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PSYCHOLOGICAL TREATMENT OF DEPRESSION IN COLLEGE STUDENTS: A METAANALYSIS

Pim Cuijpers, Ph.D.^{1,2,*}, Ioana A. Cristea, Ph.D.^{3,4}, David D. Ebert, Ph.D.⁵, Hans M. Koot, Ph.D.^{1,2}, Randy P. Auerbach, Ph.D.⁶, Ronny Bruffaerts, Ph.D.⁷, and Ronald C. Kessler, Ph.D.⁸

¹Department of Clinical, Neuro and Developmental Psychology, Vrije Universiteit Amsterdam, Amsterdam, The Netherlands ²EMGO Institute for Health and Care Research, Amsterdam, The Netherlands ³Department of Clinical Psychology and Psychotherapy, Babes-Bolyai University, Cluj-Napoca, Romania ⁴Clinical Psychology Branch, Department of Surgical, Medical, Molecular, and Critical Pathology, University of Pisa, Pisa, Italy ⁵Department of Psychology, Clinical Psychology and Psychotherapy, Friedrich-Alexander University Nuremberg-Erlangen, Erlangen, Germany ⁶Department of Psychiatry, Harvard Medical School, Center for Depression, Anxiety, and Stress Research, McLean Hospital, Belmont, Massachusetts ⁷Universitair Psychiatrisch Centrum – KU Leuven, Kortenberg, Belgium ⁸Department of Health Care Policy, Harvard Medical School, Boston, Massachusetts

Abstract

Background—Expanded efforts to detect and treat depression among college students, a peak period of onset, have the potential to bear high human capital value from a societal perspective because depression increases college withdrawal rates. However, it is not clear whether evidence-based depression therapies are as effective in college students as in other adult populations. The higher levels of cognitive functioning and IQ and higher proportions of first-onset cases might lead to treatment effects being different among college students relative to the larger adult population.

Methods—We conducted a metaanalysis of randomized trials comparing psychological treatments of depressed college students relative to control groups and compared effect sizes in these studies to those in trials carried out in unselected populations of depressed adults.

Results—The 15 trials on college students satisfying study inclusion criteria included 997 participants. The pooled effect size of therapy versus control was $g = 0.89$ (95% CI: 0.66~1.11; NNT = 2.13) with moderate heterogeneity ($I^2 = 57$; 95% CI: 23~72). None of these trials had low risk of bias. Effect sizes were significantly larger when students were not remunerated (e.g. money, credit), received individual versus group therapy, and were in trials that included a waiting list control group. No significant difference emerged in comparing effect sizes among college students versus adults either in simple mean comparisons or in multivariate metaregression analyses.

*Correspondence to: Professor Pim Cuijpers, Clinical Psychology, Department of Clinical Psychology, Vrije Universiteit Amsterdam, Van der Boechorststraat 1, 1081 BT Amsterdam, The Netherlands. p.cuijpers@vu.nl.

Conclusions—This metaanalysis of trials examining psychological treatments of depression in college students suggests that these therapies are effective and have effect sizes comparable to trials carried out among depressed adults.

Keywords

depression; college students; psychotherapy; cognitive behavior therapy; behavioral activation therapy; metaanalysis

INTRODUCTION

The college years are a peak age period for depression onset—particularly for the occurrence of first episodes.^[1,2] In high-income countries, more than half of young adults are enrolled in higher education.^[3,4] Therefore universities have the potential to become a key setting for the prevention and treatment of depression (as well as for a number of other mental disorders). Mental disorders often result in a cascade of negative educational, economic, and social outcomes,^[5–7] including elevated risk of withdrawal from college prior to completion,^[8,9] suggesting that detection and effective treatment of these disorders early in the college career might bear important positive human capital effects from a societal perspective, as well as from the perspective of the patient.

But a question can be raised about the effectiveness of standard evidence-based depression treatments among college students. It is possible that these treatments are more effective in college students, because there are some indications that therapies are more effective in people with good cognitive functioning^[10] and people with a higher IQ.^[11] Depressive disorders in college students also differ from those in the general population in that these are probably more often first-onset disorders, while in adults in older age groups recurrent depressive disorders are more common. Although this has not been examined as a predictor of outcome it may be possible that first-onset depressive disorders can be treated better and that the effects of treatments in student populations are therefore higher in college students.

On the other hand, it could also be assumed that therapies are less effective in depressed college students, because in older age groups bipolar disorders will probably be excluded more effectively, while college students with a bipolar diathesis will in many cases start out with a depressive episode before they have their first manic or hypomanic episode. This might lead to worse treatment response in a sample of depressed college students than in a sample of depressed adults. Of note, there are also other factors that may account for treatment response differences including patterns of substance use and irregular sleep schedules.

Choosing among these competing possibilities requires comparative analysis of treatment effectiveness in samples of college students versus more general adult samples. Although a number of trials of psychological treatments for depression among college students have been carried out in the past decades, no metaanalysis has integrated the results of these trials. Several metaanalyses examined the effects of interventions among college students on general distress,^[12] preventive, and early intervention,^[3] and technology-based

interventions.^[13] However, no metaanalysis has tested the effects of psychological interventions of depression in college students.

At the same time, a relatively large number of trials have focused on psychological treatment for depression in college students. This is true in part because many clinical researchers have easy access to college students as convenience samples to test new treatments or experimental interventions. Many of these studies were designed to examine innovative or experimental approaches as opposed to developing evidence-based therapies for college students. Therefore, the current metaanalysis included only studies that examined full psychological treatments of depression in college student samples. In this metaanalysis, we examine whether psychological therapies are effective in the treatment of depression in college students. We also examine whether the effects of psychological treatments of depression in college students differ from those in adults in general.

