unpublished research across the range of higher education settings (e.g., college, graduate, and professional), achieved good reliability in coding, and through meta-analytic procedures was able to estimate the magnitude of obtained effects and assess the potential influence of several outcome moderators. As a result, the current meta-analysis provides an updated, systematic examination of a large body of literature.

The current review yielded three major findings that have important implications: (a) Universal programs designed to prevent distress in higher education students appear to be effective in modifying several important dimensions of adjustment; (b) A critical moderator of program outcomes is supervised skills practice; and the (c) The gains achieved by the most effective interventions are impressive in the context of other research on universal preventive programs.

As predicted, skill-training programs with supervised practice were significantly more effective than the other two types of programs in producing changes across several types of outcomes including depression, anxiety, stress, general psychological distress, social-emotional skills, self-perceptions, and academic adjustment. Skill-training interventions lacking supervised practice were largely ineffective; these programs did not achieve a significant overall mean effect and had a significant but modest effect on only one outcome, anxiety. Psychoeducation did achieve a significant modest overall effect and modest significant effects on some outcomes including anxiety, stress, general psychological distress, academics, and self-perceptions, although not on depression, social-emotional skills, or interpersonal relationships. However, the gains achieved by supervised skill-training interventions were not only significantly higher in each case but also between two and six times greater in magnitude depending on the outcome. The clear implication is that universal skill-training programs should include a supervised practice component if they are to be of benefit, and such programs are preferred over psychoeducational programs, which are still commonly used in higher education settings. In retrospect, it is not surprising that interventions with supervised practice are effective because such programs involve two elements that other research has consistently associated with effective training, namely behavioral rehearsal and supportive feedback to promote the learning of new skills (Elliott et al. 2015; Taylor et al. 2005). What is surprising is that 22 % (17 out of 78) of the reviewed skill-training studies did not seem to include this critical component.

As noted earlier, supervised practice provides the trainer or group leader the direct opportunity to evaluate how well targeted skills are being mastered, and this information, in turn, provides opportunities for trainees to receive reinforcement and guidance on how best to incorporate the skills into their repertoire. Supportive feedback following behavioral rehearsal also has the potential to maintain or enhance students' motivation to learn and apply new skills. Several reviewed programs did require or suggest that students practice skills between sessions, and often the students would report how often they did so. Nevertheless, in the absence of direct observation, there is no way for the trainer to judge how well new skills are being learned and what adjustments may be necessary to increase the chances for skill mastery (e.g., more practice or reinforcement, or a different pacing of instruction). Supervised practice is an essential element for effective skills training.

Though only exploratory, the present study also revealed some significant differences in impact among the intervention strategies. Excluding skill-training interventions without supervised practice, as these were clearly not effective, relaxation interventions demonstrated the most overall benefit, followed by cognitive-behavioral and mindfulness interventions (which did not differ from each other), then meditation, and, lastly, psychoeducational interventions. Although each of the compared intervention types demonstrated significant effects collapsed across outcome types, the differences among them suggest the potential benefit of matching participants' needs to intervention focus. Future research is needed to discern which intervention strategy is most effective for which specific outcomes, which would allow for customizing interventions for different groups.

Findings from this meta-analysis are of practical importance in two ways that relate to the types of outcomes achieved and their magnitude of effect. First, the ability of programs containing supervised practice to achieve positive results on measures of depression, anxiety, and stress is important because these three areas are among the most common problems experienced by higher education students (ACHA 2013; Bewick et al. 2008). Programs that can significantly reduce symptoms in these categories are of preventive value. Research has frequently indicated that anxiety, depression, and stress increase the risk of poorer personal, social, and academic adjustment for higher education students (Kerr et al. 2004; Wintre and Yaffe 2000).

