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# A Systematic Review and Meta-Analysis of Yoga and Mindfulness Meditation in Prison Effects on Psychological Well-Being and Behavioural Functioning

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# A Systematic Review and Meta-Analysis of Yoga and Mindfulness Meditation in Prison: Effects on Psychological Well-Being and Behavioural Functioning

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## Abstract

This article presents results from a systematic review and two meta-analyses that examine whether prison yoga and meditation programs are significantly related to increased psychological well-being and improvements in the behavioural functioning of prisoners. Comprehensive searches of the empirical literature were conducted up to December 2014. Participants who completed yoga or meditation program in prison experienced a small increase in their psychological well-being (Cohen's  $d = 0.46$ , 95% confidence interval [CI] = [0.39, 0.54]) and a small improvement in their behavioural functioning (Cohen's  $d = 0.30$ , 95% CI = [0.20, 0.40]). Moderator analyses suggested that there was a significant difference in effect sizes for programs of longer duration and less intensity, compared with those that were shorter and more intensive, for psychological well-being. Programs of longer duration had a slightly larger positive effect on behavioural functioning ( $d = 0.424$ ), compared with more intensive programs ( $d = 0.418$ ). Overall, the evidence suggests that yoga and meditation have favourable effects on prisoners.

## Keywords

yoga, prison, Vipassana, meditation, psychological well-being, behavioural functioning

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Adjunctive therapies such as yoga and other mindfulness-based meditation techniques are widely thought to have positive effects on the psychological well-being and overall quality of life of the incarcerated, particularly those who do not wish to attend standard treatment programs. However, the nature of these effects is not well understood. Accounts of yoga's positive impact on the well-being of prisoners are largely anecdotal, as research into the form as therapy is in its early stages, but growing rapidly. Furthermore, yoga's intangible benefits are difficult to categorize and evaluate in a prison setting. Further research is needed to understand the specific effects of yoga in a systematic manner; we need better understanding of *how* yoga exerts a positive effect and its impact on other relevant practices. This meta-analysis aims to build on several recent narrative reviews of yoga and meditation programs (Fix & Fix, 2013; Himelstein, 2011a; Lyons & Cantrell, 2015; Shonin, Van Gordon, Slade, & Griffiths, 2013). These studies have all identified that such programs may benefit participants' psychological well-being and may be particularly effective with substance misuse populations. Programs may also contribute to reducing recidivism by increasing the chances that participants will positively engage with other rehabilitation programs (Himelstein, 2011a). The specific contribution of this study is to quantify the size of the effect of these programs. As such, it represents the first meta-analysis of yoga and meditation programs in prison settings. We examine program effects on two prisoner outcomes: psychological well-being and behavioural functioning. We also compare the effects of yoga and meditation programs that are of longer duration, but lower frequency, with meditation programs that are intensive, but of shorter duration.

Yoga practices are the physical, psychological, and spiritual practices or disciplines that aim to transform body and mind. The term is derived from the literal meaning of "yoking together" a span of horses or oxen, but came to be applied to the "yoking" of mind and body. The origins of Yoga are complex and subject to much speculation, but originate in ancient civilizations. Yoga gurus introduced yoga to the West, and by the 1980s, it had become popular as a system of physical exercise across the Western world. While there are several forms of yoga, it typically involves holding stretches as a low-impact physical exercise and is often used for therapeutic purposes. Yoga often takes place in a class setting and may involve meditation, imagery, breath work and music, and "while not every branch or school of yoga includes meditation in its technical repertoire, most do" (Feuerstein, 2006, p. 90).

The goal of mindfulness meditation is not to change the content of thoughts, as in cognitive therapy, but to develop a different, non-judgemental attitude or relationship to thoughts, feelings, and sensations as they occur (Teasdale, Segal, & Williams, 1995). A form of mindfulness called Vipassana meditation, which means "to see clearly," is one of India's most ancient techniques of meditation. It teaches mindfulness through objective, detached self-observation without reaction. Courses are typically conducted in standardised 10-day programs.

This review summarises the recent research on yoga and meditation, considers some of the program theory and mechanisms that may explain why these programs might be particularly effective in a prison context, and then describes the methodology and findings from the systematic review and meta-analysis.

## Research on Yoga and Meditation

Many studies have tried to determine the effectiveness of yoga as a complementary intervention for cancer (Smith & Pukall, 2009), schizophrenia (Vancampfort et al., 2012), asthma (Sharma, Haider, & Bose, 2012), anxiety (Sharma & Haider, 2013), and heart disease (Innes, Bourguignon, & Taylor, 2005). While much of the medical community views the results of yoga research to be significant, others argue that there are many flaws that undermine results. The majority of the research on yoga has been in the form of preliminary studies or clinical trials of low methodological quality, including small sample sizes, inadequate blinding, lack of randomization, and high risk of bias (Krisanaprakornkit, Ngamjarus, Witoonchart, & Piyavhatkul, 2010; Ospina et al., 2008). So far, the evidence suggests that yoga may be at least as effective at improving health outcomes as other forms of mild physical exercise when added to standard care. The current lack of specificity and standardization regarding the practice of yoga makes it difficult to evaluate, leading some to call for the creation of standardised intervention practices that could be applied for use in clinical settings (Salmon, Lush, Jablonski, & Sephton, 2009).

