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INTERVENTIONS

Articles testing the applied science and implementation of mindfulness-based interventions

Beblo, T., Pelster, S., Schilling, C.,...Fernando, S. (2017). **Breath versus emotions: The impact of different foci of attention during mindfulness meditation on the experience of negative and positive emotions.** *Behavior Therapy.* [\[link\]](#)

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Harvard School of Public Health (D. Eisenberg, PI). **2018 research day on teaching kitchens and self-care practices.** NIH/NCCIH project #1R13AT009822. [link]

Michigan State University (H. Brophy-Herb, PI). **Trajectories of teacher stress: The roles of coping and prior exposure to trauma.** NIH/NICHHD project #1R21HD090406. [link]

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HIGHLIGHTS

A summary of select studies from the issue, providing a snapshot of some of the latest research

College life is accompanied by many stresses, but few exceed the stress of final exams week—a period of intensive “cramming,” all night study sessions, and fearful anticipation of final grades. It comes as no surprise that approximately half of all college students report a significant degree of test anxiety. Galante et al. [*Lancet Public Health*] studied whether an eight-week mindfulness skills program might reduce students’ acute exam-related distress levels during final exams week.

The researchers randomly assigned 616 undergraduate and graduate students at Cambridge College, UK (62% female; 66% White; 92% age 17-30 years) to either an 8-week Mindfulness Skills for Students (MSS) program, or mental health support-as-usual group. Participants were prescreened to rule out severe mental health symptoms. The MSS program consisted of eight 75-90 minute group sessions that included mindfulness meditation, periods of reflection and inquiry, and interactive exercises. MSS participants were encouraged to engage in 8-25 minutes of home practice daily. Mental health support-as-usual consisted of access-as-needed to university counseling services and the National Health Service. No mental health services were offered to the support-as-usual group participants unless they actively sought help from these services on their own.

All participants were asked to complete a self-report distress measure and a wellness measure at post-intervention and again during final exams week. Following the completion of outcome measures, participants were offered monetary vouchers (\$4.50 at post-intervention and \$7.50 during exams week) that they could either pocket or contribute to charity. If MSS participants missed a session, they were contacted to discover whether they experienced any adverse consequences from

participation in the intervention.

Fifty-one percent (51%) of MSS participants attended at least half of the MSS sessions, and 74% of study participants completed their exam period questionnaires. Results were analyzed for all participants, whether or not they attended all the MSS sessions.



The results showed that MSS participants had significantly lower distress levels (moderate effect size) at post-intervention and during exams week. More support-as-usual group participants (57%) reported distress levels within the clinically significant range than did MSS participants (37%)—a one-third relative reduction in risk for MSS participants. MSS participants were significantly less likely to report problems affecting their academic study or university experience than control participants. MSS participants also reported significantly higher well-being levels at both post-intervention and during exam week. Finally, MSS participants were significantly more likely to donate their monetary vouchers to charity. Only one participant reported an adverse effect, feeling that MSS brought unwanted matters to the fore. The report omitted whether the adverse effect was mild or severe.

This is the largest randomized controlled study of mindfulness in a college population to date. It demonstrates that a mindfulness intervention can help reduce distress levels in college students during a stressful exam week, as well as increase altruistic action in the form of donating to charity. As the support-as-usual group was neither an active treatment nor a placebo control, the study cannot prove the superiority of mindfulness over other stress reduction programs. For the same reasons, the positive outcomes experienced by MSS participants cannot be specifically linked to mindfulness training, as they may be due to other factors such as group support or raised expectancies.

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One of the biggest difficulties in treating recurrent major depressive disorder (MDD) is that most people with recurrent MDD experience a relapse within two years following recovery from symptoms. Three treatments appear to have some success at limiting the two-year relapse rate to 30-40%: Antidepressant Medication Maintenance Therapy, Cognitive Therapy (CT), and Mindfulness-Based Cognitive Therapy (MBCT).

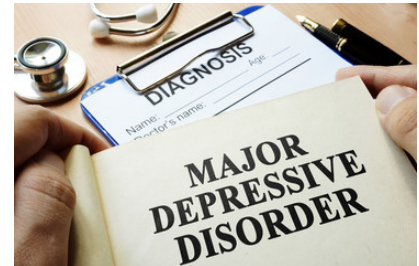
MBCT and CT attempt to reduce the risk of relapse by promoting different skill sets. CT promotes challenging dysfunctional thinking and increasing physical activity level. MBCT promotes nonjudgmental monitoring of moment-by-moment experience, and decentering from thoughts or seeing thoughts as transient mental phenomena and not necessarily valid. **Farb et al. [Journal of Consulting and Clinical Psychology]** conducted the first randomized controlled head-to-head comparison of CT and MBCT for relapse prevention in MDD.

The researchers randomly assigned 166 people with MDD (average age = 40 years, 2/3 female; average of 4 past MDD episodes) currently in remission to either a MBCT or CT group. Assessments of diagnosis and symptoms were done through a combined structured clinical interview and a self-report questionnaire. MDD symptoms were assessed bimonthly through an initial brief questionnaire. If the initial questionnaire suggested relapse, it was followed-up with another questionnaire and a structured clinical phone interview. A research psychiatrist confirmed all relapse diagnoses. In addition, participants completed questionnaires measuring decentering and dysfunctional beliefs every three months.

CT was delivered in 8 weekly 2-hour sessions that stressed goal setting, self-monitoring, maintaining thought records, and cognitive restructuring during its initial sessions, and lifestyle modification, environmental mastery, life purpose, self-acceptance, and optimizing interpersonal relationships in later sessions.

MBCT was delivered in 8 weekly 2-hour sessions with an additional retreat day. It

emphasized mindfulness meditation, disengaging from habitual ruminative processes, awareness of everyday activities, and regulating negative emotions through approach and curiosity rather than avoidance.



Two-year participant retention rates were 60% for MBCT and 56% for CT. Treatment fidelity ratings were good for both CT and MBCT. Two-year relapse rates were not significantly different for the MBCT (22%) and CT (21%) groups, nor was there any difference in the time elapsed until relapse between groups.

Participants showed a significant linear increase in decentering over time, regardless of therapy group. Those who relapsed had significantly lower decentering levels than those who remained in remission. Dysfunctional beliefs declined significantly for the CT group only, but there was no relationship between the change in dysfunctional beliefs and the risk of relapse.

The results show that MBCT and CT are equally effective in reducing the risk of relapse in people with MDD. Despite differences in curriculum, both therapies seem to achieve their effect by strengthening the metacognitive skill of decentering.

The fact that both treatments appear to be equally beneficial is good news. People with MDD can opt for the treatment that is most consistent with their personal beliefs without needing to worry about receiving an inferior treatment. It is important to note, however, that the patients in this study tended to be White and highly educated. It is unclear how well these results might generalize to other populations.

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Minami, H., Brinkman, H. R., Nahvi, S.,...Donnelly, R. (2017). **Rationale, design and pilot feasibility results of a smartphone-assisted, mindfulness-based intervention for smokers with mood disorders: Project msmart MIND.** *Contemporary Clinical Trials.* [link]

Weekly, T., Walker, N., Beck, J.,...Weaver, M. (2018). **A review of apps for calming, relaxation, and mindfulness interventions for pediatric palliative care patients.** *Children.* [link]

Wong, K. F., Massar, S. A., Chee, M. W., Lim, J. (2018). **Towards an objective measure of mindfulness: Replicating and extending the features of the breath-counting task.** *Mindfulness.* [link]

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Articles developing empirical procedures to advance the measurement and methodology of mindfulness

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REVIEWS

Articles reviewing content areas of mindfulness or
conducting meta-analyses of published research

Alexander, K. (2017). **Integrative review of the relationship between mindfulness-based parenting interventions and depression symptoms in parents.** *Journal of Obstetric, Gynecologic, and Neonatal Nursing.* [link]

Janssen, M., Heerkens, Y., Kuijer, W.,...Engels, J. (2018). **Effects of MBSR on employees' mental health: A systematic review.** *PLoS ONE.* [link]

Khng, K. H. (2018). **Mindfulness in education: The case of Singapore.** *Learning: Research and Practice.* [link]

Paulson, J., Kretz, L. (2018). **Exploring the potential contributions of mindfulness and compassion-based practices for enhancing the teaching of undergraduate ethics courses in philosophy.** *The Social Science Journal.* [link]

Thomas, K. H., McDaniel, J. T., Diehr, A. J., Hunter, K. (2018). **Mindful living with human immunodeficiency virus and AIDS: Behavioral medicine for patient resilience and improved screening practices.** *Nursing Clinics of North America.* [link]

Wamsler, C. (2018). **Mind the gap: The role of mindfulness in adapting to increasing risk and climate change.** *Sustainability Science.* [link]

Wang, Y. Y., Li, X. H., Zheng, W.,...Xiang, Y. T. (2018). **Mindfulness-based interventions for major depressive disorder: A comprehensive meta-analysis of RCTs.** *Journal of Affective Disorders.* [link]

Zou, L., Yeung, A., Quan, X.,...Wang, H. (2018). **A systematic review and meta-analysis of mindfulness-based (baduanjin) exercise for alleviating musculoskeletal pain and improving sleep quality in people with chronic diseases.** *International Journal of Environmental Research and Public Health.* [link]

TRIALS

Research studies newly funded by the National
Institutes of Health (JAN 2018)

Beth Israel Medical Center (G. Yeh, PI). **Coupling technology with mind-body exercise to facilitate physical activity in patients with chronic cardiopulmonary disease.** NIH/NCCIH project # 5R34AT009354-02. [link]

Central New York Research Corporation (K. Possemato, PI). **Primary care based mindfulness training for veterans with PTSD.** NIH/NCCIH project #1R34AT009678-01. [link]

Northwestern University at Chicago (B. Yanez, PI). **Mindfulness-based health intervention to improve medication adherence among breast cancer survivors.** NIH/NCCIH project #1R34AT009447-01A1. [link]

University of California, San Francisco (H. Weng, PI). **Optimizing measurement of mindfulness meditation using brain pattern classification.** NIH/NCCIH project #5K08AT009385-02. [link]

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HIGHLIGHTS

A summary of select studies from the issue, providing a snapshot of some of the latest research

While people generally regard helpfulness and friendliness to be virtues, they often fail to extend their empathy to strangers in need. **Berry et al. [Journal of Experimental Psychology]** conducted a series of four experiments to see whether mindfulness—as an individual’s disposition and as an induced mental state—increases prosocial behavior towards an excluded stranger by increasing empathic concern.

In the first study, 82 undergraduates (52% female, 58% Caucasian) completed the Mindful Attention Awareness Scale (MAAS) and the Act with Awareness subscale of the Five Facet Mindfulness Questionnaire (FFMQ). Participants then watched a Cyberball computer game involving three computer-generated characters playing catch. Participants were misled into believing that the computer-generated characters represented three live participants playing the game in other rooms. During the observed game, two characters excluded the third character by passing the ball only between themselves.

After watching the game, participants were assessed for empathic concern and distress, and asked to write emails to each of the players. Empathic concern is the desire to help others, whereas empathic distress often leads to focusing on relieving one’s own distress rather than helping others. Participants then played a game of Cyberball together with the other characters. The researchers rated the helpfulness of the emails written to the excluded character, and counted how often the participant threw the ball to the excluded character. The study found that higher mindfulness was significantly associated with higher empathic concern (but not empathic distress), more helpful emails, and a greater number of ball throws to the excluded character.

In the second study, 83 undergraduates (68% female, 44% Caucasian) completed the same personality measures and followed the same Cyberball protocol as in the first study. Before playing Cyberball, participants were randomly assigned to listen to audio-recorded instructions for either a brief (8.5 minute) mindfulness or attention-based training. The mindfulness training focused participants on moment-to-moment somatic, cognitive, and affective experiencing. The attention-based training centered on the importance of focusing on goals. The results showed that mindfulness trainees had significantly higher levels of empathic concern than attention-focused trainees, and the same level of empathic distress. Mindfulness trainees sent significantly more helpful emails and threw the ball significantly more often to the excluded character.