METHODS

IDENTIFICATION OF STUDIES

We began with a database of 1,756 papers on the psychological treatment of depression that has been described in detail elsewhere^[14] and has been used in a series of earlier published metaanalyses (www.evidencebasedpsychotherapies.org). The database is continuously updated and was developed through a comprehensive literature search (from 1966 to January 2015) in which 16,365 abstracts from PubMed (4,007 abstracts), PsycInfo (3,147 abstracts), Embase (5,912 abstracts), and the Cochrane Central Register of Controlled Trials (3,995 abstracts) were examined. These abstracts were identified by combining terms indicative of psychological treatment and depression (both MeSH-terms and text words). Primary studies from earlier meta-analyses of psychological treatment for depression also were checked to ensure that no published studies had been omitted.

INCLUSION AND EXCLUSION CRITERIA

We included randomized trials on the acute treatment of depression among college students, in which the effects of a psychological treatment were compared with a control group (waiting list, care-as-usual, placebo, or other). Treatments could be delivered individually, in a group, in a guided self-help format, or as Internet-based intervention (with human support). Unguided interventions without any human support were not included. Studies in which two or more types of treatment were compared to each other were excluded if no control condition was available. We only included studies in which interventions were examined that had treatment of depression as their primary goal, and experimental manipulations in depressed students in which a full psychological treatment was not examined were not included.

We compared treatment effect sizes in these trials conducted among college students with those in other trials in which a psychological treatment of depression was compared with a control condition in an unselected group of depressed adults. Studies on specific target groups (e.g., older adults, patients with comorbid general medical disorders, women with postpartum depression, etc.) were excluded from this comparison as were studies of

inpatients, patients with chronic and treatment-resistant depression, patients with coexisting marital problems, and patient groups made up exclusively of those with other comorbid mental disorders.

RISK OF BIAS ASSESSMENT

We assessed the risk of bias of the studies according to four basic criteria suggested by the Cochrane Handbook for Systematic Reviews of Interventions:^[15] (i) adequate sequence generation (the randomization scheme was generated correctly); (ii) allocation to conditions by an independent (third) party; (iii) assessors blind to outcomes; and (iv) completeness of follow-up data. Data extraction was conducted by two independent researchers. Two independent raters assessed the risk of bias and resulting disagreements were resolved until agreement was reached.

METAANALYSES

For each comparison between a psychological treatment and a control condition we calculated the effect size that indicated the difference between the two conditions at posttest, adjusted for small sample bias (Hedges' g).^[16] Effect sizes were calculated by subtracting (at posttest) the average score of the treatment group from the average score of the control group and then dividing the result by the pooled standard deviations of the two groups. We only used those instruments that explicitly measured symptoms of depression, such as the Beck Depression Inventory^[17] (BDI) or the Hamilton Rating Scale for Depression^[18] (HRSD). If more than one depression measure was used, the mean of the effect sizes was calculated, so that each study provided only one effect size.

We used the computer program Comprehensive Meta-Analysis (version 3.3.070; Biostat, 2014) to calculate pooled mean effect sizes. As we expected considerable heterogeneity, we calculated mean effect sizes using a random effects model. Numbers-needed-to-treat (NNT) were calculated using the formulae provided by Kraemer and Kupfer.^[19] In all analyses we calculated the I^2 -statistic as an indicator of heterogeneity in percentages (25% indicates low, 50% moderate, and 75% high heterogeneity).^[20] We calculated 95% confidence intervals (CI) around \hat{P} ^[21] using the noncentral Chi squared-based approach within the *Heterogi* module for Stata.^[22]

Subgroup analyses were conducted according to the mixed effects model,^[23] in which studies within subgroups are pooled with the random effects model, while tests for significant differences between subgroups are conducted with the fixed effects model. Multivariate and bivariate metaregression analyses were conducted according to the procedures developed by Borenstein and colleagues.^[23] Publication bias was examined with Duval and Tweedie's trim and fill procedure,^[24] which yields an estimate of the effect size after accounting for publication bias. We also conducted Egger's test for the asymmetry of the funnel plot.

RESULTS

SELECTION AND INCLUSION OF STUDIES

After examining a total of 16,365 abstracts (12,196 after removal of duplicates), we retrieved 1,756 full-text papers for further consideration. We excluded 1,661 of the retrieved papers for the main analyses. The reasons for excluding studies are given in Figure 1. Fifteen studies on psychological treatments for college students met inclusion criteria (main analyses). Another 79 studies (with 121 comparisons between a treatment and a control group) on psychological treatments for unselected adults were included (for the comparison of effect sizes of psychological treatments of college students versus unselected adults with depression). This makes a total of 94 studies that were included in the analyses. Figure 1 presents a flowchart describing the inclusion process.

CHARACTERISTICS OF INCLUDED STUDIES

Selected characteristics of the included studies are presented in Table 1. In the 15 included studies among college students, a total of 922 students participated (therapy conditions = 479, control conditions = 443), with a total of 22 comparisons between treatment and control conditions examined (one comparison = one study, two comparisons = three studies, and three comparisons = two studies). The average number of patients per condition was 26.

Students received compensation for participating in the study (money or study credits) in six of the 15 studies. Students were recruited through: (a) announcements in college newspapers (nine studies), (b) completion of self-report depression measures (four studies), and (c) referrals from college health services (two studies).

In 14 of the 22 comparisons between a treatment and a control condition, cognitive behavior therapy was used as the intervention, four used behavioral activation, and the remainder used another type of treatment. Fourteen comparisons used a group treatment format and eight studies utilized individual treatment. The number of treatment sessions ranged from one to 11. For the control group, six studies used a waiting list, five studies used care-as-usual, and four used another control group. Thirteen studies were conducted in the United States.

Selected characteristics of the 122 comparisons between treatment and control groups in adults are presented in Appendix A and the references for the 79 studies are given in Appendix B.