Prison is undoubtedly a stressful environment for many inmates. Several research studies provide evidence that yoga and meditation programs may provide specific benefits to directly address the negative effects of imprisonment. In vulnerable and clinical samples, there is growing evidence that yoga and meditation programs aid in reducing negative affect, depression, and anxiety (Banerjee et al., 2007; Michalsen et al., 2005; Sharma & Haider, 2013; Vadiraja et al., 2009) and improving emotional well-being (Moadel et al., 2007). Some studies also show that programs can lead to lower levels of stress (Bilderbeck, Farias, Brazil, Jakobowitz, & Wikholm, 2013) and increases in sustained attention (Rangan, Nagendra, & Bhatt, 2009).

## Theoretical Basis of Prison Yoga and Meditation Programs

The benefits of yoga and meditation practice have been widely discussed and include physical conditioning, treatment of illness, maintenance of health, fostering understanding and compassion, and personal growth. When considering these advantages in relation to prisoners, there is clear potential for incorporation of yoga and meditation practice into prison regimes. This section will outline some of the issues specific to prisoners that yoga and meditation practice could apply to.

The role of religion and spirituality in prison life is often controversial but their importance is acknowledged (Goodwin, 2001) while spirituality is being increasingly recognised as a component of one's general health and well-being. Although there is considerable overlap between the two terms, spirituality and religion are not necessarily synonymous. Religion refers to the texts, teachings, and practice of organised faiths, whereas spirituality refers to a broader conception of personal development, the search for meaning, and pursuit of inner tranquillity. The rehabilitative aspect of incarceration is reliant on a certain element of personal growth and self-integration, which is highly compatible with the goal of yoga and meditation practice. Being imprisoned

leaves individuals with a great deal of time in which to reflect on their lives. It is possible that yoga and meditation practice can help to guide an individual in using this self-reflective time in a positive and rewarding manner. Qualitative interviews with program participants reveal that some participants continue practicing yoga after their release from prison, suggesting that programs have the potential to bring about long-term changes to prisoners' lives (Silva & Hartney, 2012).

The therapeutic benefits of yoga have been discussed by van der Kolk (2014; see also Emerson & Hopper, 2011), who explains that because regulation of physical movement is a fundamental priority of the nervous system, focusing on and developing an awareness of physical movement can lead to improved synchrony between mind and body. This is beneficial, he says, especially for those suffering from psychological conditions such as depression and post-traumatic stress disorder (PTSD; the focus of van der Kolk's work) because an improved sense of connectedness between mind and body gives rise to enhanced control and understanding of their "inner sensations" and state of being (Salmon et al., 2009). Given the high prevalence of these and similar mental health problems in the prison population, yoga and meditation programs have the potential to provide a cost-effective supplementary treatment.

Although the mechanisms by which yoga and meditation assist in dealing with the symptoms of mental health problems are not fully understood, there are underlying principles that appear pertinent. For instance, mindfulness is a concept originating in Buddhist practice (Shonin et al., 2013) but is incorporated into yoga teachings through the emphasis on awareness of each action and moment (Uebelacker et al., 2010). Mindfulness teaches individuals to better understand and cope with their thoughts and feelings and as such has been successfully incorporated into cognitive behavioural therapy (CBT) programs (Tang et al., 2007), including some prison-based offending behaviour courses (Howells, Tennant, Day, & Elmer, 2010). Such training aims to teach individuals to recognise negative thoughts and unpleasant emotions without allowing these thoughts and emotions to unduly affect their disposition.

Yoga and meditation practices incorporate mindfulness to greater or lesser degrees, and practices that also incorporate a physical exercise component can communicate this mindfulness training in a format that may be highly suitable for prison populations. For instance, in relation to treating depression, Uebelacker and colleagues (2010) suggested that other ways of learning mindfulness that do not involve sitting still for long periods of time (e.g., yoga) may be needed. As prison populations are disproportionately comprised of individuals suffering from mental health problems and/or dealing with difficult circumstances and consequences related to their incarceration, techniques that improve an individual's ability to cope with difficult emotions could be valuable. As stated above, a format for introducing these techniques that demands less mental application, and so is less daunting, would be useful for prison settings.

One way in which mindfulness is believed to assist individuals is by decreasing rumination: the act of dwelling on negative or stressful situations, which can increase stress levels in an individual (Morrison & O'Connor, 2005). The aim of observing life events from a "detached" perspective echoes the goal of behavioural therapies in aiming to provide individuals with the tools to better understand and regulate their emotional

framework. In the context of prisons, such skills would be of great benefit to a community of individuals dealing with many stressful and demanding situations. Indeed, it is probable that rumination is a process familiar to many prisoners who may regret past behaviours or worry about what the future holds. Studies have shown yoga to produce positive effects in treating “depression (and) sleep complaints . . . and having an adjunctive value in schizophrenia and ADHD” (Balasubramaniam, Telles, & Doraiswamy, 2013, p. 14).