In the third study with 146 undergraduates (76% female, 40% Caucasian), a “no instruction” control group was added to the design of the second study, along with a measure of empathic anger. As in the second study, mindfulness training significantly increased empathic concern, email helpfulness, and ball throwing to the excluded character relative to both the attention-based and “no instruction” conditions. The groups didn’t significantly differ in empathic distress or empathic anger.

The fourth study randomly assigned 131 undergraduates (69% female, 44% Caucasian) to either mindfulness training, progressive muscle relaxation training, or a “no instructions” control prior to watching and playing Cyberball. A self-report measure of concentration was taken after observing the Cyberball game. Mindfulness significantly increased empathic concern, email helping, and ball throws to the excluded character relative to the muscle relaxation and no instruction controls. The groups didn’t differ in concentration, so all the groups were equally attentive to the experimental tasks.

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In a statistical analysis of combined study results, mindfulness training yielded moderate effect sizes for empathic concern ($g=.54$), email helping ($g=.67$) and ball throwing ($g=.62$). Dispositional mindfulness effects were small ($g=.14-.32$).

Consistent findings from these repeated studies show that mindfulness training and a mindful disposition increase prosocial behavior to an excluded stranger. They also demonstrate that mindfulness does this by increasing empathic concern and not by increasing empathic distress, empathic anger, concentration, or relaxation. The study is limited by the degree to which computer-based Cyberball findings can be generalized to real-life contexts. However, they may have a direct relevance to social media phenomena such as on-line social exclusion and bullying.

Event-related potentials (ERPs) are segments of brain waves occurring in response to stimuli. For example, when people with depression are shown happy faces, the amplitude of their ERPs 300 milliseconds later (the so-called "P3b" ERP) is smaller than in non-depressed people. Since mindfulness encourages openness to emotions, mindfulness may enhance P3b responding to emotional stimuli and perhaps play a role in reducing or preventing depressive symptoms.

In a pioneering study of adolescent brain function and school mindfulness programs, **Sanger et al. [Developmental Science]** tested whether a high school mindfulness-training program could affect the size of healthy students' P3b responses to happy and sad faces, and whether it improved their wellbeing relative to a control group.

The researchers assigned 40 students (16-18 years old) to mindfulness training or a waitlist control. Assignment was not random. Volunteers from two secondary schools were assigned to mindfulness training, and volunteers from two other secondary schools were assigned to the waitlist control. Control volunteers were slightly older and more likely to be male.

Participants completed the Five Facet Mindfulness Questionnaire (FFMQ) along with measures of stress, wellbeing, and empathy,

both before and after training. Schoolteachers taught the mindfulness practices in eight 50-minute classes. Curriculum topics included "Taming the Animal Mind," "Being Here and Now," "Moving Mindfully," and "Befriending the Difficult." Before and after training, students were shown pictures of faces with varying expressions while an EEG measured their P3bs. Most of the faces shown were neutral, but 20% were happy or sad. Participants were instructed to press a space bar whenever they saw a happy or sad face.



Mindfulness levels did not increase over time, nor did they differ between the mindfulness trainees and controls. Wellbeing improved significantly for the mindfulness group and decreased marginally for waitlist controls, a difference between groups that was marginally significant ($\eta^2=.06$). The mindfulness group was less empathic than the controls both before and after training. Within the mindfulness group, empathy correlated significantly with class attendance ($r=.66$) and marginally with home practice ($r=.49$). Control group ERP magnitudes decreased from pre- to post-testing, but the mindfulness group's ERP magnitudes stayed the same ($\eta^2=.12$). The magnitude of ERP change scores in response to happy and sad faces correlated positively with pre- to post changes in empathy scores (happy faces $r=.37$; sad faces $r=.33$).

The results demonstrate that adolescents in a school-based mindfulness program show less habituation in their P3b responses to emotional cues. Mindfulness training seems to prevent a diminished response to happy and sad faces over time. It's often said that mindfulness helps one to "keep things fresh" and not assume there's no new information in repeated stimuli, and this may be an example of that. Changes in P3b magnitudes varied with changes in empathy, suggesting that decreased habituation may be due to an increased attentiveness to socially relevant emotional cues. The study is limited by its lack of randomization and an active control group.



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INTERVENTIONS

Articles testing the applied science and implementation of mindfulness-based interventions

Baranski, M. F., Was, C. A. (2018). **A more rigorous examination of the effects of mindfulness meditation on working memory capacity.** *Journal of Cognitive Enhancement.* [\[link\]](#)

Bartel, K., Huang, C., Maddock, B.,...Gradisar, M. (2018). **Brief school-based interventions to assist adolescents' sleep-onset latency: Comparing mindfulness and constructive worry versus controls.** *J Sleep Research.* [\[link\]](#)

Bennett, R. I., Egan, H., Cook, A., Mantzios, M. (2018). **Mindfulness as an intervention for recalling information from a lecture as a measure of academic performance in higher education: A randomized experiment.** *Higher Education for the Future.* [\[link\]](#)

Brito-Pons, G., Campos, D., Cebolla, A. (2018). **Implicit or explicit compassion? Effects of compassion cultivation training and comparison with MBSR.** *Mindfulness.* [\[link\]](#)

Ergas, O., Hadar, L. L., Albelda, N., Levit-Binnun, N. (2018). **Contemplative neuroscience as a gateway to mindfulness: Findings from an educationally framed teacher learning program.** *Mindfulness.* [\[link\]](#)

Fahmy, R., Wasfi, M., Mamdouh, R.,...Sambataro, F. (2018). **MBIs modulate structural network strength in patients with opioid dependence.** *Addictive Behaviors.* [\[link\]](#)

Farver-Vestergaard, I., O'Toole, M. S., O'Connor, M.,...Zachariae, R. (2018). **MBCT in COPD: A cluster RCT.** *European Respiratory Journal.* [\[link\]](#)

Garner, P. W., Bender, S. L., Fedor, M. (2018). **Mindfulness-based SEL programming to increase preservice teachers' mindfulness and emotional competence.** *Psychol in Schools.* [\[link\]](#)

Gilmartin, H., Saint, S., Rogers, M.,...Chopra, V. (2018). **Pilot RCT to improve hand hygiene through mindful moments.** *BMJ Qual Saf.* [\[link\]](#)

Hong, P. Y., Hanson, M. D., Lishner, D. A.,...Steinert, S. W. (2018). **A field experiment examining mindfulness on eating enjoyment and behavior in children.** *Mindfulness.* [\[link\]](#)

Horan, K. A., Taylor, M. B. (2018). **Mindfulness and self-compassion as tools in health behavior change: An evaluation of a workplace intervention pilot study.** *Journal of Contextual Behavioral Science.* [\[link\]](#)

Kersemaekers, W., Rupperecht, S., Wittmann, M.,...Kohls, N. (2018). **A workplace mindfulness intervention may be associated with improved psychological well-being and productivity. A preliminary field study in a company setting.** *Frontiers in Psychology.* [\[link\]](#)

Klassen-Bolding, S. (2018). **A qualitative investigation of preteen girls' experiences in a mindfulness-based eating disorder prevention program.** *Counseling Outcome Research Eval.* [\[link\]](#)

Laraia, B. A., Adler, N. E., Coleman-Phox, K.,...Epel, E. (2018). **Novel interventions to reduce stress and overeating in overweight pregnant women: A feasibility study.** *Maternal and Child Health Journal.* [\[link\]](#)

Lymeus, F., Lindberg, P., Hartig, T. (2018). **Building mindfulness bottom-up: Meditation in natural settings supports open monitoring and attention restoration.** *Consciousness and Cognition.* [\[link\]](#)

Lynch, S., Gander, M. L., Nahar, A.,...Walach, H. (2018). **Mindfulness-based coping with university life: A randomized wait-list controlled study.** *SAGE Open.* [\[link\]](#)

Ong, J. C., Xia, Y., Smith-Mason, C. E., Manber, R. (2018). **A RCT of mindfulness meditation for chronic insomnia: Effects on daytime symptoms and cognitive-emotional arousal.** *Mindfulness.* [\[link\]](#)

Pearson, S., Wills, K., Woods, M., Warnecke, E. (2018). **Effects of mindfulness on psychological**

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Mindfulness. [\[link\]](#)

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Townshend, K., Caltabiano, N. J., Powrie, R., O'Grady, H. (2018). **A preliminary study investigating the effectiveness of the caring for body and mind in pregnancy (CBMP) in reducing perinatal depression, anxiety and stress.** *Journal of Child and Family Studies.* [\[link\]](#)

Wong, K. F., Teng, J., Chee, M. W.,...Lim, J. (2018). **Positive effects of mindfulness-based training on energy maintenance and the EEG correlates of sustained attention in a cohort of nurses.** *Frontiers Human Neuroscience.* [\[link\]](#)

Yang, E., Chamber, E., Meyer, R. M., Gold, J. I. (2018). **Happier healers: RCT of mobile mindfulness for stress management.** *Journal of Alternative and Complementary Medicine.* [\[link\]](#)

Zelazo, P. D., Carlson, S. M., Masten, A. S., Forston, J. (2018). **Mindfulness plus reflection training: Effects on executive function in early childhood.** *Frontiers in Psychology.* [\[link\]](#)

ASSOCIATIONS

Articles examining the correlates and mechanisms of mindfulness

Aalders, J., Hartman, E., Neefs, G.,...Pouwer, F. (2018). **Mindfulness and fear of hypoglycaemia in parents of children with type 1 diabetes: Results from diabetes MILES youth – the Netherlands.** *Diabetic Medicine.* [\[link\]](#)

Agnoli, S., Vanucci, M., Pelagatti, C., Corazza, G. E. (2018). **Exploring the link between mind wandering, mindfulness, and creativity: A multidimensional approach.** *Creativity Research Journal.* [\[link\]](#)

Annameier, S. K., Kelly, N. R., Courville, A. B.,...Shomaker, L. B. (2018). **Mindfulness and laboratory eating behavior in adolescent girls at risk for type 2 diabetes.** *Appetite.* [\[link\]](#)

Beshai, S., Parmar, P. (2018). **Trait mindfulness may buffer against the deleterious effects of childhood abuse in recurrent depression: A retrospective exploratory study.** *Clinical Psychologist.* [\[link\]](#)

Chan, K. K., Lee, C. W., Mak, W. W. (2018). **Mindfulness model of stigma resistance among individuals with psychiatric disorders.** *Mindfulness.* [\[link\]](#)

Conley, S. L., Faleer, H. E., Raza, G. T.,...Wu, K. D. (2018). **The moderating effects of rumination facets on the relationship between mindfulness and distress reduction.** *Cognitive Therapy and Research.* [\[link\]](#)

Droit-Volet, S., Chaulet, M., Dambrun, M. (2018). **Time and meditation: When does the perception of time change with mindfulness exercise?** *Mindfulness.* [\[link\]](#)

Dummel, S. (2018). **Relating mindfulness to attitudinal ambivalence through self-concept clarity.** *Mindfulness.* [\[link\]](#)

Greenfield, B. L., Roos, C., Hagler, K. J.,...Witkiewitz, K. A. (2018). **Race/ethnicity and racial group**

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Greeson, J. M., Zarrin, H., Smoski, M. J.,...Wolever, R. Q. (2018). **Mindfulness meditation targets transdiagnostic symptoms implicated in stress-related disorders: Understanding relationships between changes in mindfulness, sleep quality, and physical symptoms.** *E-CAM.* [\[link\]](#)

Guyot, E., Baudry, J., Hercberg, S.,...Péneau, S. (2018). **Mindfulness is associated with the metabolic syndrome among individuals with a depressive symptomatology.** *Nutrients.* [\[link\]](#)

Hicks, L. M., Dayton, C. J., Brown, S.,...Raveau, H. (2018). **Mindfulness moderates depression and quality of prenatal attachment in expectant parents.** *Mindfulness.* [\[link\]](#)

Khaddouma, A., Gordon, K. C. (2018). **Mindfulness and young adult dating relationship stability: A longitudinal path analysis.** *Mindfulness.* [\[link\]](#)