RISK OF BIAS

The risk of bias in most studies was considerable. Only one of the 15 studies reported an adequate sequence generation method. Two of the 15 studies reported allocation to conditions by an independent (third) party. Twelve used only self-reported treatment outcomes and one of the three remaining studies reported using blinded outcome assessors. In five studies intent-to-treat analyses (completeness of follow-up data) were conducted. None of the included 15 studies met all quality criteria. One study met three criteria, four others met two criteria, and the other 10 met only one of the four criteria.

EFFECTS OF PSYCHOLOGICAL TREATMENT OF COLLEGE STUDENTS VERSUS CONTROL GROUPS

From the 15 included studies, we compared the effects of treatment with a control group in 22 comparisons. The overall effect size was $g = 0.89$ (95% CI: 0.66~1.11), which corresponds with a NNT of 2.13. Heterogeneity was moderate ($I^2 = 57$; 95% CI: 23~72).

Inspection of a forest plot of the effect sizes and 95% CIs (Fig. 2) indicated that there were potential outliers. Exclusion of the two effect sizes that did not overlap with the 95% CI of the pooled effect size resulted in a larger effect size ($g = 0.96$; 95% CI: 0.75~1.17; NNT = 1.99) as well as a reduction in heterogeneity ($I^2 = 42$; 95% CI: 0~65).

Given that five studies included multiple psychological treatments that were considered in the same analysis, which may have (a) resulted in an artificial reduction of heterogeneity and (b) affected the pooled effect size, we conducted an analysis in which we included only one effect size per study (either the largest or the smallest effect size in each study). As can be seen from Table 2, the resulting effect sizes were somewhat smaller and more heterogeneous than the overall effect sizes.

We also calculated the effect sizes based on the BDI (no other measure was used in more than three studies). As can be seen in Table 2, the effect size based on the BDI only was somewhat higher than the overall pooled effect size ($g = 1.02$; 95% CI: 0.78~1.26; NNT 1.89).

Inspection of the funnel plot suggested considerable publication bias. Egger's test of the intercept was significant (intercept: 2.14; 95% CI: 1.00~3.28; $P = 0.0004$). Duvall and Tweedie's trim and fill procedure indicated that eight studies might be missing due to publication bias and that the pooled effect size would decrease to $g = 0.61$ (95% CI: 0.37~0.85) if these presumably negative studies were included.

SUBGROUP ANALYSES

We conducted a series of subgroup analyses to examine whether characteristics of the studies were associated with effect sizes (Table 2). We found no indication that type of recruitment of students (through announcements in media, referrals from clinical services, or systematic screening), definition of depression (diagnosed mood disorder, scoring above a cut-off on a self-report measure, or subthreshold depression), or type of treatment (CBT, BAT, or other) was significantly associated with the effect size. We did, however, find that the effect size was significantly larger when the students were not compensated (through money or study credits; $P = 0.01$). In addition, individual therapy was significantly more effective than group therapy ($P = 0.003$), and the type of control group was significantly associated with the effect size ($P = 0.02$). Because almost all studies had a comparable risk of bias (score 1 or 2), we did not conduct a separate analysis for variation in estimated effect size as a function of the level of risk of bias.

EFFECTS OF PSYCHOLOGICAL TREATMENT OF COLLEGE STUDENTS VERSUS ADULTS IN GENERAL

The above results among college students were compared with the results of parallel analyses carried out in the 79 studies of treatments for depressed adults in general. The estimated pooled effect size found for adults across the 121 comparisons in these 79 studies ($g = 0.79$; 95% CI: 0.69~0.88; $I^2 = 73$; 95% CI: 67~77; NNT = 2.36) did not differ significantly from the pooled effect size found among college students ($g = 0.89$, $P = 0.38$).

As aggregate comparison of effect sizes between college students and adults might be influenced by differences in treatment type and format, study quality, or other design features, we conducted a multivariate meta-regression analysis in which we adjusted for all study characteristics extracted (Table 3). To avoid collinearity, we first calculated the correlation among all study variables, and results indicated no association was higher than $r = 0.60$. Therefore, all study variables were included in the model. After this, a multivariate meta-regression analysis was conducted with the effect size as the dependent variable. Predictors included a dummy variable indicating whether the study was aimed at college students or unselected adult populations as well as the other characteristics of the studies, participants, and interventions. All variables were entered simultaneously in the model (Table 3). The effect of the dummy variable indicating whether the study was aimed at college students or unselected adult populations was not significant ($P = 0.64$), again suggesting the effects in these groups are comparable.

DISCUSSION

We conducted a metaanalysis of randomized trials examining the effects of psychological treatments of depression in college students. We identified 15 trials satisfying our inclusion criteria and comparing a psychological treatment to a control group. These trials suggest that the effects of psychological treatment in college students are in the range conventionally considered large (i.e. $g > 0.8$ ^[25]). At the same time, none of the studies met all criteria for low risk of bias and only one met three of the four criteria. This implies that the results should be interpreted with caution.

We compared the studies in college students with those in unselected populations of adults with depression (which did include studies with low risk of bias). In multivariate meta-regression analyses—which adjusted for the characteristics of the population, the interventions, and the study—we found no indication that effect sizes differed from those in unselected populations of adults. Despite differences in the quality of interventions in college students, these results suggest that effects found in adults may be generalizable to depressed college students.

We hypothesized that psychological treatment in students may differ from adult populations because students have higher levels of cognitive functioning and IQ, are more often experiencing a first episode, and may more often have a bipolar disorder instead of a depressive disorder. We found no evidence, however, that there is a difference in effects of treatments between college students and adults in general, so this investigation does not support these hypotheses.

In subgroup analyses, our results indicated that compensating students for participating in the trial resulted in lower effects. We could not verify this in the larger group of studies in unselected populations of adults, as few of these studies compensated participants (and course credit is not feasible). This finding was not anticipated, and it may be spurious. However, the need for remuneration may underscore a lack of intrinsic motivation in study participants (i.e., completing intervention for extrinsic gains). It is well-documented that college students perceive a significant number of barriers in seeking help for mental health problems (see^[26,27]). Conversely, those who participated without receiving compensation may be more internally motivated to alleviate depressive symptoms.