A much greater proportion of prisoners are believed to suffer from attention deficit disorder/attention deficit/hyperactivity disorder (ADD/ADHD) than the general population. Studies have shown that practicing mindfulness techniques can reduce ADHD symptoms and improve performance on attention conflict tasks (Zylowska et al., 2008). Similarly, studies have shown a cumulative and lasting effect on attention tasks from meditation training (Tang et al., 2007), which could improve prisoners’ ability to engage with courses and education programs during their sentence.

Studies have also shown that yoga can provide benefits for a range of physical health problems when used as an alternative or supplementary therapy. For instance, Sharma and colleagues (2012) reported a range of studies that showed significant improvements in asthma sufferers’ symptoms following yoga treatment programs. Equally, positive effects were found for a wide range of health problems, including osteoarthritis, coronary artery disease, and diabetes in a review by Field (2011). General fitness can also be improved with yoga practice through increased strength and flexibility (Field, 2011), which is of particular relevance to the prison population, given the enforced sedentary lifestyle. Indeed, the search for alternative methods of treating health problems has become increasingly relevant given the aging prison population and the difficulty of providing adequate treatment to ill prisoners (Crawley & Sparks, 2005).

The potential benefits of yoga and meditation practice extend beyond those with psychological and physical health problems, diagnosed or otherwise. Prison is a difficult environment, and prisoners must come to terms with a range of painful and stressful experiences including loss of control, family contact, privacy, status, and safety (Crewe, 2007; Liebling, 1999). The loss of family life, liberty, and the fear of decay and deterioration are particularly painful experiences for prisoners (e.g., S. Cohen & Taylor, 1972), all of which can further rumination. Equally, strained relationships with staff and other prisoners can lead to a tense living environment. Yoga and meditation practices can help individuals to better understand and cope with difficult situations and emotions and so have the potential to improve both interpersonal relationships and psychological well-being. Findings from a recent qualitative interview study of 22 male prisoners who participated in a 10-day Vipassana course highlighted the importance of a rehabilitative and supportive atmosphere in supporting change. During the course, in which participants engaged in a “demanding struggle with themselves,” several staff members closely supported the prisoners. Some of the prisoners “presented strikingly positive perceptions of the staff members,” especially those who had been in close contact with them during the course. The process created a “unique social atmosphere” (Ronel, Frid, & Timor, 2013).

Treatment programs that utilise Buddhist-derived philosophies like mindfulness could prove more effective in providing anger management training than current programs (Howells et al., 2010). Moreover, when considering the stressful nature of the prison environment, the impact of elevated stress levels on pre-existing health problems must not be overlooked. Cortisol, the chemical produced by the body as a reaction to stress, can exacerbate physical and mental health problems and there is growing evidence that yoga and meditation can help to reduce cortisol levels, which in turn could reduce the symptoms of illness (Ross & Thomas, 2010).

Finally, the practicability of initiating yoga and meditation programs in prison settings should be considered. The various potential benefits of practicing yoga or meditation are easily achievable, due to favourable logistics in terms of program delivery. Yoga and meditation classes require little equipment and can cater for relatively large groups. Classes can be provided in a cost-effective manner as once an individual reaches a reasonable level of familiarity with the techniques being taught he or she will also be able to practice alone. This increases the practicability alluded to above, as upon completion of a course a prisoner would be able to continue his or her practice independently.

In the United Kingdom, organisations like the Prison Phoenix Trust produce instructional CDs, easy-to-read books (see, for example, Chubb & MacInnes, 2006), and a network of support for prisoners who wish to develop their practice alone. There are similar organisations in other countries, such as The Human Kindness Foundation in the United States and Freeing the Human Spirit in Canada. This allows the benefits of practice to be sustained even if there is a gap in prison provision. Equally, if courses were run back-to-back, the possibility of solo practice allows course places to be freed up for other participants. Utilising the techniques of yoga and meditation would allow prisoners to continue to benefit from the range of positive outcomes listed above over the course of their sentence. This should be considered in light of the length of time spent in cells for many prisoners. However, there is also the possibility of continued benefits to be reaped upon release from prison, when the maintenance of a positive outlook (Giordano, Cernkovich, & Rudolph, 2002; Maruna, 2001) and the ability to remain focused on goals can be paramount to successful transition back into society. Furthermore, participation in yoga or meditation classes outside of prison could support an individual's efforts to embrace an alternative persona and interact with others prepared to support healthy living and a greater sense of hope and purpose in life, as evaluations of other related programs have found (see, for example, Austin, Hardyman, & Irwin, 2002; Kubrin & Stewart, 2006; LeBel, Burnett, Maruna, & Bushway, 2008; Maruna, 2012; McNeill & Weaver, 2010), as well as having additional beneficial effects of their own.