Kiken, L. G., Shook, N. J., Robins, J. L., Clore, J. N. (2018). **Association between mindfulness and interoceptive accuracy in patients with diabetes: Preliminary evidence from blood glucose estimates.** *Complementary Therapies in Medicine.* [\[link\]](#)

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Xue, T., Li, H., Wang, M.,...Cui, D. (2018). **Mindfulness meditation improves metabolic profiles in healthy and depressive participants.** *CNS Neuro & Therapeutics.* [\[link\]](#)

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Lo, H. H., Yeung, J. W., Duncan, L. G.,...Ng, S. M. (2018). **Validating of the interpersonal mindfulness in parenting scale in Hong Kong Chinese.** *Mindfulness.* [link]

Medvedev, O. N., Bergomi, C., Röthlin, P., Krägeloh, C. U. (2018). **Assessing the psychometric properties of the comprehensive inventory of mindfulness experiences (CHIME) using rasch analysis.** *European Journal Psychological Assessment.* [link]

Sinatra, E., Black, D. S. (2018). **MBIs for cancer survivors: What do we know about the assessment of quality of life outcomes?** *Expert Review Quality of Life Cancer Care.* [link]

Westenberg, R. F., Zale, E. L., Heinhuis, T. J.,...Vranceanu, A. M. (2018). **Does a brief mindfulness exercise improve outcomes in upper extremity patients? A RCT.** *Clinical Orthopaedics and Related Research.* [link]

REVIEWS

Articles reviewing content areas of mindfulness or conducting meta-analyses of published research

Dunn, C., Haubenreiser, M., Johnson, M.,...Thomas, C. (2018). **Mindfulness approaches and weight loss, weight maintenance, and weight regain.** *Current Obesity Reports.* [link]

Falcone, G., Jerram, M. (2018). **Brain activity in mindfulness depends on experience: A meta-analysis of fMRI studies.** *Mindfulness.* [link]

Hedman-Lagerlöf, M., Hedman-Lagerlöf, E., Öst, L.-G. (2018). **The empirical support for MBIs for common psychiatric disorders: A systematic review and meta-analysis.** *Psychol Med.* [link]

Horesh, D., Gordon, I. (2018). **Mindfulness-based therapy for traumatized adolescents: An under-utilized, under-studied intervention.** *Journal of Loss and Trauma.* [link]

Martin, M. (2018). **Mindfulness and transformation in a college classroom.** *Adult Learning.* [link]

Newton, T. L., Ohrt, J. H. (2018). **Infusing MBIs in support groups for grieving college students.** *Journal for Specialists in Group Work.* [link]

Potes, A., Souza, G., Nikolitch, K.,...Rej, S. (2018). **Mindfulness in severe and persistent mental illness: A systematic review.** *International Journal of Psychiatry in Clinical Practice.* [link]

Russell-Williams, J., Jaroudi, W., Perich, T.,...Moustafa, A. A. (2018). **Mindfulness and meditation: Treating cognitive impairment and reducing stress in dementia.** *Rev in Neuro.* [link]

Santiago, P. H., Colussi, C. F. (2018). **Feasibility evaluation of a MBI for primary care professionals: Proposal of an evaluative model.** *Complementary Therapies in Clinical Practice.* [link]

Shaw, J., Sekelja, N., Frasca, D.,...Price, M. A. (2018). **Being mindful of MBIs in cancer: A systematic review of intervention reporting and study methodology.** *Psycho-oncology.* [link]

Simpson, S., Mercer, S., Simpson, R.,...Wyke, S. (2018). **MBIs for young offenders: A scoping review.** *Mindfulness.* [link]

Wong, S. Y., Chan, J. Y., Zhang, D.,...Tsoi, K. K. (2018). **The safety of MBIs: A systematic review of RCTs.** *Mindfulness.* [link]

TRIALS

Research studies newly funded by the National Institutes of Health (FEB 2018)

Michigan Technological University (J. Durocher, PI). **Mindfulness and neural cardiovascular control in humans.** NIH/NHLBI project #1R15AT009789-01. [link]

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A summary of select studies from the issue, providing a snapshot of some of the latest research

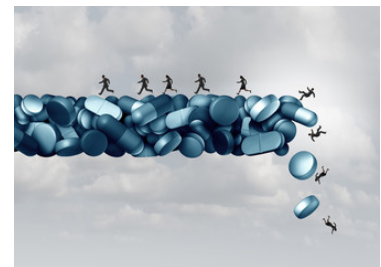
The United States is in the midst of an opioid epidemic, with over 42,000 opioid overdose related deaths in 2016. There is a clear need for innovative approaches to help deal with the problems of substance dependency and misuse. Mindfulness-based interventions are sometimes used as adjunctive treatments for substance use disorders, but little is known about how these interventions affect the brains of substance users. **Fahmy et al. [Addictive Behaviors]** used structural magnetic resonance imaging (MRI) to investigate brain changes in opiate dependent patients undergoing either treatment-as-usual (TAU), or treatment-as-usual plus Mindfulness-Based Stress Reduction (MBSR).

MRI data were analyzed to identify structural changes in the cellular networks connecting brain regions. The researchers limited their investigation to regions previously shown to be of interest in addiction and mindfulness research. They also looked at whether structural brain network changes were accompanied by meaningful changes in personality traits relevant to recovery and relapse. The study followed 28 opiate dependent patients (average age = 30 years; 89% male) in a four-week inpatient substance treatment program in Cairo, Egypt. Half the participants were assigned to treatment as usual (TAU) and half to MBSR. Assignment was based on order of enrollment in the study and was not strictly random.

Nineteen participants completed their treatments and post-treatment evaluations. There was no difference in treatment dropout rates. TAU included medication and group cognitive behavioral therapy. The MBSR program was a culturally adopted Arabic-language version of MBSR. Participants completed the Freiburg Mindfulness Inventory (FMI), self-reported measures of distress tolerance, sensation seeking, impulsivity, and

addiction severity, and underwent MRI scanning before and after treatment.

MBSR participants showed significant strengthening in the brain networks connecting the prefrontal cortex with the anterior cingulate cortex (prefrontal-cingulate network) and the bilateral insular region with the bilateral striatal region (striatal-insular network). These structural changes did not occur in the TAU group. Additionally, the greater the degree of prefrontal-cingulate network strengthening, the greater the decrease in the use of impulsive behavior as a strategy to decrease unpleasant emotional states ($r=.74$; a large effect).



Self-reported mindfulness scores on the FRI improved significantly over time for both groups (average TAU increase = 5 points; average MBSR increase = 8 points), as did measures of distress tolerance. MBSR participants' tendency to resort to impulsive behavior to distract from unpleasant emotions declined significantly over time, whereas a similar trend within the TAU group did not reach significance. The difference in impulsivity change rates between groups was not significant.

The study demonstrates that four weeks of MBSR can strengthen brain networks associated with executive control and interoceptive awareness in patients with opiate dependence. There was a strong association between strengthening the prefrontal-cingulate network and decreasing impulsivity. This makes intuitive sense given that the prefrontal cortex and cingulate cortex are associated with controlling attention, reducing distraction and inhibiting impulsive responding. These are all important functions in resisting temptation and preventing relapse. The finding that MBSR also strengthens the striatal-insular network is important because decreased striatal and insular volumes have been previously noted in patients with alcohol dependence. The study is limited by its lack of randomization, small sample size, and lack of statistical correction for multiple comparisons.

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Chronic Obstructive Respiratory Disease (COPD) is an incurable progressive inflammatory lung disease that restricts airway flow and causes shortness of breath, wheezing, excessive mucus production, and coughing. The disease afflicts 16 million Americans and 65 million people worldwide. Treatment commonly includes smoking cessation, exercise, bronchodilator inhalers, anti-inflammatory medications, and supplementary oxygen. About one third of COPD patients report symptoms of anxiety and/or depression that are linked to poorer health and quality of life outcomes.

Farver-Vestergaard et al. [European Respiratory Journal] investigated whether Mindfulness-Based Cognitive Therapy (MBCT) could provide additional psychological, health, and quality of life benefits when provided in conjunction with standard pulmonary rehabilitation (PR).

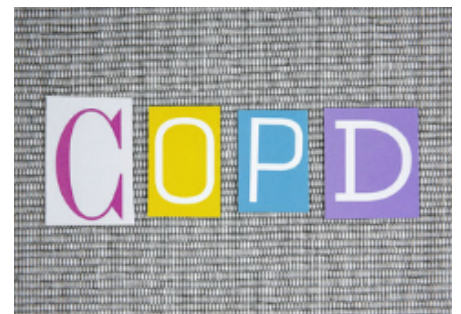
The researchers randomly assigned 84 Danish COPD patients (average age = 67 years; 57% female) to PR alone or PR plus MBCT. PR was delivered in 2 weekly sessions over an 8-week period and consisted of exercise in combination with disease and lifestyle education. The add-on MBCT program consisted of 8 weekly 105-minute group sessions. MBCT meditations were modified to focus on the sensations of heartbeat, blood flow, and contact of the feet with the floor rather than on the breath. Meditations were shortened, cognitive exercises simplified, and the full-day retreat eliminated.

Participants were assessed on anxiety, depression, COPD health status impairment, mindfulness (the Five Facet Mindfulness Questionnaire), self-compassion, COPD self-efficacy, and breathlessness-related catastrophizing at five time points: before treatment, mid-treatment, after treatment, and at 3- and 6-month follow-up.

Pre- and post-treatment measures were taken of activity level (using an accelerometer, a Fitbit-like device for measuring movement), and pre- and post-treatment blood samples were drawn to measure blood inflammatory factors including tumor necrosis factor alpha (TNF- α), and a variety of interleukins (IL-6, IL-8, and IL17E).

The results show that depression scores declined significantly for the MBCT group, but not for the PR group (Cohen's $d=0.51$). This improvement in depressive symptoms was sustained at 3-month and 6-month follow-up. Anxiety scores were unaffected in both groups. There was a trend toward improved COPD health status for MBCT participants, but not the PR participants (Cohen's $d=0.42$, $p=.06$).

TNF- α levels increased significantly for the PR group, but not for the MBCT group. There were no significant effects on interleukins or activity level. An examination of moderating and meditating variables showed that younger COPD patients benefited significantly more from MBCT (Cohen's $d=0.38$), and that improvements in self-compassion temporally preceded improvements in depressive symptoms.



The study demonstrates that MBCT can significantly decrease depressive symptoms in COPD patients beyond that of conventional pulmonary rehabilitation. MBCT's marginally positive effect on COPD illness impairment status and the lack of TNF- α increase for MBCT participants points to potential health benefits. The finding in regard to TNF- α is important since TNF- α plays a pro-inflammatory role in COPD.

The study's low initial enrollment rate and fairly large attrition rate (at 6-month follow-up, 36% of the MBCT group and 27% of PR group failed to complete assessments) led to a smaller sample size than intended, reducing the study's power to detect potentially significant differences. The study is also limited by the absence of a placebo or active psychosocial control, and its reliance on blood rather than bronchoalveolar lavage samples to detect interleukin levels.

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INTERVENTIONS

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METHODS

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Economides, M., Martman, J., Bell, M. J., Sanderson, B. (2018). **Improvements in stress, affect, and irritability following brief use of a mindfulness-based smartphone app: A RCT.** *Mindfulness.* [link]

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TRIALS

Research studies newly funded by the National Institutes of Health (MAR 2018)

UMASS Medical School (J. Brewer, PI). **Mechanisms of mindfulness for smoking cessation.** NIH/NCCIH project #3R61AT009337-02S1. [link]

University of Colorado (K. Hutchinson, PI). **Dismantling MBRP: Identifying critical neuroimmune mechanisms of action.** NIH/NIAAA project #5R01AA024632-03. [link]

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HIGHLIGHTS

A summary of select studies from the issue, providing a snapshot of some of the latest research

Previous learning sometimes interferes with our ability to learn new things. For example, when we memorize one poem and then another, we may mistakenly include words from the first poem when reciting the second. This problem is called proactive interference (PI). People may be able to reduce PI by focusing on the present while screening out competing thoughts and memories—in other words, by mindfulness.