The subgroup analyses also revealed that individual treatment was more effective than group therapy among college students. However, in the metaregression analyses, which included a larger sample of studies, we did not find any indication that treatment format was associated with effect size after adjustment for other characteristics of the studies. These results should therefore be considered with caution.

We also found that type of control group is significantly associated with the effect size, with waiting lists resulting in significantly higher effect sizes relative to other types of control groups. This finding remained significant in the multivariate metaregression analyses and is in line with previous metaanalyses.^[28,29]

The results of this metaanalysis should be interpreted in the light of several limitations. First, risk of bias in the included studies was high. To address this limitation, we compared the results with a larger sample of studies in adults. Although this provides a statistical adjustment, it cannot completely compensate for the limitations in study designs in college students. Second, few studies examined the long-term effects of the treatments and the effect sizes we focused on here were ones that examined episode resolution rather than risk of recurrence. Third, the number of studies in this population was relatively small, which reduced our ability to carry out powerful moderator analyses. Finally, in this meta-analysis we could only compare studies in college students with those in adult populations. It may have been preferable to compare college students and same-aged nonstudent young adults in order to determine whether education is a key moderator. Unfortunately, no studies have been completed that specifically target this nonstudent population.

Despite these limitations, the results suggest that the effects of psychological treatments of depression among college students are significant and comparable to those of depressed adults, suggesting that systematic efforts to expand detection, outreach, and treatment of depressed college students with standard treatments are warranted. Such efforts could have important societal effects, as college students represent the future leaders of society and their success is critical for societal human capital development, while depression is an important risk factor that, if untreated or inadequately treated, can have profoundly negative effects on this human capital development. The results reported here also highlight the importance of conducting higher quality treatment studies among college students in the future and, in addition, collecting sufficient baseline information to allow future analyses to go beyond the aggregate level of analysis to examine heterogeneity of treatment effects and to explore the possibility that different types of treatment might be optimal for different types of students.

It is well-established that individual, group, and guided self-help treatments are effective in the treatment of depression, with no major differences between the effects of these different formats.^[30–32] It is also known that for some depressed individuals even unguided self-help may be effective.^[33] Currently, it is not known which patients respond to which treatment or treatment format. It is important, therefore, to conduct large surveys among students to explore potential predictors of the outcomes of therapies, to develop models to predict the most efficient treatment for individual students, and to test these models in new randomized trials examining if they can strengthen treatment outcome and improve efficiency of treatments.

Appendix A: Selected characteristics of comparisons between treatment and control groups in adults (N = 121)

| | Recr | Diagn | Type | Control | Format | Nsess | RoB | Countr |
|---|-------|---------|-------|---------|--------|-------|-----|--------|
| Allart et al. ^[1] | Comm | Cut-off | CBT | cau | grp | 12 | 1 | EU |
| Andersson et al. ^[2] | Comm | Cut-off | CBT | other | gsh | 5 | 4 | EU |
| Barber et al. ^[3] | Comm | Mood | DYN | other | ind | 20 | 3 | US |
| Barrera ^[4] | Comm | Cut-off | BAT | wl | grp | 8 | 1 | US |
| Berger et al. ^[5] | Comm | Mood | CBT | wl | gsh | 10 | 4 | EU |
| Bohlmeijer et al. ^[6] | Comm | Cut-off | Other | wl | grp | 8 | 4 | EU |
| Bolton et al. ^[7] | Other | Mood | IPT | cau | grp | 16 | 3 | Other |
| Bowman et al. ^[8] —cogn | Comm | Cut-off | CBT | wl | gsh | 4 | 0 | US |
| Bowman et al. ^[8] —se | Comm | Cut-off | PST | wl | gsh | 4 | 0 | US |
| Brown and Lewinsohn ^[9] —grp | Comm | Mood | CBT | wl | grp | 12 | 1 | US |
| Brown and Lewinsohn ^[9] —gsh | Comm | Mood | CBT | wl | gsh | 12 | 1 | US |
| Brown and Lewinsohn ^[9] —ind | Comm | Mood | CBT | wl | ind | 12 | 1 | US |
| Carlbring et al. ^[10] | Comm | Mood | Other | wl | gsh | 7 | 4 | EU |
| Carrington ^[11] —cbt | Comm | Mood | CBT | wl | ind | 12 | 1 | US |
| Carrington ^[11] —dyn | Comm | Mood | DYN | wl | ind | 12 | 1 | US |
| Castonguay et al. ^[12] | Comm | Mood | CBT | wl | ind | 16 | 1 | US |
| Chan ^[13] —cbt | Comm | Mood | CBT | wl | ind | 10 | 2 | Other |
| Chan ^[13] —mbt | Comm | Mood | Other | wl | ind | 10 | 2 | Other |
| Cullen ^[14] | Comm | Mood | BAT | wl | ind | 10 | 1 | US |
| DeRubeis et al. ^[15] | Comm | Mood | CBT | other | ind | 14 | 2 | US |
| Dimidjian et al. ^[16] —ba | Comm | Mood | CBT | other | ind | 16 | 3 | US |
| Dimidjian et al. ^[16] —ct | Comm | Mood | BAT | other | ind | 16 | 3 | US |
| Dowrick et al. ^[17] —cwg | Comm | Mood | CBT | cau | grp | 12 | 4 | UK |
| Dowrick et al. ^[17] —pst | Comm | Mood | PST | cau | ind | 6 | 4 | UK |
| Ekers et al. ^[18] | Comm | Mood | BAT | cau | ind | 12 | 4 | UK |
| Elkin et al. ^[19] —cbt | Comm | Mood | CBT | other | ind | 16 | 2 | US |
| Elkin et al. ^[19] —ipt | Comm | Mood | IPT | other | ind | 16 | 2 | US |
| Epstein ^[20] | Comm | Mood | CBT | wl | grp | 8 | 1 | US |
| Fledderus et al. ^[21] —act-e | Comm | Mood | Other | wl | gsh | 9 | 3 | EU |