## **Method**

### *Systematic Review: Search Strategy*

We followed guidelines and recommendations made by the Centre for Reviews and Dissemination at the University of York Dissemination (2009).<sup>1</sup> The databases Medline,

PubMed, Web of Science, Embase, the Cochrane Database of Systematic Reviews, the Campbell Library, the Centre for Reviews and Dissemination, Health Systems Evidence, the Evidence for Policy and Practice Information and Co-ordinating Centre evidence library, PsycINFO, Allied and Complementary Medicine Database (AMED), Zetoc, and Applied Social Sciences Index and Abstracts (ASSIA) were searched to identify studies of the effects of yoga in prison from inception to December 31, 2014. The literature search used the following terms (with synonyms and closely related words): “prison” or “incarcerated” or “jail” combined with “yoga” and “mindfulness,” “meditation,” or “Vipassana.” The searches were not limited by study design, sample size, or language of publication. Further studies were identified by examining the reference lists of all included articles and searching relevant websites. All studies in the present meta-analysis ( $N = 13$ ) are identified in the references with an asterisk.<sup>2</sup>

### *Inclusion Criteria*

Studies were eligible for inclusion if they satisfied all our criteria: the study participants consisted of incarcerated offenders, the intervention consisted of yoga or mindfulness/Vipassana meditation, and the outcome of interest was either psychological or behavioural. Only studies of yoga and/or meditation programs that took place with incarcerated participants were included. Studies of samples in the community were excluded, as were studies of prisoners of war.

### *Meta-Analysis*

The objective of this meta-analysis is to calculate standardised effect sizes to establish whether there is a relationship between participation in a prison yoga program and psychological well-being and/or behavioural functioning, and also discover which covariates (e.g., the duration/intensity of the program) are independently related to the adjusted effect sizes.

For the meta-analysis, it was only possible to include studies that contained enough statistical data to calculate an effect size. For six studies, the first author contacted the corresponding authors and requested further information on the studies' methodology and findings. The final sample of studies included published and unpublished reports: journal articles (7), master's and PhD theses (2), research project report (1), and research monographs (2). As previously mentioned, suggestions for studies that might be suitable for the review were sought from the corresponding authors of included studies as well as from other researchers.

### *Analytical Strategy: Effect Sizes*

Sometimes it was the case that it was possible to calculate more than one effect size, which could be categorized under psychological well-being or behavioural functioning. If different effect sizes were reported for stress, negative affect, distress, or self-esteem, they were combined into one effect size. Wolf (1986) and Rosenthal (1991) have



cautioned that in these circumstances the effect sizes are not independent from each other, yet as Borenstein, Hedges, Higgins, and Rothstein (2011) pointed out, not combining effect sizes assigns more weight to studies reporting more outcomes and leads to an improper estimate to the precision of the summary effect size, as it treats each outcome as independent when they are measuring characteristics in the same population.

Where possible, information on overall measures of psychological well-being was used in the meta-analysis, rather than combining data from subscales. The full list of combined outcomes is available from the corresponding author.<sup>3</sup> Twenty-four studies from 23 publications were included in the systematic review and 13 studies were included in the meta-analysis. In cases where there are multiple publications relating to a single study of the same sample, the most recent article was included in the meta-analysis.

### Data Extraction

First, titles and abstracts were examined, and then one reviewer (the first author) assessed the relevant full-text articles. The second author also reviewed a random selection of 12 (10%) of the full-text articles screened, with any inconsistencies resolved by the first author. The first and second authors extracted study characteristics and the first author calculated effect sizes with 95% confidence intervals (CIs) and recorded data in a standardised data proforma. Quality and risk of bias assessments as recommended by Borenstein et al. (2011) were also undertaken.

### Statistical Analysis

All studies that met the eligibility criteria and that presented sufficient data for the calculation of the standardised mean difference (Cohen's *d*) with 95% CIs were included in the meta-analysis. For studies that report means and standard deviations (as the majority of ours did), the standardised mean difference (Cohen's *d*) is most typically used.<sup>4</sup> Psychological and behavioural outcomes were analysed separately.

The results of an initial fixed-effects analysis revealed that  $I^2$  was large (>50%), indicating that there was a considerable amount of heterogeneity among studies. Therefore, a random-effects analysis was run. A key difference between the two models is that under a fixed-effects model it is assumed that there is one true effect size and that differences in observed effect sizes are due to sampling error. In a random-effects model, the true effect size is allowed to vary to take into account differences between participants in each study; for example, ages may vary from study to study. The effect sizes of the studies included in the meta-analysis are assumed to be a random sample of all possible studies that would meet the inclusion criteria (see; Borenstein et al., 2011; Hunter & Schmidt, 2000). We visually assessed forest plots to examine standardised mean differences (Cohen's *d*) and 95% CIs for each study, and also examined funnel plots to gauge publication bias. Forest plots examine whether effect size is dependent on study size. Finally, Egger's method of testing for funnel plot asymmetry was used (Egger, Smith, Schneider, & Minder, 1997). Analyses were conducted with Comprehensive Meta-Analysis statistical software (version 2.2.050).