Previous research suggests that reduced PI depends on activation of a brain structure known as the hippocampus. The hippocampus plays an important role in learning and memory, and helps us distinguish old learning from new. Prior research shows that mindfulness training can increase the size of the hippocampus.

Greenberg et al. [Brain Imaging and Behavior] investigated whether mindfulness training reduces PI, and whether that reduction is associated with increases in hippocampal size.

The researchers randomly assigned 79 participants (70% female; average age = 27 years; 65% Caucasian) to a 4-week mindfulness-training program or a 4-week creative writing program. Of those, 67 participants were scanned using magnetic resonance imaging (MRI) before and after training to assess hippocampal volume.

Both the mindfulness and creative writing programs were offered in four 1-hour group sessions using a web-based technology that enabled participants to see and communicate with instructors and fellow participants. The mindfulness program offered training in focused-attention and open monitoring meditation. Participants were asked to practice learned mindfulness skills on their own for 30 minutes five times a week. The creative writing participants wrote short essays in response to

photos or texts, and were asked to write on their own for 30 minutes five times a week.

PI was assessed before and after training by having participants memorize sets of 6 letters shown briefly on a computer screen. They were then shown a single letter and asked if it had been in the set of 6 letters just seen. This process was repeated using 144 six-letter sets. Each new set contained 3 letters seen in the previous trial together with 3 novel letters. Researchers measured errors in identifying whether the singly presented letters were included in the most recent set of six.



Mindfulness trainees showed significantly lower PI error rates after training than the writing group, after controlling for differences in pre-training error rates (partial $\eta^2=.08$). Mindfulness trainees' PI error rates decreased from 4.9 to 3.0%, while creative writing group error rates increased from 1.7 to 7.1%. Reduced PI rates were not correlated with the extent of home practice outside of class. There was no significant difference between groups with respect to hippocampal volume change after the training period. However, within the mindfulness group only, increases in left hippocampal volume were significantly correlated with decreases in PI scores ($r=.43$).

The study shows that mindfulness training reduces the interference effect of previous learning on current learning. For mindfulness trainees, this reduction is associated with increased left hippocampal size. This study is important because it demonstrates a relationship between changes in hippocampal size after mindfulness-training and enhanced attention and learning. The brevity of the study's mindfulness training may have limited its ability to detect significant hippocampal change as compared to a control condition. Previous studies that demonstrated significant hippocampal change used an 8-week training paradigm.

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Attention-Deficit Hyperactivity Disorder (ADHD) is a childhood developmental disorder that can persist into adulthood, affecting 2.5% of the adult population. Adult ADHD symptoms include inattentiveness, distractibility, and difficulty staying organized. Stimulant medications remain the standard first-line treatment for adult ADHD, sometimes supplemented by cognitive-behavioral interventions. Some adults object to stimulant medication, some experience adverse medication-related side-effects, and some fail to achieve complete symptom remission through its use.

As a result, there is interest in developing psychosocial treatments as adjunctive or alternative treatments. Mindfulness-based interventions may be good candidates for such treatments, as they improve attentional regulation in healthy populations, and strengthen the brain regions associated with it. **Janssen et al. [Psychological Medicine]** tested the efficacy of Mindfulness-Based Cognitive Therapy (MBCT) as an adjunctive treatment for adults with ADHD in a multi-center, randomized, controlled study.

Researchers recruited 120 participants (50% male; average age = 39 years) from three Dutch specialty outpatient clinics for adult ADHD, as well as through media recruitment, physician referral, and a patient support-and-advocacy group. Participants were randomly assigned to either treatment-as-usual (TAU) or treatment-as-usual plus MBCT. TAU consisted of medication for 59% of participants, while 59% received previous or current psycho-educational/skills training, and 55% received previous or current psychosocial treatment. MBCT was offered in 8 weekly 2.5-hour group sessions and a 6-hour silent retreat.

Modifications were made in the standard MBCT format: the length of meditations gradually increased to 30 minutes, and material relevant to depression was replaced by material relevant to ADHD. There was also greater emphasis on mindfulness in daily life, mindful listening, and mindful speaking. Participants were encouraged to practice at home 6 days a week.

Participants were assessed at baseline, post-treatment, and at 3- and 6-month follow-up using both blind clinician and self-report ratings of ADHD symptoms, as well as self-report measures of executive function, general functioning, emotional and social wellbeing, self-compassion, and mindfulness (using the Five Facet Mindfulness Questionnaire).



At post-treatment, clinicians rated MBCT participants as exhibiting significantly fewer ADHD symptoms (Cohen's $d=.41$) than controls. More MBCT participants (31%) were rated as significantly clinically improved than TAU participants (5%). On self-report measures, MBCT participants showed significantly greater improvements in ADHD symptoms ($d=.37$), mindfulness ($d=.36$), self-compassion ($d=.42$) and emotional and social wellbeing ($d=.32$) than controls.

Clinician-rated differences persisted and remained stable through 6-month follow-up. Between group differences in self-rated ADHD symptoms increased over time, with Cohen's d increasing to .79 at 6-months. MBCT group executive functioning improved from post-treatment to 6-month follow-up, first becoming statistically significant at 6 months ($d=.49$).

The study shows adjunctive MBCT alleviates both clinician-rated and self-rated ADHD symptoms and improves self-rated mindfulness, self-compassion and emotional and social wellbeing in adults with effects lasting up to 6 months. The study is limited by its use of a TAU control rather than an active control because of the possible variations in TAU between treatments, as well as the lack of control for extra attention received by the MBCT group.

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Learning to BREATHE is an adaptable, mindfulness-based, group program that helps teenagers sustain focus and curiosity, ease anxiety, reduce depression and somatic symptoms. It enables them to recognize, accept and modulate emotions, cultivate compassion for themselves and others, and improve their own health and emotional well-being. A number of published research studies have demonstrated its benefits for adolescents and young adults. <http://learning2breathe.org/curriculum/research>.

This three-day, four-night workshop offers the established L2B protocol in a comfortable rural setting. The residential program combines three components: a review of the rationale and research informing the L2B structure (Foundation Training); direct hands-on practice in teaching the curriculum (Intensive Training); and mindfulness practice for teachers.

<https://www.trinitywallstreet.org/about/trinity-retreat-center>

L2B is grounded in Mindfulness-Based Stress Reduction (MBSR) and is designed to fit into existing curricula. Implementation requires no additional expense for materials, equipment or technology.

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and psychology students; results from a RCT.

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University of New Mexico (B. McCrady, PI). **Neurocognitive and neurobehavioral mechanisms of change following psychological treatment for alcohol use disorder.** NIH/NIAAA project #1R01AA025762-01A1. [link]

University of Pittsburgh (H. Thomas, PI). **Adaption and pilot testing of a MBI for older women with low sexual desire.** NIH/NIA project #5K23AG052628-02. [link]

Veterans Affairs Medical Center San Francisco (J. Ford, PI). **Identifying biomarkers of rumination and mindfulness through concurrent EEG and fMRI studies of schizophrenia and depression.** VA project #2I01CX000497-05. [link]

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HIGHLIGHTS

A summary of select studies from the issue, providing a snapshot of some of the latest research

Most mindfulness research studies do not follow participants long after the intervention ends. At best, a few studies have followed their participants for up to two years. As a result, little is known about whether the effects of mindfulness-based interventions persist, strengthen, or fade over time. To address this limitation, **de Vibe et al. [PLOS One]** followed participants for six years after completing a Mindfulness-Based Stress Reduction (MBSR) program.

The researchers randomly assigned 288 Norwegian medical and psychology graduate students (76% female, average age = 24 years) to a slightly abridged form of MBSR or a no-intervention control. The MBSR program consisted of seven 1.5-hour weekly group sessions and required 20 minutes of daily home practice. Participants were assessed on dispositional mindfulness (using the Five Facet Mindfulness Questionnaire), subjective wellbeing, problem-focused coping and avoidance-focused coping at baseline, one month post-intervention, and at 1, 2, 4, and 6-year follow-up. Problem-focused coping involves facing one's problems head-on by actively addressing them, while avoidance-focused coping consists of avoiding one's problems or suppressing thoughts and emotions about them.

Participants also had the opportunity to enroll in a 1.5-hour mindfulness "booster" class each semester. While most attended at least one booster class, 46% never attended any. There were dropouts at each assessment time-point, with 61% of the participants having dropped out of the study by year six. There was no difference between MBSR and control group dropout rates, but participants with higher baseline avoidance-focused coping were significantly more likely to drop out.

Six-year longitudinal growth curves revealed that the MBSR participants showed significant continuing increases in mindfulness and problem-focused coping, with significant continuing decreases in avoidance-focused coping over time. MBSR rates of increase in mindfulness and problem-focused coping significantly exceeded those of the controls. For example, MBSR mindfulness scores increased by an average of 15 points, while control scores increased by an average of 7 points.



Outcome differences were observed even though half of the MBSR participants no longer practiced formal meditation by year six, and those who did only practiced for an average of 15 minutes weekly. Additionally, about one third of the controls subsequently attended courses in qigong, tai chi, yoga, or meditation that they also practiced for an average of 15 minutes weekly.

Increases in mindfulness were moderately correlated with increases in problem-focused coping ($r=.67$) and decreases in avoidance-focused coping ($r=-.72$). Increases in problem-focused coping were in turn correlated ($r=.67$) with increases in subjective well-being, making it the best predictor of wellbeing.

The study shows that the psychological benefits of MBSR persist and increase over a six-year interval in a young, educated, non-clinical sample. It also demonstrates that most subjective improvements in wellbeing come from increased reliance on problem-focused coping, which is correlated with increased mindfulness. Generalizations from this sample are limited by the relatively high long-term follow-up dropout rate, and by the lack of an active control.

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Mindfulness-Based Stress Reduction (MBSR) and Relaxation Response (RR) training are both well-established mind-body interventions designed to reduce stress. While there is some overlap between these modalities—both involve meditative attention to bodily sensations—there are also significant differences. MBSR emphasizes non-judgmental awareness to increase acceptance of the present moment, while RR employs muscle relaxation to induce a parasympathetic state that interferes with the fight-or-flight response. To understand the ways in which these two programs function, **Sevinc et al. [Psychosomatic Medicine]** tested for commonalities and differences in terms of psychological effects and brain correlates.

The researchers randomly assigned 50 volunteers (64% female, average age = 38 years) to either MBSR or RR with 40 of the volunteers completing the programs. Both programs involved 8 weekly 2-hour group sessions with 20 minutes of daily home practice. RR included a body scan meditation emphasizing muscle relaxation along with breath-focused and mantra-focused meditations. Participants were assessed at baseline and after the intervention on self-report measures of mindfulness (using the Five Facet Mindfulness Questionnaire or FFMQ), perceived stress, self-compassion, and rumination.

After the intervention, participants underwent fMRI brain scanning while at rest and while engaging in the body scan meditation specific to each program: the RR body scan emphasized relaxing various muscle groups, whereas the MBSR body scan emphasized mindful awareness of body sensations. The researchers were interested in exploring changes in functional connectivity in specific brain regions of interest. Brain regions exhibiting simultaneous increases and decreases in activity are said to be functionally connected. Usable fMRI data was obtained from 34 participants.

The results showed that both programs significantly reduced perceived stress (RR Cohen's $d=0.5$; MBSR $d=1.0$). After the intervention, RR participants showed significant FFMQ increases on the Describing,

Acting with Awareness, Observing, and Non-reactivity sub-scales, while MBSR participants showed significant increases on the Observing and Non-reactivity sub-scales. MBSR participants also showed a significant increase in self-compassion and a decrease in rumination, but these group differences did not reach statistical significance.



The fMRI results showed that the MBSR and RR body scans both induced a common increased functional connectivity between the brain's ventromedial prefrontal cortex, which plays a role in attention, and the brain's supplementary motor areas, which play a role in voluntary muscle control.