| | Recr | Diagn | Type | Control | Format | Nsess | RoB | Countr |
|---|------|---------|-------|---------|--------|-------|-----|--------|
| Fledderus et al. ^[21] —act-m | Comm | Mood | Other | wl | gsh | 9 | 3 | EU |
| Gehr ^[22] | Comm | Mood | Other | other | ind | 7 | 1 | EU |
| Hegerl et al. ^[23] | Comm | Cut-off | CBT | other | grp | 10 | 4 | EU |
| Horrell et al. ^[24] | Comm | Mood | CBT | wl | grp | 4 | 4 | UK |
| Jamison and Scogin ^[25] | Comm | Mood | CBT | wl | gsh | 4 | 0 | EU |
| Jarrett et al. ^[26] | Comm | Mood | CBT | other | ind | 20 | 3 | EU |
| Johansson et al. ^[27] | Comm | Mood | DYN | other | gsh | 9 | 4 | EU |
| Johansson et al. ^[28] —stand | Comm | Mood | CBT | other | gsh | 8 | 3 | EU |
| Johansson et al. ^[28] —tayl | Comm | Mood | CBT | other | gsh | 8 | 3 | EU |
| Kessler et al. ^[29] | Comm | Mood | CBT | wl | gsh | 10 | 4 | EU |
| King et al. ^[30] —cbt | Clin | Cut-off | CBT | cau | ind | 6 | 3 | EU |
| King et al. ^[30] —sup | Clin | Cut-off | SUP | cau | ind | 6 | 3 | UK |
| Kivi et al. ^[31] | Comm | Mood | CBT | cau | gsh | 7 | 2 | EU |
| Klein et al. ^[21] | Comm | Mood | CBT | other | grp | 12 | 1 | US |
| Korrelboom et al. ^[33] | Comm | Mood | other | cau | grp | 8 | 3 | EU |
| Krampen ^[34] —aut | Comm | Mood | other | wl | ind | 20 | 1 | EU |
| Krampen ^[34] —ind | Comm | Mood | CBT | wl | ind | 20 | 1 | EU |
| Liu et al. ^[35] | Comm | Mood | CBT | wl | gsh | 4 | 1 | EU |
| Lynch et al. ^[36] | Comm | Cut-off | PST | cau | other | 6 | 1 | US |
| Lynch et al. ^[37] | Comm | Mood | PST | cau | other | 6 | 1 | EU |
| MacPherson et al. ^[38] | Comm | Mood | SUP | cau | ind | 12 | 4 | EU |
| Maina et al. ^[39] —bdt | Comm | Mood | DYN | wl | ind | 20 | 2 | EU |
| Maina et al. ^[39] —bsp | Comm | Mood | SUP | wl | ind | 20 | 2 | EU |
| McKendree-Smith ^[40] —beh | Comm | Mood | CBT | wl | gsh | 8 | 1 | EU |
| McKendree-Smith ^[40] —cogn | Comm | Mood | CBT | wl | gsh | 8 | 1 | EU |
| Miller and Weissman ^[41] | Comm | Mood | IPT | cau | other | 12 | 1 | EU |
| Mohr et al. ^[42] | Comm | Mood | CBT | wl | gsh | 18 | 4 | EU |
| Morris ^[43] | Comm | Mood | CBT | wl | grp | 6 | 1 | Other |
| Mukhtar and Oei ^[44] | Comm | Mood | CBT | wl | grp | 8 | 1 | Other |
| Murphy et al. ^[45] | Comm | Mood | CBT | other | ind | 20 | 1 | US |
| Mynors-Wallis ^[46] | Comm | Mood | PST | other | ind | 6 | 2 | UK |
| Naeem et al. ^[47] | Comm | Mood | CBT | cau | gsh | 7 | 2 | EU |
| Nezu and Perri ^[48] —pf | Comm | Mood | PST | wl | grp | 8 | 1 | US |
| Nezu and Perri ^[48] —pst | Comm | Mood | PST | wl | grp | 8 | 1 | US |
| Nezu ^[49] —apst | Comm | Mood | PST | wl | grp | 10 | 1 | US |
| Nezu ^[49] —pst | Comm | Mood | PST | wl | grp | 10 | 1 | US |
| Omidi et al. ^[50] —cbt | Comm | Mood | CBT | cau | grp | 8 | 1 | EU |
| Omidi et al. ^[50] —mbct | Comm | Mood | MBCT | cau | grp | 8 | 1 | EU |
| Perini et al. ^[51] | Comm | Mood | CBT | wl | gsh | 6 | 2 | Other |
| Pots et al. ^[52] | Comm | Mood | MBCT | wl | grp | 11 | 4 | EU |
| Power and Freeman ^[53] —cbt | Comm | Mood | CBT | cau | ind | 16 | 2 | UK |
| Power and Freeman ^[53] —ipt | Comm | Mood | IPT | cau | ind | 16 | 2 | UK |