Second, the magnitude of effects achieved for depression, anxiety, and stress is impressive in the context of other prevention research. For example, to our knowledge, no other meta-analysis of universal preventive mental health has reported mean effects for these aspects of emotional distress as high as those obtained in the current review. Other meta-analyses have obtained significant mean effects for such outcomes in the low 0.20s for elementary, middle, or high school populations (see Table 5 in Durlak et al. 2011). In fact, the mean effect of supervised skill-training interventions on *preventing* anxiety in the current review is comparable to results reported in previous meta-analyses of *treatment* for anxiety problems in college students and adults (see Lipsey and Wilson 1993), quite a remarkable achievement for prevention. Also important, the current review found no indication of significant iatrogenic effects for any program. In sum, the current findings provide empirical support for the notion that skill-training programs with supervised skill practice can be helpful in preventing emotional distress and promoting adaptive assets and strengths. These considerations lead to the conclusion that skill-training interventions that contain supervised practice and target higher education students now join the ranks of other effective preventive programs.

Directions for Future Research

The current review identified several limitations in the current body of research that qualify our major conclusions. Collectively, the following issues thus offer a useful research agenda for the future.

Durability of Effects Over Time It is important to go beyond assessing an intervention's effectiveness at its conclusion, and to assess its effects over time, during variable follow-up periods. Unfortunately, the data on longer-term impact of interventions for higher education students was too limited to reach meaningful conclusions. Although, on the one hand, it would not be surprising if some effects diminished over time, on the other hand, some program benefits may increase over time or only appear at follow-up. This might occur if the skills initially learned in some interventions are particularly helpful at later periods of development such as when very demanding and stressful academic coursework is encountered, or during periods of serious interpersonal conflicts.

Increasing the Objectivity of Outcome Assessments Most of the reviewed outcomes were based on self-reports, which are a common and reasonable way to assess changes in such areas as self-perceptions, depression, anxiety, or perceived stress, but it would strengthen confidence in the results if more objective outcomes also were collected. For example, seven studies did obtain positive results using physiological indices to assess stress reactions (e.g., cortisol levels, heart rate, or muscle tension) suggesting that such measurement can be easily incorporated into experimental designs targeting stress. Less than half of the academic outcomes in the current review were assessments involving GPA or test performance, but such measures could be routinely gathered from institutional records with participants' knowledge and permission. It also would be helpful to track students' academic careers over time to measure retention and graduation rates, which might prove very useful in assessing the cost-benefit return of interventions. Behavioral assessments of performance in targeted skill areas also are needed to confirm the level of students' mastery of different skills. Finally, peer reports of interpersonal functioning could add another perspective to how interventions are affecting students' lives.

Determining What Moderates Outcomes Although skill-training interventions were effective, there was still a high degree of variability (58 %) in outcomes in some cases. Therefore, it is important to determine what factors influence this variability. Although we were able to identify one component of skills training, supervised practice, that was a critical moderator for positive outcomes, it is possible that other dimensions of training are equally important. These may include how the skills are initially presented and defined, the types of models that are offered to demonstrate the skills, how practice is scheduled and paced, how often and what types of feedback are delivered, what strategies are used to encourage the transfer or generalization of newly learned behaviors, and what steps are used, if any, to maintain trainee motivation and persistence during the learning process. Unfortunately, we could not code for these other components due to lack of information in the reviewed reports. Moreover, training tactics are likely to vary depending on the specific skills that are targeted. Greater details in future research about which specific intervention procedures and change techniques were used to develop which skills, along with experimental designs that measure and compare differing training methods, are needed to begin to understand the relative value of different strategies for achieving different training goals.

Results indicated that a few different features were related to effect sizes across our three main study groupings. First, published studies yielded significantly higher outcomes than unpublished reports confirming the general recommendation that meta-analyses should strive to include the latter type of reports. Although statistical methods exist to estimate the possible influence of publication bias, it is better practice to search carefully and include unpublished studies so that publication bias can be directly assessed and diminished. Our search for unpublished work identified unpublished gray literature available through computer searches of ERIC and Proquest Dissertations and Theses. Although this search procedure does improve upon previous reviews of research on higher education students that only included published work (e.g., Galbraith

and Brown 2011; Reavley and Jorm 2010; Regehr et al. 2013), an even more complete search would attempt to obtain unpublished manuscripts possibly held by authors of all included studies.