Brain differences by group were also identified. RR practice produced stronger functional connectivity between the right inferior parietal gyrus and the supplementary motor areas, reflecting greater intentional inhibition and control of muscle relaxation. MBSR practice significantly increased functional connectivity between the anterior insula and the Anterior Cingulate Cortex (ACC), reflecting enhanced bodily awareness and regulation of limbic-mediated emotionality. This did not significantly differentiate the MBSR practice from the RR practice, which may be attributed to their shared emphasis on enhanced bodily awareness.

This is one of the first head-to-head comparisons of mind-body practices using both self-report and brain imaging data. Both MBSR and RR reduce stress levels and increase aspects of mindfulness. Their unique pattern of brain commonalities and differences makes sense given that MBSR emphasizes non-judgmental awareness, while RR emphasizes parasympathetic relaxation along with attention to muscular sensations. The results also support the idea that mindfulness is not identical to relaxation: the two have their own unique neurological signatures. The study is limited by its small sample size and lack of an attention-only control.

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HIGHLIGHTS

A summary of select studies from the issue, providing a snapshot of some of the latest research

Work-related stress contributes to a variety of health ailments including anxiety, depression, heart disease, and adult-onset diabetes. Up to 8% of U.S. health care costs are attributable to work-related stress. Mindfulness-based Interventions (MBIs) can reduce stress, but finding qualified teachers, allocating meeting spaces, and arranging for employees to attend sessions can be challenging. Consequently, it remains difficult to scale-up MBIs to meet the needs of larger corporations.

Bostock et al. (*Journal of Occupational Health Psychology*) conducted a randomized, controlled study of whether a mindfulness app, as a lower-cost alternative to in-person training, could reduce work-related stress among corporate employees.

The researchers randomly assigned 238 office workers (average age = 35 years; 59% female) from two United Kingdom Fortune 500 companies to a mindfulness group or a wait-list control. Mindfulness participants were provided access to an app called Headspace, containing several short introductory mindfulness videos and 45 guided mindfulness meditation sessions lasting 10-20 minutes. Sessions offer sequential, graduated instruction on key aspects of mindfulness practice. Participants were instructed to listen to one session per day for 45 days. They were assessed on psychological measures, job strain, perceived workplace social support, and blood pressure at baseline, post-intervention, and 2 months after the intervention had ended.

The employees completed an average of 17 of the 45 meditation sessions: 13% completed 0 sessions, 74% completed at least 6 sessions, 68% completed at least 10 sessions, 23% completed at least 25 sessions, and 2% completed all 45 sessions. The mindfulness group showed significantly greater

improvement on wellbeing (partial $\eta^2=.04$), mood ($\eta^2=.04$), depression ($\eta^2=.03$), anxiety ($\eta^2=.005$), job strain ($\eta^2=.04$), and perceived workplace social support ($\eta^2=.07$). Further analysis of job strain showed that perceived job control improved even though perceived job demands remained the same. The mindfulness group also showed a trend towards lower systolic blood pressure ($\eta^2=.002$).



Improvements in wellbeing ($\eta^2=.05$), mood ($\eta^2=.06$), depression ($\eta^2=.06$), and anxiety ($\eta^2=.15$) were significantly associated with the number of meditation sessions participants completed. Only employees who completed more than 10 meditations during the 45 days significantly improved. Employees in the mindfulness group maintained their improvement on wellbeing, job strain, and depression at 2 months post-intervention.

The results show that using a meditation app at least 10 times over the course of a month-and-a-half can improve wellbeing and perceived job control in healthy office-workers. These effects were dose-dependent and persisted up to 2 months after the intervention. The study is limited by the absence of an active control group, and the brevity of its follow-up period.

Mindful people have the generalized tendency to be aware of the present moment with an attitude of openness in day-to-day life. Researchers are interested in discovering whether mindful people exhibit a unique pattern of brain activity. **Lim et al. [*NeuroImage*]** used brain imaging to explore the dynamic functional connectivity within and between brain networks of people with high versus low mindfulness levels. Functional connectivity is a measure of the degree to which different brain regions vary their activity together in synchrony. The researchers measured how the

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functional connections between different brain networks varied over time.

The researchers selected participants from a pool of 125 people who had previously completed a breath-counting task. For this task, participants counted their breaths from 1 to 9 repeatedly for twenty minutes while the researchers tracked how often they lost count. Participants who performed in the top third on this task were identified as highly mindful, while those in the lower third were designated as less mindful.

The high and low mindfulness participants were then invited back to the lab for functional magnetic resonance (fMRI) scans while in a resting state. Data were obtained for 21 high (average age=24 years; 38% male) and 18 low mindfulness participants (average age = 22 years; 28% male). Participants also completed the Five Facet Mindfulness Questionnaire, or FFMQ. The researchers studied three fMRI scan variables: the total time spent in different brain states, the number of transitions between states, and the average dwell time within each state.

There are two types of brain connectivity: within- and between-network connectivity. Within-network connectivity is the degree to which the components of a network synchronize their activity, while between-network connectivity is the degree to which different networks either coordinate their activity or remain segregated from each other.

The researchers further identified two distinct brain connectivity states. One, labeled the “task ready” state, showed strong within-network correlations for the Default Mode (DMN) and Salience (SAL) networks, and a strong dissociation between the DMN and the combined (SAL) and Executive Control (ECN) networks. The other state, labeled the “idling” state, showed weaker within-network correlations and a smaller degree of dissociation between the DMN and other networks. The “task ready” state is an alert state of readiness to perform a task, while the “idling” state is a state of low attentiveness in which cognitive resources are conserved.

The results showed that the high mindfulness group spent significantly more time in the task ready state and less time in the idling state than the low mindfulness group. The high mindfulness group also significantly transitioned between states more often. The FFMQ correlated with total time in the task ready state ($r=.32$), but the correlation was no longer significant when corrected for multiple comparisons.

When the degree of connectivity was averaged for the within and between networks over time as a measure of static connectivity, the high mindfulness group showed stronger within-network connectivity for the DMN and SAL and a stronger degree of segregation of the DMN from the dorsal attention network.



This study shows that highly mindful people have a unique pattern of brain activity compared to those who are less mindful. Mindful people transition more frequently between brain states and spend more time in the task ready state. This suggests both greater attentiveness and preparedness to engage in tasks, and greater flexibility in shifting attentional focus. Mindful people also show greater within-network integration and between-network segregation, which may indicate increased attentional focus and decreased mind-wandering. These results reinforce previous findings regarding the default mode, executive control, and salience networks, and their central role in the neurobiology of mindfulness.

The study is limited by the degree to which the breath-counting task can be seen as an adequate measure of mindfulness, as opposed to being a measure of just one component of mindfulness, namely concentration.

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UC San Francisco (J. Felder, PI). **Optimizing a MBI for poor sleep quality during pregnancy.** NIH/NCCIH project #1K23AT009896-01. [[link](#)]

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HIGHLIGHTS

A summary of select studies from the issue, providing a snapshot of some of the latest research

Acute respiratory infections including colds and flu affect over 50% of the population annually. Interestingly, our psychological states and behaviors can affect our susceptibility to these infections. People who are under stress or otherwise unhappy are more likely to catch acute respiratory infections, while people who exercise regularly are less likely to catch them.

Barrett et al. [PLOS One] conducted a randomized controlled study to test the effects of Mindfulness-Based Stress Reduction (MBSR) and moderate intensity sustained exercise on the frequency, duration, and severity of colds and flu compared to a control group.

The researchers recruited 413 volunteers (average age = 50 years, 76% female, 85% white, 77% college educated) and randomly assigned them to a MBSR, exercise, or non-active control group. The MBSR and exercise interventions were matched on group size, program length, session frequency, and the amount of home practice (20-45 minutes).

The interventions were conducted in the fall, and participants were monitored for colds and flu from autumn through spring. During this time, participants completed weekly health reports. If participants developed an infection, they completed daily reports until symptoms abated. Additionally, they provided oral and nasal swabs to assess their immune response and identify viruses. Participants completed a variety of mental health and personality measures at baseline and at various points along the study timeline. Absenteeism, the number of respiratory infection-related medical appointments, and illness related costs were also assessed.

The study found that the MBSR and exercise groups both reduced acute respiratory infection incidence, duration, and severity. Compared to

controls, the MBSR group showed a 16% reduction in incidence, a 14% reduction in duration, and a 21% reduction in severity. Compared to controls, the exercise group showed a 10% reduction in incidence, a 16% reduction in duration, and a 31% reduction in severity. All these reductions were statistically significant at $p < .05$.



Compared to the control group, MBSR and exercise both resulted in significant improvements in a variety of mental health and personality variables including general mental health, perceived stress, sleep quality, depressive symptoms, and self-efficacy. MBSR and exercise groups both improved mindfulness scores on the Mindful Attention Awareness Scale.

In terms of biological measures, the MBSR and exercise group participants who developed an infection both showed a stronger interferon-gamma-induced protein 10 (IP-10) response to infection than the control group participants. IP-10 is part of the body's response to viral infection and is correlated with reduced viral load and recovery from infection.

The study shows that MBSR and exercise both significantly reduce cold and flu frequency, length, and severity, along with providing general mental health benefits. The authors suggest that the magnitude of MBSR and exercise benefit may be similar to that of other preventative interventions such as flu vaccination. Depending on the year and the variable under study, the reduction of flu incidence and severity due to vaccination ranges from 13-70%. By way of comparison, MBSR cold and flu incidence, duration, and severity reduction rates in this study and one previous study ranges from 14-60%.

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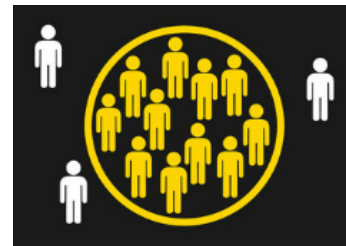
Social rejection can be hurtful, but people differ in how distressed they become following rejection. People also vary in the strategies they use to reduce distress. Some people subdue feelings of distress by employing a “top-down” strategy in which cognitive-related brain centers suppress the activity of emotion-related brain centers. This “top-down” strategy is taxing on cognitive resources, and if those resources become depleted, feelings of distress can re-emerge. Other people employ “bottom-up” strategies such as mindfulness of negative emotions that do not require suppression by cognitive-related brain centers.

Martelli et al. [Social Cognitive and Affective Neuroscience] studied whether highly mindful people feel less distress when socially rejected, and examined whether cognitive- and emotion-related brain responses to rejection varied according to levels of mindfulness.

The researchers assessed dispositional mindfulness levels among 40 participants (54% male, average age = 19 years) using the Mindful Attention Awareness Scale. Participants then played a computerized Cyberball game while undergoing functional magnetic resonance imaging. Cyberball involves a pair of computer-generated characters playing virtual catch with the participant. Participants are misled into believing the computer-generated characters are avatars for real people playing the game. Initially, the computer-generated characters toss the ball between themselves and the participant equally, but in the final minute of play, they toss the ball only between themselves, effectively excluding the participant from the social interaction. Approximately an hour after the game, participants completed a questionnaire measuring their level of social distress. Participants also completed a manipulation check that showed they believed they were playing Cyberball with live co-participants.

The neurobiology of distress and its suppression is complicated. Feelings of distress are associated with increased activity in the dorsal anterior cingulate cortex (dACC), the anterior insula (AI) and the amygdala, while activity in the left ventrolateral prefrontal

cortex (VLPFC) down-regulates distress. One might think that the more the VLPFC down-regulates distress, the better we would feel, but things are not that simple. If the VLPFC becomes over-activated, its down-regulatory effect is followed by a refractory period accompanied by rebound distress. This is why top-down VLPFC regulation may not be the best strategy.



The results showed that mindfulness scores were significantly and negatively correlated with distress ($r=-.43$) an hour after rejection, and with VLPFC ($r=-0.53$), left amygdala ($r=-0.44$) right amygdala ($r=-0.37$) and dACC ($r=-0.34$) activity during rejection. More mindful participants showed decreased functional connectivity between the VLPFC and the bilateral amygdala and dACC during moments of rejection in the game. The inverse relationship between mindfulness and distress scores was mediated by decreased VLPFC activity during rejection.