## Results

Our initial search yielded 326 records of which 115 remained after we screened the abstracts and made an assessment regarding eligibility. We then removed the duplicates (Figure 1).

### *Systematic Review*

Of the 115 studies identified, 24 were considered for the systematic review and 13 were eventually included in the meta-analysis. Seventeen of the 115 studies identified incorporated a control group in the research design and 4 employed a form of random assignment to the treatment and control conditions. The nature of the control groups varied but included random assignment to a non-treatment condition, treatment as usual (TAU; which varied depending on the institutional setting), alternative treatment programs, different combinations of yoga and meditation, and delayed treatment. The median sample size reported was 75, with 14 studies reporting fewer than 75 participants and 16 reporting more than 75 participants. Two studies had especially large samples (more than 900) and, further to these, 8 studies had more than 100 participants. The majority of the studies reviewed were of male participants ( $n = 12$ ) although 4 used all female samples and a further 9 used a mixture of male and female. The age of participants in the studies considered ranged from 18 to 66 years and included participants of different ethnic and cultural heritage, including Native Hawaiian Indians, Filipino, Native American, Japanese, African American, Taiwanese, and White participants from both the United States and United Kingdom.

The studies considered for review reported positive findings for yoga and meditation treatment programs in a wide variety of settings. Programs were completed in the United States, United Kingdom, India, and Taiwan in male and female prisons of varying security levels (i.e., minimum and maximum security) and also in substance use treatment centres. Attrition was a recurring issue, which is a common problem in prison-based studies.

Although there is significant overlap between yoga and meditation, 5 of the studies primarily focused on yoga, 18 focused on meditation (of which, 14 were Vipassana programs), and 5 considered a combination of yoga and meditation. The intensity and frequency of sessions in the programs also varied considerably. Vipassana programs followed the same schedule of a 10-day, highly intensive course that involved 10 to 11 hours per day of meditation. Most of the other courses ran for 7 weeks or more with sessions lasting from 1.5 to 2 hours.

The studies reported no adverse effects for the participants and no significant logistical or organisational difficulties in implementing the treatment programs. The outcomes considered were varied, though virtually all of the studies primarily utilised self-report questionnaires to collect data from participants. Conducting research in a prison setting generally restricts data collection to survey and interview data, so this is not viewed as particularly problematic. Moreover, many of the studies utilised established scales, such as the Beck Depression Inventory-II, for their outcome measures.

In support of the above review of yoga and meditation research, Ramadoss and Bose (2010) found that juvenile offenders reported a reduction in perceived stress and