The finding that longer interventions were related to better outcomes is not unusual in intervention literature, but this finding is tempered by the brief duration of many studies (median of 10 sessions). Finding that "longer is better" does not clarify why this would be so. Therefore, hypotheses about the benefits of longer programs should be assessed specifically. For example, do longer programs lead to higher levels of acquired skills or provide participants with more opportunities to generalize their newly learned behaviors?

Interventions specifically targeting first-year students obtained only modest significant effects overall (0.11) and tended to include larger samples while programs involving graduate and professional students achieved the highest effects (mean ES=0.53). The former finding is particularly concerning in light of evidence that first-year students experience elevated risk for psychological distress compared to students in later years (Bayram and Bilgel 2008; Sher et al. 1996; Towbes and Cohen 1996). It is possible that developmental differences occurring over the course of higher education might be responsible. For example, graduate and professional students might be more motivated and able to take advantage of helping services due to their life experiences and more mature cognitive abilities. It is also possible that the addition of booster sessions that occur in the later school years would improve outcomes for first-year students.

Although some of the examined methodological variables (i.e., experimental design, sample attrition, and intervention format) were not associated with current outcomes, methodological features can influence outcomes. Therefore, future researchers should strive, among other things, to (a) check for pre-intervention equivalence between groups, (b) track attrition over time and determine if there are differences between continuers and dropouts, or differences in attrition between experimental conditions, (c) employ randomized designs whenever possible, (d) conduct the proper analyses of clustered or nested data for group or classroom-based studies, and (e) monitor implementation to insure that programs are conducted as intended. Intent-to-treat analyses, which were rare among the reviewed studies (e.g., Tavakoli et al. 2009), would also improve experimental rigor and increase confidence in the results.

On the one hand, the finding that the total percentage of ethnic minority participants (e.g., African-Americans, Asian-Americans, Hispanics) was positively related to outcomes is encouraging because it suggests that interventions were beneficial for underrepresented students, a result that is not typically found in prevention research (Weisz et al. 2005). Further, as the disparity in retention among ethnic majority and minority students is a concern among higher education personnel and institutions, the current findings suggest one potentially effective avenue for improving outcomes for ethnic minority students, as psychosocial adjustment predicts academic success and retention (Eisenberg et al. 2009). On the other hand, the positive results for ethnic minority students are tentative, at best, because only approximately one third of the reports (35 out of 103) provided sufficient information on the ethnicity of their samples. Full reporting on the ethnic composition of samples should be routine in future studies, and researchers should strive to compare the benefits accruing to different groups. Furthermore, because there can be more variability within than across ethnic groups, it is important that researchers consider how additional variables may play a role. Some of these factors might be associated with ethnic status such as one's worldview, level of acculturation, or bicultural competence. Others might be germane for all students such as academic and career motivations and plans, and levels of perceived social support and encouragement received from families, friends, and the educational institution. There are other features of student samples that were almost never mentioned in the current studies but might provide clues about how to improve adjustment for different student groups. These include aspects of students' background such as familial income levels, being the first in their families to attend college, and the presence of various disabilities. If future research systematically collects and reports this information, we will be better able to conduct moderation analyses examining relative effectiveness for different at-risk or underrepresented groups, which will allow for improved intervention planning and impact overall.

Determining What Mediates Outcomes The assumption in skill-training interventions is that it is the mastery of targeted skills that are the active mechanisms of change, but this assumption needs to be tested systematically. This requires careful assessments of skill levels so that the presumed mechanisms of change in such programs can be evaluated. Other variables that might mediate outcomes, such as participants' motivation, or the degree to which they are fully engaged in the intervention, also deserve scrutiny.

Implications for Higher Education

Finally, current findings have implications for how higher education institutions can extend the reach of skill-training interventions to more students. For example, many schools have elective mental-health-related course offerings that contain experiential components for students; examples in the current review include courses on stress management (e.g., Abel 2005) and mental health skills (Brown 2001). These course offerings have appealed to students, and as research continues to demonstrate their effectiveness, they can and should become part of an institution's core curriculum.

Current findings suggest that incorporating supervised skill-training components into these courses is beneficial for students.

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Conflict of Interest The authors declare that they have no conflict of interest.

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