The study demonstrates that mindful people are less prone to distress after experiencing social exclusion. Results also show that mindful people are less likely to depend on VLPFC suppression to cope with rejection-related distress. This is important because VLPFC suppression is a “top-down” strategy that taxes adaptive coping resources and, if resources are exhausted, paradoxically leads to increased distress. Higher mindfulness was accompanied by lower levels of amygdala and dACC activity supporting the hypothesis that mindfulness exerts a beneficial effect on lower emotional centers independent of the VLPFC. The study is limited by not adjusting for important covariates of mindfulness such as neuroticism. In addition, the one-hour delay between playing Cyberball and measuring distress limits our understanding of whether VLPFC suppression was initially more successful at reducing distress and only subsequently increased distress, or whether it was an inferior strategy from the start.

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INTERVENTIONS

Articles testing the applied science and implementation of mindfulness-based interventions

Alsubaie, M., Dickens, C., Dunn, B. D.,...Kuyken, W. (2018). **Feasibility and acceptability of MBCT compared with MBSR and treatment as usual in people with depression and cardiovascular disorders: A three-arm RCT.** *Mindfulness*. [\[link\]](#)

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Articles reviewing content areas of mindfulness or conducting meta-analyses of published research

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TRIALS

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Northwestern University (I. Burnett-Zeigler, PI). **Effectiveness and implementation of a mindfulness intervention for depressive symptoms among low-income minority adults.** NIH/NIMHHD #1R01MD012236-01A1. [\[link\]](#)

University of Colorado (S. Dimidjian, PI). **Preventing depressive relapse in pregnant women with recurrent depression.** NIH/NIMH project #1R01MH117251-01. [\[link\]](#)

University of Kentucky (B. Reynolds, PI). **Using mindfulness training to reduce delay discounting in rural adult smokers.** NIH/NIDA project #1R21DA046551-01. [\[link\]](#)

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HIGHLIGHTS

A summary of select studies from the issue, providing a snapshot of some of the latest research

Multiple sclerosis is a central nervous system disorder in which the body's immune system attacks the fatty layer of insulation surrounding nerve cells. Symptoms may include visual and sensory disturbances, muscle weakness and discoordination, fatigue, pain, and problems with mood and cognition. Stress can worsen these symptoms, and stress management can reduce the risk of the illness spreading to other brain regions. **Senders et al. [Multiple Sclerosis Journal]** tested the feasibility of using Mindfulness-Based Stress Reduction (MBSR) with multiple sclerosis patients, and whether MBSR worked better than an active control intervention in improving psychological symptoms and wellbeing.

The researchers randomly assigned 67 patients with multiple sclerosis (average age = 53 years, 77% female, 97% Caucasian) to a standard 8-week MBSR intervention or to an education control group matched for time and attention. The control group curriculum covered topics such as medication, symptom management, financial planning, knowing one's rights, and connecting with resources.

The groups were assessed on a variety of self-report measures of psychological symptoms, stress, and wellbeing at baseline, immediately after program completion, and at twelve months post-intervention. Attention and cognition were assessed using a serial addition task in which participants listened to an audio recording of single digits presented at three-second intervals. Participants had to add each newly presented digit to the previously presented one. Participant expectations for the success of their respective interventions were assessed at baseline, with MBSR assignees having significantly higher expectations.

In regard to feasibility, 85% of the MBSR patients attended at least 6 of the 8 group

sessions, thus meeting the author's standard for course completion. They completed their at-home meditation on 55% of the assigned days for an average of 38 minutes per meditation. There were only two MBSR-related adverse events: a case of muscle cramps after a body scan meditation, and a case of anxiety and migraine following the six-hour retreat. It was unclear if these were due to MBSR activities or random occurrences.



In terms of psychological outcomes, MBSR and educational group participants both showed significant improvements on measures of perceived stress, emotional wellbeing, anxiety, depression, fatigue, resilience, and serial addition proficiency immediately after the intervention. While improvement scores were generally higher for MBSR participants, group differences failed to reach statistical significance. Within-group effect sizes for MBSR ranged from $d = 0.56$ on the serial addition task to $d = 0.77$ on anxiety. Within-group effect sizes for the control group ranged from $d = 0.28$ on the serial addition task to $d = 0.75$ on anxiety. Improvements on stress, anxiety, depression, fatigue, and resilience remained significant at 12-month follow-up for both groups.

The results showed that MBSR was a safe and feasible intervention for multiple sclerosis patients. Both interventions showed improvements on psychological measures up to a year after the intervention. Although MBSR improvements tended to be slightly larger than the active control, the difference did not reach statistical significance. The study's small sample size may have lacked sufficient statistical power to reveal significant differences between groups. The absence of a no-treatment control and a mindfulness measure makes it impossible to tell whether improvements were spontaneous, due to group support effects, or associated with the specific content of the interventions.

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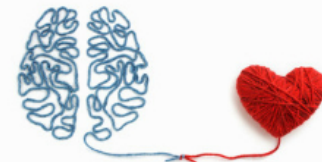
Mindfulness-based interventions can enhance emotional regulation and improve mood, but we are only just beginning to understand the brain mechanisms responsible for these benefits. **Kral et al. [Neuroimage]** compared the brain activity of long-term meditators, short-term meditators, and non-meditators in response to emotionally positive, negative, and neutral images. The researchers sought to discover whether or not the amount of an individual's meditation practice correlated with their response to emotional stimuli.

The researchers recruited a sample of 31 long-term Vipassana mediators (average age = 50 years, 55% female, average meditation practice = 9,000 hours) and compared them to a sample of 127 meditation-naive recruits. Following initial data collection, 86 of the meditation-naive recruits (average age = 48, 63% female) were randomly assigned to a standard 8-week MBSR program or a Health Enhancement program (HEP) which served as a time-and-attention control.

The long-term mediators and the meditation-naive participants spent a day in the laboratory prior to the meditation-naive group's random assignment to intervention. Following intervention, the meditation-naive group returned to the laboratory for re-assessment. In the laboratory, participants were shown emotionally positive, negative, and neutral images while undergoing functional magnetic resonance imaging (fMRI), a procedure that measures metabolic activity in different regions of the brain. The researchers measured fMRI activity in two specific brain regions: the amygdala, which plays a role in generating emotion, and the ventromedial prefrontal cortex (VMPFC), which plays a role in regulating emotion. Participants also completed a self-report measure of mindfulness, the Five Facet Mindfulness Questionnaire (FFMQ).

Results from the pre-intervention data showed that meditation-naive participants had significantly greater right amygdala activity in response to positive images than long-term meditators. While there were no overall group differences in response to negative images, long-term mediators with the most lifetime Vipassana retreat hours had the smallest right

amygdala response to negative images ($r = -.47$). For all participants, higher scores on the FFMQ Non-reactivity scale ("When I have distressing thoughts or images I just notice them and let them go") were associated with less right amygdala reactivity to positive images ($r = .24$). Long-term meditators had significantly higher FFMQ Non-reactivity scores than meditation-naive participants. HEP control group participants showed significantly greater right amygdala activity in response to positive images than the MBSR participants immediately after the interventions.



The researchers also looked at the degree of functional connectivity (the degree to which activity varied in tandem) between the amygdala and the VMPFC. Long-term meditators showed significantly greater amygdala-VMPFC connectivity in response to negative images than to neutral images. Meditation-naive participants failed to show the same pattern, but the between-group difference was not significant. MBSR participants showed significantly greater amygdala-VMPFC connectivity during positive and negative as opposed to neutral images than HEP controls.

The study shows that short-term meditation practice reduces emotional reactivity by VMPFC dampening of amygdala activity. Long-term meditators, however, regulate their amygdala activity without VMPFC dampening and report superior levels of emotional non-reactivity. The authors suggest that amygdala activity reflects the tendency to hold on to or avoid stimuli rather than the tendency to experience them as pleasant or unpleasant. Long-term meditators may have developed the capacity to attend to stimuli without grasping at them or pushing them away. This differs from the short-term meditators suppression of emotional reactivity after the fact of its occurrence. The results also suggest that meditation retreats are more effective than non-retreat daily practice in developing this non-reactive capacity.

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INTERVENTIONS

Articles testing the applied science and implementation of mindfulness-based interventions

Adhikari, K., Kothari, F., Khadka, A. (2018). **The effect of short-term training of vipassana's body-scan on select cognitive functions.** *Psychological Studies.* [\[link\]](#)

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Barrington, J., Jarry, J. L. (2018). **Does thought suppression mediate the association between mindfulness and body satisfaction?** *Mindfulness*. [\[link\]](#)

Benzo, R. P., Anderson, P. M., Bronars, C., Clark, M. (2018). **Mindfulness for healthcare providers: The role of non-reactivity in reducing stress.** *EXPLORE*. [\[link\]](#)

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Chadi, N., Weisbaum, E., Malboeuf-Hurtubise, C.,...Vo, D. X. (2018). Can the mindful awareness and resilience skills for adolescents (MARS-A) program be provided online? Voices from the youth.

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REVIEWS

Articles reviewing content areas of mindfulness or
conducting meta-analyses of published research

Carlson, L. E. (2018). **Uptake of mindfulness-based interventions: A phenomenon of wealthy white western women?** *Clinical Psychology: Science and Practice*. [\[link\]](#)

Chopko, B. A., Papazoglou, K., Schwartz, R. C. (2018). **Mindfulness-based psychotherapy approaches for first responders: From research to clinical practice.** *American Journal of Psychotherapy*. [\[link\]](#)

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TRIALS

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Institutes of Health (AUG 2018)

Boston University (M. Otto, PI). **Engaging working memory and distress tolerance to aid smoking cessation.** NIH/NIDA project # 1R21DA046963-01. [\[link\]](#)

Duke University (C. Cox, PI). **Optimizing a self-directed mobile mindfulness intervention.** NIH/NCCIH project #1U01AT009974-01. [\[link\]](#)

Johns Hopkins University (T. Mendelson, PI). **Promoting maternal mental health in neonatal intensive care through mindfulness.** NIH/NCCIH project #5R34AT009615-02. [\[link\]](#)

Oregon Health and Science University (K. Mackiewicz, PI). **Mechanisms of action of MBCT-PD: A pilot study.** NIH/NCCIH project #1R21AT010292-01. [\[link\]](#)

Penn State University (D. Fishbein, PI). **Optimizing a mindful intervention for urban youth via stress physiology.** NIH/NCCIH project #1R61AT009856-01. [\[link\]](#)

Washington University (E. Lenze, PI). **Remediating age related cognitive decline: MBSR and exercise.** NIH/NIA project #5R01AG049369-05. [\[link\]](#)

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HIGHLIGHTS

A summary of select studies from the issue, providing a snapshot of some of the latest research

About one-in-five major depressive episodes are not responsive to either medication or psychotherapy and go on to become chronic illnesses. Mindfulness-Based Cognitive Therapy (MBCT) has been shown to be useful as an adjunctive treatment in acute depressions and the prevention of depressive relapse in patients with a history of multiple depressive episodes. Its effectiveness in chronic treatment-resistant depressions has not yet been established.

Cladder-Micus et al. [Depression and Anxiety] compared the effectiveness of MBCT as an adjunctive treatment to treatment-as-usual in patients with treatment-resistant chronic depression.

The researchers randomly assigned 106 patients with treatment-resistant chronic depression (female = 62%; mean age = 47 years; mean length of depressive episode = 70 months; mean number of previous episodes = 2.7) to either treatment-as-usual (TAU) or TAU combined with adjunctive MBCT. MBCT was offered in the standard 8-week group format. TAU consisted of medication, psychological treatment, psychiatric nursing support, and day hospitalization as needed. There was no difference between conditions as to the type and amount of TAU received.