| | Recr | Diagn | Type | Control | Format | Nsess | RoB | Countr |
|--|------|---------|-------|---------|--------|-------|-----|--------|
| Propst et al. ^[54] —nrct-nt | Comm | Cut-off | CBT | wl | ind | 19 | 1 | US |
| Propst et al. ^[54] —nrct-rt | Comm | Cut-off | CBT | wl | ind | 19 | 1 | US |
| Propst et al. ^[54] —rct-nt | Comm | Mood | CBT | wl | ind | 19 | 1 | US |
| Propst et al. ^[54] —rct-rt | Comm | Mood | CBT | wl | ind | 19 | 1 | US |
| Rehm et al. ^[55] —sm | Comm | Cut-off | other | wl | grp | 7 | 1 | US |
| Rehm et al. ^[55] —sm+se | Comm | Cut-off | other | wl | grp | 7 | 1 | US |
| Rehm et al. ^[55] —sm+sr | Comm | Cut-off | other | wl | grp | 7 | 1 | US |
| Rohen ^[56] | Comm | Cut-off | CBT | wl | gsh | 4 | 2 | US |
| Ross and Scott ^[57] | Comm | Mood | CBT | wl | other | 12 | 1 | UK |
| Rude ^[58] | Comm | Mood | other | wl | grp | 12 | 1 | US |
| Schmidt and Miller ^[59] —gsh | Comm | Mood | CBT | wl | gsh | 8 | 1 | US |
| Schmidt and Miller ^[59] —ind | Comm | Mood | CBT | wl | ind | 8 | 1 | US |
| Schmidt and Miller ^[59] —lgrp | Comm | Mood | CBT | wl | grp | 8 | 1 | US |
| Schmidt and Miller ^[59] —sgrp | Comm | Mood | CBT | wl | grp | 8 | 1 | US |
| Schmitt ^[60] —pst | Comm | Mood | PST | wl | grp | 12 | 0 | US |
| Schmitt ^[60] —sst | Comm | Mood | other | wl | grp | 12 | 0 | US |
| Schulberg et al. ^[61] | Comm | Mood | IPT | cau | ind | 16 | 2 | US |
| Scott and Stradling ^[64] —cgt | Comm | Mood | CBT | wl | grp | 12 | 2 | UK |
| Scott and Stradling ^[64] —ict | Comm | Mood | CBT | wl | ind | 12 | 2 | UK |
| Scott and Freeman ^[62] —cbt | Comm | Mood | CBT | cau | ind | 16 | 2 | UK |
| Scott and Freeman. ^[62] —sup | Comm | Mood | SUP | cau | ind | 16 | 2 | UK |
| Scott et al. ^[63] | Comm | Mood | CBT | wl | ind | 6 | 1 | UK |
| Selmi et al. ^[65] —ccb | Comm | Mood | CBT | wl | gsh | 6 | 2 | US |
| Selmi et al. ^[65] —icbt | Comm | Mood | CBT | wl | ind | 6 | 2 | US |
| Skinner ^[66] —bat | Comm | Mood | BAT | other | ind | 5 | 1 | US |
| Skinner ^[66] —cbt | Comm | Mood | CBT | other | ind | 5 | 1 | US |
| Smit et al. ^[67] | Clin | Mood | CBT | cau | ind | 14 | 3 | EU |
| Sudweeks ^[68] —cbt | Comm | Mood | CBT | wl | ind | 6 | 1 | EU |
| Sudweeks ^[68] —hypn | Comm | Mood | other | wl | ind | 6 | 1 | EU |
| Sudweeks ^[68] —hypn+cbt | Comm | Mood | CBT | wl | ind | 6 | 1 | EU |
| Teasdale et al. ^[69] | Comm | Mood | CBT | cau | ind | 15 | 1 | EU |
| Titov et al. ^[70] —icbt-techn | Comm | Mood | CBT | wl | gsh | 6 | 2 | Other |
| Titov et al. ^[70] —icbt-ther | Comm | Mood | CBT | wl | gsh | 6 | 2 | Other |
| Vernmark et al. ^[71] —email | Comm | Mood | CBT | wl | gsh | 7 | 4 | EU |
| Vernmark et al. ^[71] —self-h | Comm | Mood | CBT | wl | gsh | 7 | 4 | EU |
| Warmerdam et al. ^[72] —cbt | Comm | Mood | CBT | wl | gsh | 8 | 4 | EU |
| Warmerdam et al. ^[72] —pst | Comm | Cut-off | PST | wl | gsh | 5 | 4 | EU |
| Weissman ^[73] | Comm | Mood | IPT | other | ind | 16 | 1 | EU |
| Wierzbicki and Bartlett ^[74] —grp | Comm | Mood | CBT | wl | grp | 6 | 1 | US |
| Wierzbicki and Bartlett ^[74] —ind | Comm | Mood | CBT | wl | ind | 6 | 1 | US |
| Wilson et al. ^[75] —beh | Comm | Mood | BAT | wl | ind | 8 | 0 | Other |

| | Recr | Diagn | Type | Control | Format | Nsess | RoB | Countr |
|---|------|-------|------|---------|--------|-------|-----|--------|
| Wilson et al. ^[75] —cogn | Comm | Mood | CBT | wl | ind | 8 | 0 | Other |
| Wollersheim and Wilson ^[76] —cop | Comm | Mood | CBT | wl | grp | 10 | 1 | US |
| Wollersheim and Wilson ^[76] —gsh | Comm | Mood | CBT | wl | gsh | 10 | 1 | US |
| Wollersheim and Wilson ^[76] —sup | Comm | Mood | CBT | wl | grp | 10 | 1 | US |
| Wong II ^[77] | Comm | Mood | CBT | wl | grp | 10 | 2 | Other |
| Wright et al. ^[78] —cbt | Comm | Mood | CBT | wl | ind | 9 | 2 | US |
| Wright et al. ^[78] —ccbtt | Comm | Mood | CBT | wl | gsh | 9 | 2 | US |
| Zu et al. ^[79] | Clin | Mood | CBT | cau | ind | 20 | 2 | Other |

BAT, behavioral activation therapy; Cau, care-as-usual; CBT, cognitive behavior therapy; Clin, clinical samples only; Comm, community recruitment; Countr, country; Diagn, diagnosis of depression; DYN, psychodynamic therapy; Grp, group format; Gsh, guided self-help; Ind, individual format; IPT, interpersonal psychotherapy; Mood, mood disorder; Nsess, number of sessions; PST, problem-solving therapy; Recr, recruitment; RoB, risk of bias; wl, waiting list.