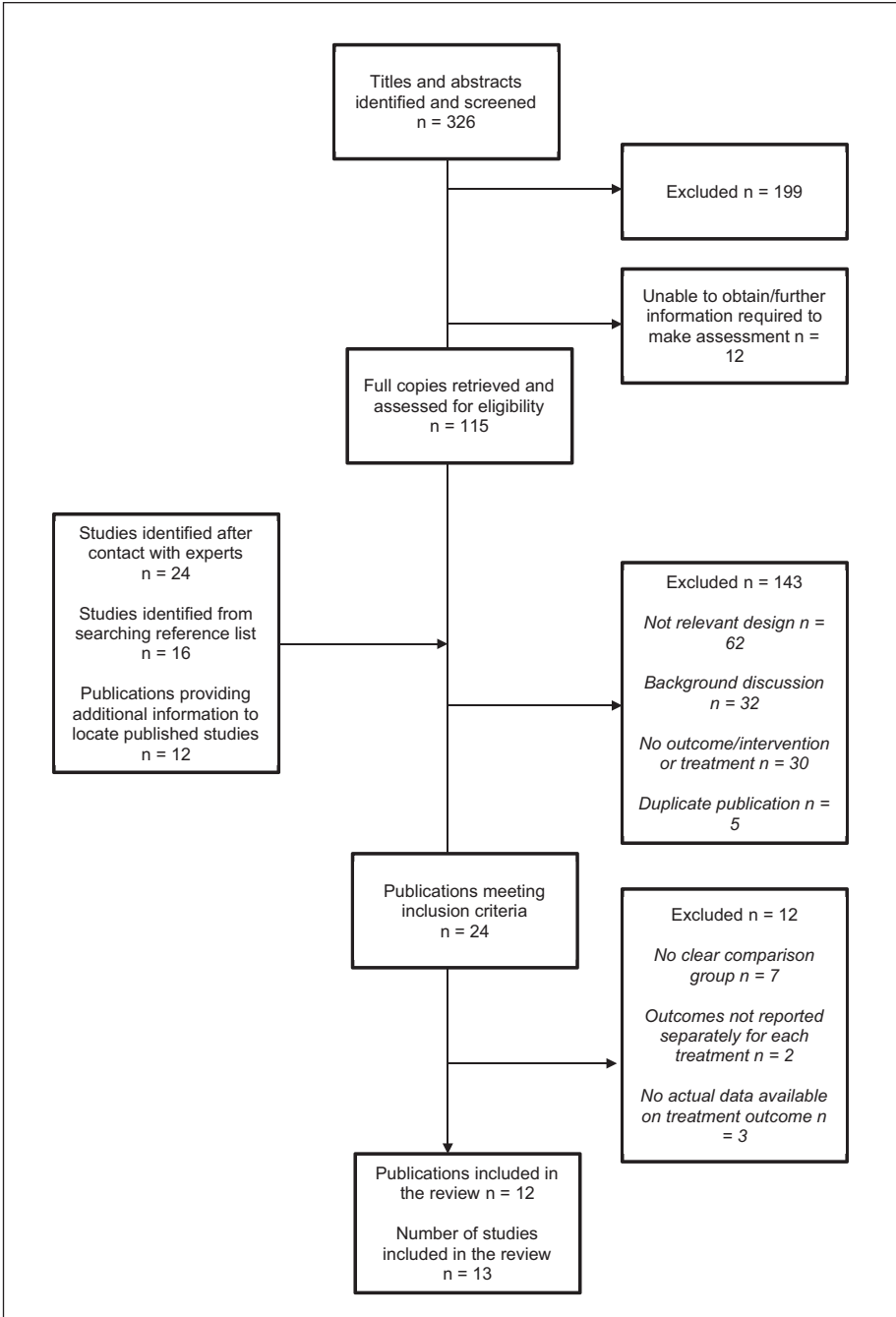


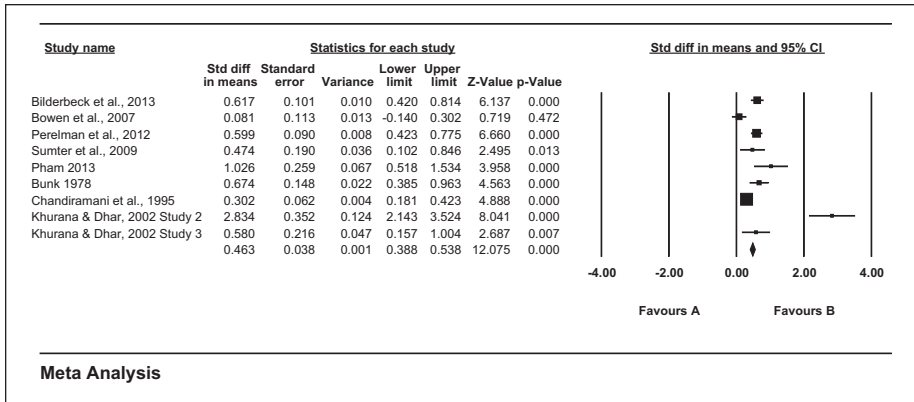
Figure 1. Flow chart of study selection process.

an increase in self-control. Although this was a pilot study with no control group, the findings are supported by the results of a British study that reported a reduction in stress and psychological distress among prisoners after a 10-week yoga course, as well as improvement on a cognitive behavioural task (Bilderbeck et al., 2013).

Programs that were run in women's and young offender institutions (as above, Ramadoss & Bose, 2010 and also Himelstein, 2011b, below) were included in this systematic review. Sumter, Monk-Turner, and Turner (2009) studied a meditation program at Tidewater Detention Center (TDC) in Virginia, United States. They found that female inmates who completed the meditation program had fewer difficulties sleeping, felt less guilt, and had more hope for the future, perhaps as a result of decreased rumination and a better ability to cope with their own thoughts. Khurana and Dhar (2002) found positive effects for prisoners on a range of items, including subjective well-being and criminal propensity in a female only prison in India.

The literature reviewed above suggests that individuals with problematic substance use can particularly benefit from yoga and meditation programs. Himelstein (2011b) observed positive effects of a yoga and meditation program among juvenile male inmates, aged 15 to 18 years. Participants showed a reduction in impulsiveness and an increase in "perceived drug risk," which quantified the extent to which youths enrolled on the program had absorbed information from a drug awareness element of the course. Lee, Bowen, and An-Fu (2011) reported a decrease in depressive symptoms in the treatment group of a study of Taiwanese prisoners with a history of substance use. However, no comparison was possible with the control group on this measure and other comparable measures failed to produce significant results, perhaps due to the shortness of the intervention and the limited sample size ( $n = 24$ ). A series of studies carried out by Bowen and colleagues at North Rehabilitation Facility, Seattle, assessed the effectiveness of a Vipassana meditation program for inmates with prior substance use problems. The main study (Bowen et al., 2006) reported reductions in post-release drug use for three substances and a decrease in alcohol-related problems. The study also found improvements in psychosocial functioning, which, the authors note, is of interest due to "the high prevalence of co-occurring disorders in incarcerated populations" (Bowen et al., 2006, p. 346). Additional studies at the North Rehabilitation Facility showed significant reductions in substance use, even for inmates with comorbid PTSD symptoms (Simpson et al., 2007). Similarly, Bowen, Witkiewitz, Dillworth, and Marlatt (2007) found that inmates who had participated in the Vipassana course were better able to deal with unwanted thoughts, which in turn explained the effects of the intervention on drinking and its consequences upon release.