Participants were assessed at baseline and post-treatment on symptom severity, remission of illness (no symptoms for two weeks), quality of life, rumination, self-compassion, and mindfulness (using the Five Facet Mindfulness Questionnaire). The MBCT attrition rate was 24.5%, with participants dropping out due to physical complaints, trouble awakening in the morning, and practical considerations (e.g., moving away from the area). Completers did not differ from non-completers in terms of baseline depressive symptoms. The main analyses were performed using an intention-to-

treat (ITT) protocol using data from all participants available for post-testing, whether or not they successfully completed the MBCT program. Secondary analyses were conducted using only those MBCT participants who completed 4 or more group sessions.



Results showed that there were no significant immediate post-treatment between-group differences in severity of depressive symptoms when the entire ITT sample was analyzed. When data from completers was analyzed, MBCT completers had significantly fewer depressive symptoms than TAU participants ($d = 0.45$). Using the entire ITT sample, significantly more MBCT participants (42%) achieved partial or complete symptom remission than TAU participants (22%).

MBCT participants also reported significantly less rumination ($d = .39$), significantly better quality of life ($d = .42$), significantly more self-compassion ($d = .64$), and significantly greater degrees of mindfulness ($d = .73$) than TAU participants. MBCT participants with higher baseline levels of rumination benefited more from MBCT than those with lower baseline levels ($d = 1.64$).

This study shows that adjunctive MBCT increases mindfulness, self-compassion, and quality of life while reducing rumination in patients with treatment-resistant chronic depression when compared to patients in treatment-as-usual alone.

MBCT reduces symptom severity for those patients who complete the MBCT protocol, and increases the odds of achieving a partial remission of symptoms. MBCT is more effective for depressed patients who experience high levels of rumination. The study is limited by the absence of an active control adjunctive intervention and by its relatively high attrition rate.

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Meditation practice reliably demonstrates beneficial effects for memory, attention, mood, and emotional regulation. It is unclear, however, whether there is a minimum dosage necessary to attain these benefits. **Basso et al.**

[Behavioural Brain Research] measured the benefits of meditation in a group of meditation-naïve participants by assigning them to either daily brief guided meditations or to a control group, and measuring their changes in mood and cognition over time.

The researchers randomly assigned 72 meditation-naïve participants to either a meditation audio or a podcast audio. The meditation group listened to 13-minute guided meditations daily for 8 weeks. The meditations included breath-focused exercises and a body scan practice. The podcast group listened to 13-minute excerpts from NPR's Radiolab podcast daily for 8 weeks.

Participants underwent neuropsychological and psychological evaluations and salivary cortisol (a stress hormone) assessments at baseline, 4 weeks, and 8 weeks. Computer-administered neuropsychological tests included measures of attention, working and recognition memory, and response inhibition.

The psychological tests measured mindfulness (Mindful Attention Awareness Scale or MAAS), mood, stress, depression, anxiety, rumination, sleep quality, fatigue, quality of life, self-esteem, and life satisfaction.

Following the final assessments, participants were subjected to a stress-inducing task. They were told to prepare for a job interview and deliver a five-minute presentation on why they should be hired in front of two stone-faced judges. They were then told to perform a difficult serial subtraction problem. Whenever they made an arithmetic mistake, they were instructed to start the problem over from the beginning. Subjective measures of anxiety were taken at baseline, immediately after, and at 10, 20, and 30-minute intervals after the stress-inducing tasks. Salivary cortisol levels were also assessed at each of these time points.

The study had a significant attrition rate: 45% of the participants either dropped out or were excluded due to insufficient participation. The final sample included 42 participants (15 male, 27 female).

There were no differences between the groups at baseline or 4 weeks. At 8 weeks, meditators showed better mood (partial $\eta^2 = 0.11$) (especially reduced anger, hostility, bewilderment, and confusion), less anxiety ($\eta^2 = 0.10$), and less fatigue ($\eta^2 = 0.15$) than controls. Meditators also displayed better working memory ($\eta^2 = 0.11$) and recognition memory ($\eta^2 = 0.10$), and made more correct responses on congruent Stroop task trials ($\eta^2 = 0.12$) than controls.



On the other hand, controls showed improved sleep quality over time, while meditators did not ($\eta^2 = 0.18$). Meditators reported experiencing less anxiety during the stress-inducing tasks ($\eta^2 = 0.10$). Meditation participants who showed the largest improvement in mood also showed the least anxiety in response to the stress-inducing task ($r = -0.41$). There were no measurable effects on cortisol levels.

The study showed that 8 weeks of daily brief meditation measurably improves mood, anxiety in response to stress, and aspects of attention and memory. The study also showed that 4 weeks of practice were not sufficient to yield results. This suggests that meditative effects are cumulative and only emerge with repeated practice over time.

The study was limited by its high attrition rate. Additionally, the fact that the interventions did not differentially affect mindfulness scores makes it unclear whether the mood and cognitive benefits were actually attributable to changes in mindfulness.

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HIGHLIGHTS

A summary of select studies from the issue, providing a snapshot of some of the latest research

Glaucoma is a leading cause of blindness that affects 65 million people worldwide. It is caused by increased fluid buildup inside of the eye (intraocular pressure) that results in progressive damage to the optic nerve. Psychological stress is known to increase several glaucoma risk factors (oxidative stress, inflammation, glutamate toxicity, and vascular dysregulation) while simultaneously reducing several protective factors (neurotrophins and glial activity). This finding has led some to wonder whether stress reduction interventions might benefit glaucoma patients. **Dada et al. [Journal of Glaucoma]** conducted a randomized, controlled study to test if a mindfulness-based intervention (MBI) could reduce intraocular pressure and affect psychological stress-related biomarkers as well as alter gene expression in glaucoma patients.

The researchers randomly assigned 90 patients (average age = 57 years; 55% male) with moderate-to-severe glaucoma to either a MBI or a wait-list control group. MBI participants engaged in daily hour-long teacher-led group sessions for 21 consecutive days. The sessions included 15 minutes of slow-breathing exercises followed by 45 minutes of mindfulness meditation. Attrition rate was 18% in the MBI group and 7% in the wait-list control group.

Intraocular pressure was assessed pre- and post-intervention, as were biomarkers of psychological stress (cortisol and β -endorphins), inflammation (IL-6 and TNF- α), oxidative stress (the imbalance between free radicals and antioxidants as measured by ROS and TAC), and a protein that protects nerve cells (BDNF). Whole blood RNA was assessed for post-intervention differences in

gene expression, and participants completed the World Health Organization Quality of Life Questionnaire.



MBI participants showed a significant 6 mmHg reduction in intraocular pressure, while controls only decreased by about 1 mmHg. Seventy-five percent of the participants who completed the MBI reduced their pressure by over 25%. In evaluating quality of life, MBI participants recorded significant improvements while controls recorded little to no improvement. Biological markers for stress (cortisol, β -endorphins) showed significant improvement for MBI participants, but remained essential unchanged for controls.

One measure of inflammation (TNF- α) significantly decreased for MBI participants and significantly increased for controls. For MBI participants, levels of BDNF significantly increased and oxidative stress measures (ROS and TAC) significantly improved, but similar changes were not observed for controls.

With regard to gene expression, 109 genes differentiated MBI participants from controls. These included genes implicated in nerve cell maturation, cell death and survival, inflammation, glutamate toxicity, and ocular hypertension.

There were significant intercorrelations between intraocular pressure, all of the biomarkers, differential gene expression, and quality of life. For example, lower intraocular pressure was positively associated with quality of life, BDNF, TAC, β -endorphins and a variety of genes, but negatively associated with cortisol, IL-6, ROS, and certain other genes.

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The results show initial promise for the adjunctive use of mindfulness-based interventions in the treatment of glaucoma. Mitigating stress by means of a daily mindfulness practice appears to play a role in reducing biological markers that indicate progression of glaucoma. The results are limited by the absence of long-term follow-up or an active control. As this is the first study of the use of a MBI as an adjunctive treatment for glaucoma, the results require replication before more definitive statements can be made.

Children from low-income, high-stress families are at increased risk for obesity. Further, highly stressed parents tend towards parenting styles that are less warm, less involved, and more punitive. An intervention that improves parental nonjudgmental attention to moment-to-moment parent-child interactions might also prove helpful in preventing childhood obesity. **Jastreboff et al. [Journal of Pediatrics]** explored whether a novel mindful parenting program could improve parenting style and reduce the risk for obesity in the parents' preschool-aged children.

The researchers randomly assigned 42 highly stressed low-income parents of preschool aged children (average age = 31 years; 98% female; 62% multiracial; average BMI=36) to either an 8-week Parenting Mindfully for Health (PMH) program or an educational control group. High parental stress was defined by high scores on a perceived stress scale. The PMH and control participants both attended 8 weekly 2-hour group sessions that included 20 minutes of nutrition and physical activity education and counseling. The remainder of the time in the PMH group was modeled after MBSR, which included a focus on mindful parenting, eating, and physical activity. The remainder of the control group's time was devoted to viewing and discussing nature videos.

Parents were assessed pre- and post-intervention for mindfulness (using the Mindful Attention Awareness Scale), perceived stress, nutritional intake, pedometer-measured

physical activity, and BMI. Their preschool children wore an activity sensor to measure levels of physical activity and also had their BMI calculated from their height and weight. Parent-child dyads were videotaped during a "Toy Wait Test" in which the children had to wait five minutes until their parents completed some paperwork before they could play with a toy. Toy Wait Test videotapes were rated for the quality of parent-child interaction by independent blind raters.



The average child's BMI percentile increased significantly more for control children (a 12 percentile increase) than for PMH children (a 1 percentile increase; $f=0.42$). After intervention, PMH parents spent significantly more time verbally interacting with their children to help them tolerate waiting for the toy and remained more involved with their children than control parents ($f=0.34$). PMH parents also showed a trend towards increased positive parental affect, warmth, and engagement, but control parents did not. Both groups of parents ate healthier diets after intervention ($f = 0.36$), but only the PMH parents significantly decreased their eating in response to emotional upset. There were no significant changes in parental mindfulness, stress, BMI, or physical activity at post-intervention in either group.

The results show that the Parenting Mindfully for Health (PMH) program effectively improved positive parenting style, and significantly slowed weight gain in their preschool children over the course of 8 weeks. Given that PMH parents showed no significant changes in mindfulness or stress, the mechanisms of action remain unknown. Didactic aspects of the program involving mindful parenting and eating may have been responsible for the observed intervention effects, as the control group contained no similar components. The study is limited by its small sample size and lack of longer-term follow up.

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Research studies newly funded by the National Institutes of Health (OCT 2018)

VA Connecticut Healthcare (L. Kachadourian, PI). **Mindfulness treatment for anger in veterans with PTSD.** Veterans Affairs project #51K2CX001259-03. [link]

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HIGHLIGHTS

A summary of select studies from the issue, providing a snapshot of some of the latest research

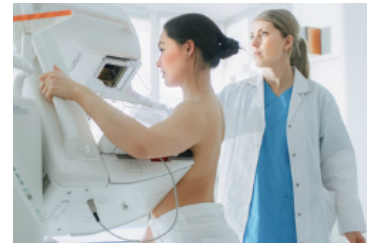
About one in eight U.S. women will be diagnosed with breast cancer at some point in their lives. Cancer is often diagnosed by a stereotactic breast biopsy that uses a mammography-guided needle to extract suspicious tissue. The procedure requires women to remain immobile for 15-30 minutes while undergoing breast compression, which can be an uncomfortable, anxiety provoking experience.

Patients can take prescription drugs to reduce anxiety, but this requires them to be driven to and from the procedure and can delay their return to work. As a result, there is interest in non-drug interventions to reduce biopsy discomfort and anxiety. **Ratcliff et al. [Journal of the American College of Radiology]** compared the effect of mindfulness meditation or focused breathing to a control group on breast biopsy pain and anxiety.

The researchers randomly assigned 76 women (average age = 55 years; 74% Caucasian and 20% Hispanic/Latina) preparing to undergo stereotactic breast biopsy to: 1) a 10-minute guided mindfulness meditation, 2) a 10-minute guided period of focused diaphragmatic breathing, or 3) a 10-minute period of listening to a neutral audio clip.