Appendix B: References for trials comparing psychological treatments for adult depression and control groups (N = 79)

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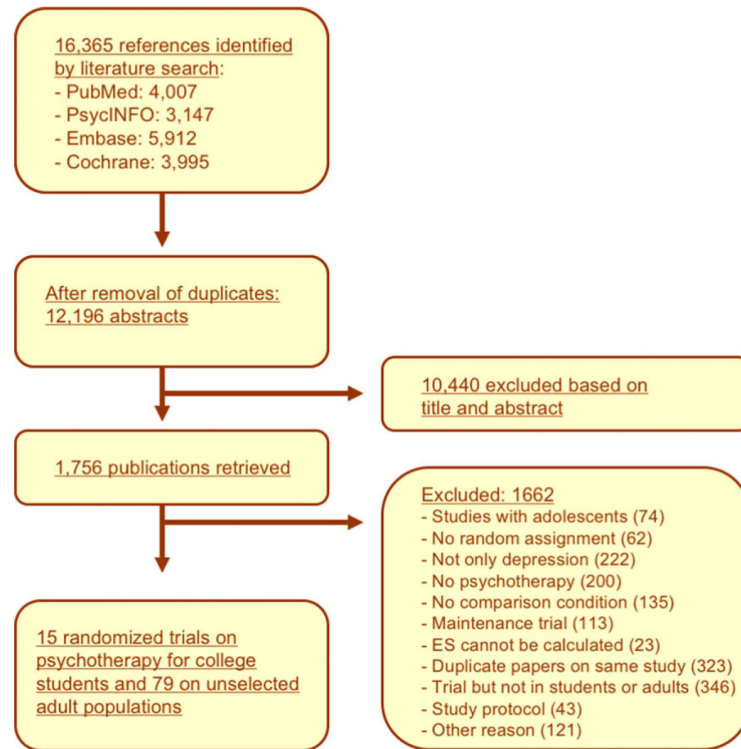


Figure 1.
Flowchart of inclusion of studies.

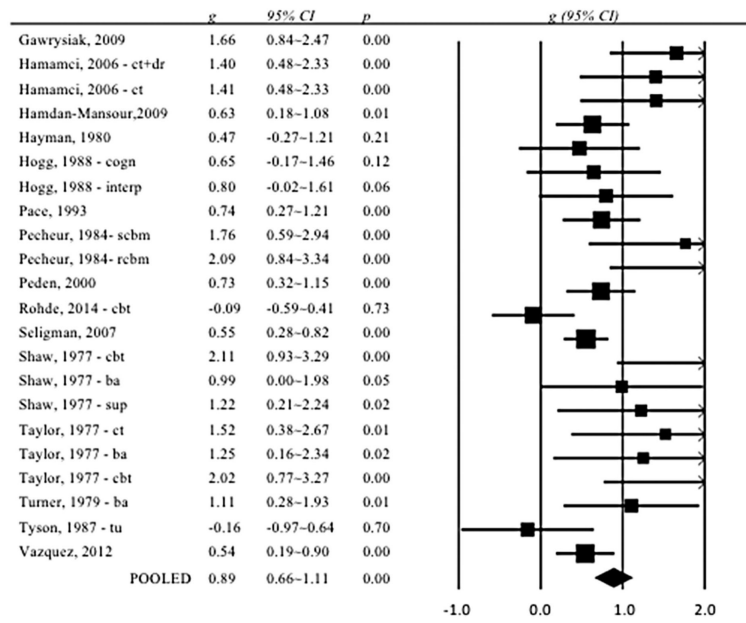


Figure 2. Forest plot of effect sizes of randomized trials comparing psychological treatments for college students with control groups: Hedges' *g*.

TABLE 1
Selected characteristics of studies comparing psychological treatments of depression in college students with control conditions

| Comp | Definition of depression | Conditions | N | Nsess | Form | Rob ^{a)} | Country |
|--------------------------------|---|-------------------------------|--------|-------|------|-------------------|---------|
| Gawrysiak ^[34] | 1 st year Psychology students; screening instrument | BDI-II 14 | 14 | 1 | Ind | ---st+ | USA |
| Hamamci ^[35] | Announcements | BDI 19 | 10 | 11 | Grp | ---st- | Turkey |
| Hamdan-Mansour ^[36] | Announcements | BDI 15 | 44 | 10 | Grp | -+st- | Jordan |
| Hayman ^{[37] b)} | Announcements | BDI 13-30 | 16 | 8 | Grp | +st- | USA |
| Hogg ^[38] | Students seeking treatment at college counseling center | Mood disorder + BDI 14 | 13 | 8 | Grp | ---st- | USA |
| Pacci ^[39] | Undergraduate educational psychology classes | BDI 10-29 | 31 | 7 | Ind | ---st- | USA |
| Pecheur ^[40] | Announcements; Christian students from different years | MDD (RDC) + BDI 15 + HAM-D 20 | 7 | 8 | Ind | ---+ | USA |
| Peden ^[41] | Announcements; All female college students | BDI 16 or CES-D 16 | 46 | 6 | Grp | ---st- | USA |
| Rohde ^[42] | Direct mailings to 1 st /2 nd year students | 2 symptoms, no MDD | 27 | 6 | Grp | +st+ | USA |
| Seligman ^[43] | Mail to all incoming students of one university | BDI 9-24 | 102/25 | 8 | Grp | ---+ | USA |
| Shaw ^[44] | Referral from college health center, or self-referral | BDI 18 | 8 | 8 | Grp | ---st- | USA |
| Taylor ^[45] | Announcements | BDI 13 + D-30 70 | 7 | 6 | Ind | ---st- | Canada |
| Turner ^[46] | Announcements | DAACL T-score 70 | 17 | 5 | Ind | ---st- | USA |
| Tyson ^[47] | Experimental pool of students + announcements | MMPI-d T-score 60 | 11 | 4 | Grp | ---st- | USA |
| Vazquez ^[48] | Announcements | CES-D 16 + no MDD | 65 | 8 | Grp | ---st+ | Spain |
| | | | 61 | | | | |

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^{a)}In this column a positive (+), or negative (-) sign is given for four risk of bias criteria, respectively: allocation sequence; concealment of allocation to conditions; blinding of assessors; and intention-to-treat analyses.