As mentioned above, 14 studies assessed the impact of Vipassana meditation courses. These courses all follow a 10-day intensive program of meditation for around 10 hr a day. The course engages participants in a "strict schedule" during which they must refrain from communicating for the first 9 days (Perelman et al., 2012), encouraging a state of deep reflection. Perelman et al. (2012) attempted to measure the underlying changes that meditation can provoke, finding that participants on a Vipassana course improved their levels of mindfulness and emotional intelligence. Further studies of Vipassana courses have found reductions in anxiety and depression, and short-term increase in hopefulness



**Figure 2.** Prison yoga and meditation: Psychological well-being.

(Chandiramani, Verma, & Dhar, 1995), as well as reductions in criminal propensity and improvements on subjective well-being measures (Khurana & Dhar, 2002).

In summary, research into yoga and meditation programs in prison is still in its early stages. Although recent reviews have criticised these studies for poor methodological quality (Shonin et al., 2013), experimental research in prisons is very difficult to carry out in practice. Research studies need to be mindful of the social ecology of prison wings. So far, studies show promise and, most importantly, are distinct from many rehabilitative programs that are often deficit-orientated. Furthermore, as Lyons and Cantrell (2015) pointed out, it could be that through the establishment of yoga and meditation groups in prison, individuals could connect to the social capital of others practicing in the community upon release.

**Meta-Analysis**

Of the 24 records that met our inclusion criteria for the systematic review, 12 articles (reporting a total of 13 studies)<sup>5</sup> contained the necessary data for inclusion in the quantitative analysis (meta-analysis). Seven records were excluded from the quantitative analysis because they did not include a control or comparison group.

**Participation in Prison Yoga Programs and Psychological Well-Being: Effect Sizes**

There were nine studies reporting data on the association between participating in a prison yoga program and psychological well-being. The effect size for these studies was as follows: Cohen’s *d* = 0.46; 95% CI = [0.39, 0.54]. All but one of the studies produced a significant effect size (see forest plot, Figure 2). The size of *d* suggests that participants who completed a yoga or meditation program in prison experienced a moderate increase in their psychological well-being (J. Cohen, 1988).

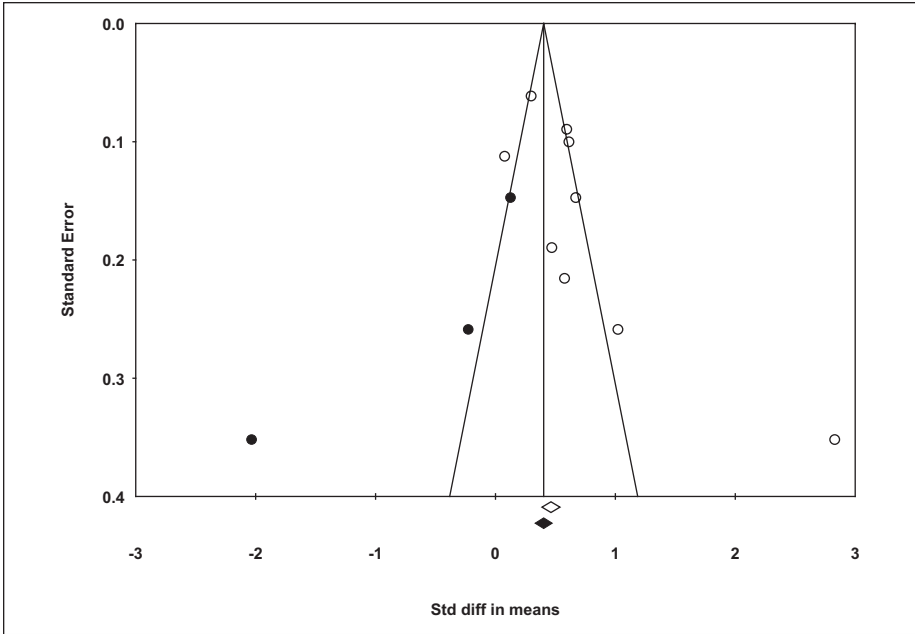
### ***Participation in Prison Yoga Programs and Psychological Well-Being: Moderator Analyses***

Despite each individual study producing a significant effect size suggesting that participation in prison yoga programs led to increased psychological well-being post-intervention, the forest plot revealed that the effect size varied considerably among the studies, indicating substantial heterogeneity. Moderator analyses were carried out to see if they could explain this variability ( $Q = 75.22, p = .004, I^2 = 82.85$ ). A variable to denote whether the program was a yoga and/or meditation program of low frequency and long duration or high frequency and short duration was included as a moderator. The results revealed that the less intensive but longer duration programs had a non-significant larger effect on the psychological well-being of prisoners ( $d = 0.73$ ), when compared with more intensive programs of shorter duration ( $d = 0.65$ ).