Mindfulness meditation emphasized nonjudgmental observation of the breath, sensations, thoughts, and feelings with reminders to refocus whenever the mind wandered. The meditation was guided in-person by a mind-body medicine specialist. The specialist also accompanied the patient to the biopsy, coaching them in meditation during the procedure. Focused breathing was taught and coached similarly. Audio clip patients were not accompanied or coached during the biopsy.

Measures of anxiety and pain were taken after the training interventions, every four minutes during the biopsy, and immediately following the biopsy. Additionally, an electroencephalogram (EEG) measured patient brain wave activity in regions of interest before, during, and after the biopsy.



The mindfulness group showed a significantly greater reduction in anxiety during the biopsy than the focused breathing group (Cohen's $d = 0.48$) or the audio clip control ($d = 0.45$). Reported pain levels did not significantly differ across groups. Although mindfulness reduced anxiety more than focused breathing, a significantly greater percentage of focused breathing participants rated their intervention as useful or very useful (97%) than did mindfulness participants (77%).

The mindfulness group displayed significantly stronger EEG beta range activity in the insula ($d = 1.4$) and anterior cingulate cortex ($d = 1.0$) during the biopsy compared to the control group. There were similar trends for the insula ($d = 1.6$) and anterior cingulate cortex ($d = 0.7$) when compared to the focused breathing group. The mindfulness group also showed a trend towards greater theta activity in three brain regions. Brain wave differences were indicative of improved attention and bodily awareness. There was a trend in both the mindfulness and the focused breathing groups towards reduced delta activity in the precuneus region. This decreased delta activity correlated significantly ($r = 0.51$) with decreased anxiety during the biopsy.

The study shows that a brief, instructor-led mindfulness meditation is superior to instructor-led focused breathing in reducing anxiety during stereotactic breast biopsy. The study is limited by the fact that a mind-body specialist did not accompany control group participants during the biopsy. Useable EEGs were obtained for only one third of the participants, limiting the statistical power of the analyses.

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While there is a fairly extensive research literature evaluating the benefits of Mindfulness Based Stress Reduction (MBSR) for adults with depression and anxiety, research into the benefits of MBSR for adolescents with mental health problems is sparse.

Vohra et al. [*Child and Adolescent Mental Health*] conducted a controlled trial of MBSR as an adjunctive treatment for adolescents attending an intensive residential mental health treatment program.

The researchers studied 85 non-psychotic adolescent patients (average age = 14 years; 59% male; 73% Caucasian) residing in an intensive residential mental health treatment program. Half of the residents received standard residential care and half received standard residential care plus adjunctive MBSR. Assignment to condition was based on the time of year that patients resided in the treatment program, rather than on individual randomization.

Standard residential care consisted of a structured program including daily group therapy, medication, education, recreation, and weekly family therapy. Adjunctive MBSR was offered in eight two-hour weekly sessions with a three-hour retreat in week eight. The standard MBSR protocol was modified for the age group and homework was less demanding.

Outcome measures assessed at baseline, 10 weeks, and 3 months included parent, teacher, and self-ratings using the Behavioral Assessment System for Children System (BASC) as well as self-ratings on perceived stress, mindfulness (using the Child Acceptance and Mindfulness Measure), and emotional regulation. During the course of the study, 4 participants were discharged early and one participant declined further participation. Average MBSR session attendance was 88%.

BASC teacher ratings showed significant improvements for the adjunctive MBSR group on measures of internalizing problems (depression, anxiety, somatization) and adaptive skills (social skills, study skills, leadership) compared to standard care alone. Average ratings of internalizing problems in the MBSR group decreased from 53 to 51, whereas standard care alone ratings increased from 56 to 63. Average MBSR adaptive skills ratings improved from 44.7 to 45.5, whereas standard care alone ratings improved from 44.4 to 44.6.



Effect sizes for adaptive skills were not indicated, but appear small. There were no significant differences on any other rating scales. In a post-hoc analysis, the MBSR group had a significantly shorter length of stay in the program (133 vs.151 days).

The results of this study show that adjunctive MBSR can improve teacher-reported internalizing problems and adaptive skills among adolescents attending an intensive residential mental health program. These same improvements were not found for participant self-report or parental ratings, but as this was a residential program, parents had only minimal contact with their children.

The study was limited by its lack of individual random assignment, as well as the fact that teachers performing ratings were not blind to condition, introducing the possibility of evaluation bias.

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INTERVENTIONS

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Baker, A. W., Frumkin, M. R., Hoepfner, S. S.,...Simon, N. M. (2018). **Facets of mindfulness in adults with generalized anxiety disorder and impact of co-occurring depression.** *Mindfulness.* [link]

Bravo, A. J., Witkiewitz, K., Kelley, M. L., Redman, J. C. (2018). **Prevalence of mental health problems and willingness to participate in a mindfulness treatment: An examination among veterans injured in combat.** *Mindfulness.* [link]

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Baer, R. (2018). **Assessment of mindfulness by self-report.** *Current Opinion in Psychology.* [\[link\]](#)

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Articles reviewing content areas of mindfulness or conducting meta-analyses of published research

Bristow, J. (2018). **Mindfulness in politics and public policy.** *Current Opinion in Psychology.* [\[link\]](#)

Cifu, G., Power, M. C., Shomstein, S., Arem, H. (2018). **Mindfulness-based interventions and cognitive function among breast cancer survivors: A systematic review.** *BMC Cancer.* [\[link\]](#)

de Costa, M. A., de Oliveira, G. S. D., Tatton-Ramos, T.,...Salum, G. A. (2018). **Anxiety and stress-related disorders and mindfulness-based interventions: A systematic review and multilevel meta-analysis and meta-regression of multiple outcomes.** *Mindfulness.* [\[link\]](#)

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Research studies newly funded by the National Institutes of Health (NOV 2018)

Olin Teague Veterans Center (E. Meyer, PI). **Promoting recovery by targeting mindfulness and psychological flexibility.** VA project #2101RX000304-08A1. [\[link\]](#)

Kaiser Foundation Research Institute (K. Sherman, PI). **Using an implementation framework to enhance participation in mindfulness programs for patients with chronic low back pain.** NIH/NCCIH project #1R21AT010170-01. [\[link\]](#)

Wake Forest University (R. Wells, PI). **Mindfulness and mechanisms of pain processing in adults with migraines.** NIH/NCCIH project #3K23AT008406-04S1. [\[link\]](#)

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A summary of select studies from the issue, providing a snapshot of some of the latest research

High blood pressure is a major cardiovascular risk factor impacting 35% of U.S. adults. Stress, anxiety, and depression can contribute to its onset and intensification. The condition is usually treated with antihypertensive medications, but a significant proportion of patients fail to achieve adequate control with medication alone.

Researchers are interested in whether stress-reduction interventions together with conventional medical care can improve outcomes compared to medication alone. In a randomized controlled trial, **Marquez et al. [Journal of Human Hypertension]** compared relative effectiveness of mindfulness meditation and health education programs in reducing blood pressure as well as levels of stress, anxiety, and depression.

The researchers randomly assigned 42 meditation-naïve participants (average age = 57 years; 43% male; 69% on antihypertensive medication) with high-normal blood pressure or stage 1 hypertension to a Mindfulness Meditation or Health Education intervention. Both interventions were offered in two-hour group sessions that met weekly over the course of 8 weeks.

Mindfulness Meditation content was similar to that offered in Mindfulness-Based Stress Reduction (MBSR). The Health Education intervention offered didactic information on hypertension risk factors, along with methods of prevention through medication, diet, and exercise. Participants were assessed at baseline, 4, 8, and 20 weeks on measures of mindfulness (evaluated using the Five Facet Mindfulness Questionnaire), mood, perceived stress, anxiety, depression, and clinically assessed blood pressure (BP).

Additionally, each participant's ambulatory BP was assessed over a 24-hour period at baseline and at week 8 using a body-worn automated device that measured BP at 15-30 minute intervals throughout the day and night. Ambulatory BP is a sound measure because it eliminates the error associated with the "white coat" effect—the spurious elevation in BP that occurs when doctors measure it.



At post-intervention, the mindfulness group had significantly lower clinically assessed systolic BP (130 mmHg) than the controls (133 mmHg). Similar results were found for 24-hour ambulatory BP: the mindfulness group had significantly lower systolic BP (124 mmHg) and diastolic BP (78 mmHg) than controls (126 mmHg and 80 mmHg, respectively). When ambulatory BP was divided into measures taken while awake and measures taken while asleep, only measures taken while asleep proved significant (109 vs. 114 mmHg and 65 vs. 69 mmHg).

At 20 weeks, clinically assessed systolic BP in the mindfulness group dropped 13 mmHg from baseline, whereas the control group dropped only 1 mmHg, a statistically significant difference. Diastolic BP dropped by 14 mmHg in the mindfulness group but only by 3 mmHg in the control group, a difference that failed to reach statistical significance.

At 8 weeks, the mindfulness group reported significantly lower levels of anxiety, stress, and depression, and significantly higher levels of mindfulness. At 20 weeks, the mindfulness group reported significantly lower perceived stress levels than controls, but none of the other group differences in psychological scores reached significance.

The study shows that mindfulness meditation in combination with conventional medication

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treatment reduces blood pressure and stress levels, while improving mindfulness and mood more than medication coupled with health education. The findings appear to be clinically meaningful as a 3 mmHg reduction in systolic blood pressure can reduce stroke mortality by 8% and cardiovascular mortality by 5%. The reductions in this study are equivalent in magnitude to those obtained through regular aerobic exercise. The study is limited by its small sample size and three-month follow-up period.

Mental health problems are costly to society both in terms of treatment-related expenses and lost productivity. If research shows that two treatments are equally effective in reducing symptoms, it seems reasonable to ask which of the two is more cost effective. A recent Swedish study showed that a group-based mindfulness intervention was equally as effective as standard care (mostly individual-based cognitive behavioral therapy) in reducing symptoms of anxiety and depression. Saha et al. [British Journal of Psychiatry] evaluated the previously published Swedish study to determine the cost-effectiveness of group-based mindfulness interventions as compared to the costs of standard care.

The original study randomly assigned 215 Swedish patients (average age = 42 years; 85% female) diagnosed with depression, anxiety, stress, or adjustment disorders who were being treated at 16 different primary care health centers to either a mindfulness-based intervention (MBI) or standard care. The MBI was offered in two-hour weekly group sessions over eight weeks and based on Mindfulness-Based Stress Reduction and Mindfulness-Based Cognitive Therapy. The majority of standard care patients (76%) received individual cognitive-behavioral therapy for an average of 6.3 sessions.

Intervention and control participants were equally likely to be taking antidepressant and/or anti-anxiety medications, so that group differences cannot be attributed to medication effects. The researchers compared the two groups in terms of 1) total health care costs over the course of 8 weeks (the costs of

therapy, medication, and medical visits), 2) self-reported quality of life improvement in terms of mobility, self-care, activities of daily living, pain, suffering, anxiety, and depression, and 3) productivity in terms of patient reported sick leave and hours worked.



The results showed that the group-based mindfulness intervention cost about \$130 less per patient over the course of 8 weeks than standard care consisting of mostly individual therapy and counseling. The cost difference was not due to differences in medication use or healthcare utilization, but to the fact that group treatments require less professional time than individual treatments. The groups did not differ significantly in terms of patient reported quality of life or work productivity.

This study shows that over the course of 8 weeks, a group-based mindfulness intervention was less expensive than standard Swedish primary care. A prior analysis showed that the mindfulness intervention was roughly equivalent to standard care in terms of symptom outcomes. The results are important because they point to a potential cost savings gained from group treatments compared to individual treatments without inferior outcomes.

In the United States, 30% of patients with diagnosable depression receive no treatment at all. Many do not have adequate insurance, and there are not enough individual therapists to meet the need. Finding more affordable ways to deliver care and taking advantage of opportunities to utilize therapist time more efficiently is important. The study is limited by its eight-week length, as there may be other cost and productivity differences that emerge over a longer period of time. It is also limited by relying on patient reports of medication use and medical visits rather than making use of more objective pharmacy, clinic, and insurance records.