^{b)}In this study 4 of the 26 included subjects were not college students.

\$. compensation by money; BA, behavioral activation; CAU, care as usual; CBT, cognitive behavior therapy; Comp, compensation; CR, compensation by study credits; Form, format; Grp, group; Ind, individual; Interpers, interpersonal; MDD, major depressive disorder; Nness, number of sessions; RoB, risk of bias; Sr, self-report; Ther, therapy.

TABLE 2

Effects of psychological treatments for depressed college students compared with control groups: Hedges' g^a

| | N_{comp} | g | 95% CI | I^2 | 95% CI | P | b | NNT |
|----------------------------|------------|------|------------|-------|--------|-----|-------|------|
| All studies | 22 | 0.89 | 0.66~1.11 | 57 | 23-72 | | | 2.13 |
| Two outliers excluded | 20 | 0.96 | 0.75~1.17 | 42 | 0~65 | | | 1.99 |
| Only BDI | 17 | 1.02 | 0.78~1.26 | 46 | 0~68 | | | 1.89 |
| One ES per study (highest) | 15 | 0.79 | 0.53~1.05 | 64 | 29~78 | | | 2.36 |
| One ES per study (lowest) | 15 | 0.70 | 0.48~0.93 | 53 | 0~73 | | | 2.63 |
| Subgroup analyses | | | | | | | | |
| Compensation | | | | | | | | |
| Yes | 6 | 0.53 | 0.18~0.88 | 71 | 0~85 | | 0.01 | 3.42 |
| No | 16 | 1.08 | 0.81~1.36 | 36 | 0~64 | | | 1.81 |
| Recruitment | | | | | | | | |
| Announcements | 13 | 0.96 | 0.65~1.26 | 52 | 0~73 | | 0.38 | 1.99 |
| Clinical referrals | 5 | 1.07 | 0.53~1.62 | 12 | 0~68 | | | 1.82 |
| Screening | 4 | 0.63 | 0.17~1.08 | 79 | 4~90 | | | 2.91 |
| Mood disorder | 4 | 1.16 | 0.57~1.76 | 44 | 0~80 | | 0.06 | 1.70 |
| Self-report | 16 | 0.95 | 0.69~1.20 | 49 | 0~70 | | | 2.01 |
| Subthreshold | 2 | 0.26 | -0.31~0.82 | 75 | xxx) | | | 6.85 |
| Psychological treatment | | | | | | | | |
| CBT | 14 | 0.88 | 0.61~1.14 | 64 | 25~78 | | 0.19 | 2.15 |
| BA | 4 | 1.27 | 0.69~1.84 | 0 | 0~68 | | | 1.59 |
| Other | 4 | 0.54 | -0.01~1.08 | 40 | 0~79 | | | 3.36 |
| Format | | | | | | | | |
| Group | 14 | 0.66 | 0.43~0.90 | 50 | 0~71 | | 0.003 | 2.78 |
| Individual | 8 | 1.35 | 0.96~1.73 | 27 | 0~67 | | | 1.52 |
| Control group | | | | | | | | |
| Waiting list | 12 | 1.13 | 0.81~1.46 | 30 | 0~64 | | 0.02 | 1.74 |
| Care-as-usual | 6 | 0.90 | 0.55~1.25 | 54 | 0~80 | | | 2.10 |
| Other | 4 | 0.33 | -0.10~0.76 | 66 | 0~86 | | | 5.43 |

* $P < 0.05$,** $P < 0.01$,*** $P < 0.001$.CI, confidence interval; N_{comp} , number of comparisons; NNT, numbers-needed-to-treat.^a According to the random effects model.

The P -values in this column indicate whether the difference between the effect sizes in the subgroups is significant.

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Standardized regression coefficients of characteristics of studies on psychological treatment of depression in college students and unselected adult populations: Multivariate metaregression analyses

TABLE 3

| | Coef. | 95% CI | P |
|---------------------------------------|--------|--------------|-------------|
| Students vs adults in general (dummy) | 0.08 | -0.25~-0.41 | 0.64 |
| Diagnosis | | | |
| • Mood disorder | Ref. | | |
| • Self-report | -0.15 | -0.38~-0.08 | 0.20 |
| • Subthreshold | -0.41 | -1.01~-0.18 | 0.17 |
| Type of treatment | | | |
| • CBT | Ref. | | |
| • BAT | 0.43 | -0.01~-0.87 | 0.06 |
| • Other | 0.04 | -0.17~-0.25 | 0.71 |
| Format | | | |
| • Individual | Ref. | | |
| • Group | -0.05 | -0.30~-0.20 | 0.68 |
| • Guided self-help | -0.20 | -0.52~-0.11 | 0.20 |
| Number of sessions (continuous) | -0.02 | -0.05~-0.01 | 0.16 |
| Control group | | | |
| • Waiting list | Ref. | | |
| • Care-as-usual | -0.34 | -0.61~-0.07 | <u>0.01</u> |
| • Other | -0.39 | -0.67~-0.11 | <u>0.01</u> |
| Risk of bias (continuous) | -0.21 | -0.32~-0.10 | <u>0.00</u> |
| Publication year (continuous) | 0.01 | 0.00~-0.03 | <u>0.02</u> |
| Intercept | -27.95 | -52.15~-3.75 | <u>0.02</u> |