### ***Participation in Prison Yoga Programs and Psychological Well-Being: Publication Bias Analyses***

Several publication bias analyses were carried out to investigate any possible biasing influence on the summary effect size in the sample of studies in our meta-analysis. First, we used Duval and Tweedie's (2000a, 2000b) trim-and-fill procedure. This iterative procedure produces the best estimate of the unbiased effect size by removing the most extreme small studies until the funnel plot is symmetrical around an adjusted effect size and then inserts them back into the analysis to correct the variance (Borenstein et al., 2011). The funnel plot that is produced shows imputed studies (in black) and an adjusted effect size (the black diamond), which can be assessed visually. The funnel plot produced by our analysis (see Figure 3) reveals three imputed effect sizes and a small overestimation of the summary effect size is also suggested. For the random-effects model, the point estimate and 95% CI for the eight studies is 0.68 (95% CI = [0.43, 0.94]). Using the Trim and Fill procedure, the imputed point estimate is 0.42 (95% CI = [0.14, 0.70]). Egger's test for bias (Egger et al., 1997) suggested some funnel plot asymmetry (bias coefficient 4.18, 95% CI = [ $<0.01$ , 8.36],  $p = .05$ ), which indicates biasing factors such as selective outcome reporting.

The Begg and Mazumdar (1994) test statistic computes an adjusted rank correlation (Kendall's tau-b) between the effect size and the standard error. In our meta-analysis, Kendall's tau-b correlation coefficient is  $\tau_b = .30556$  ( $p = .13$ , one-tailed; .13, two-tailed) corrected for ties. Rosenthal's Fail-Safe  $N$  test addresses the concern that studies with small effects might be missing from the meta-analysis and calculates how many studies would need to be found before the  $p$  value became not significant, with higher numbers being preferred. In our meta-analysis of 9 studies ( $z$  value = 13.38;  $p = <.001$ , two-tailed) the fail-safe  $N$  is 411, so there would need to be 411 studies with an effect size of zero to make our  $p$  value exceed .05. In summary, the sensitivity tests indicate that there is a little publication bias in our meta-analysis.



**Figure 3.** Funnel plot of standard error by standard difference in means.

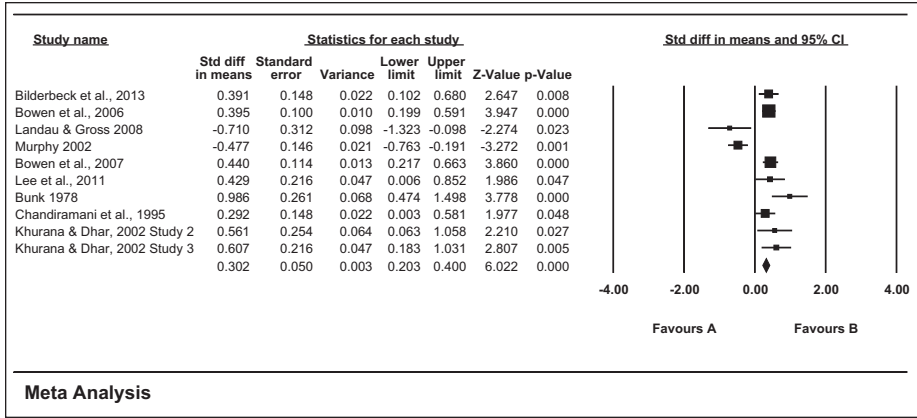
### *Participation in Prison Yoga Programs and Behavioural Functioning: Effect Sizes*

There were 10 studies reporting data on participation in yoga programs and the behavioural functioning of participants. The overall effect size across these studies was (Cohen's  $d = 0.30$ ; 95% CI = [0.20, 0.40]). The effect size varied across the individual studies, as shown in the forest plot (Figure 4). The size of  $d$  means that participants who completed yoga programs in prison experienced a small increase in their behavioural functioning.

### *Participation in Prison Yoga Programs and Psychological Well-Being: Moderator and Publication Bias Analyses*

The same moderators were included in the analysis to see if they could account for the heterogeneity in effect sizes. ( $Q = 54.61$ ,  $p = .004$ ,  $I^2 = 82.84$ ). The results revealed that the less intensive but longer duration programs had a statistically significant effect on the behavioural functioning of prisoners ( $d = 0.42$ ), when compared with more intensive programs of shorter duration ( $d = 0.41$ ).

Tests of publication bias suggested a minimal level of bias was present; for Duval and Tweedie's trim-and-fill procedure, the funnel plot had only two imputed studies



**Figure 4.** Prison yoga and meditation: Behavioural functioning.

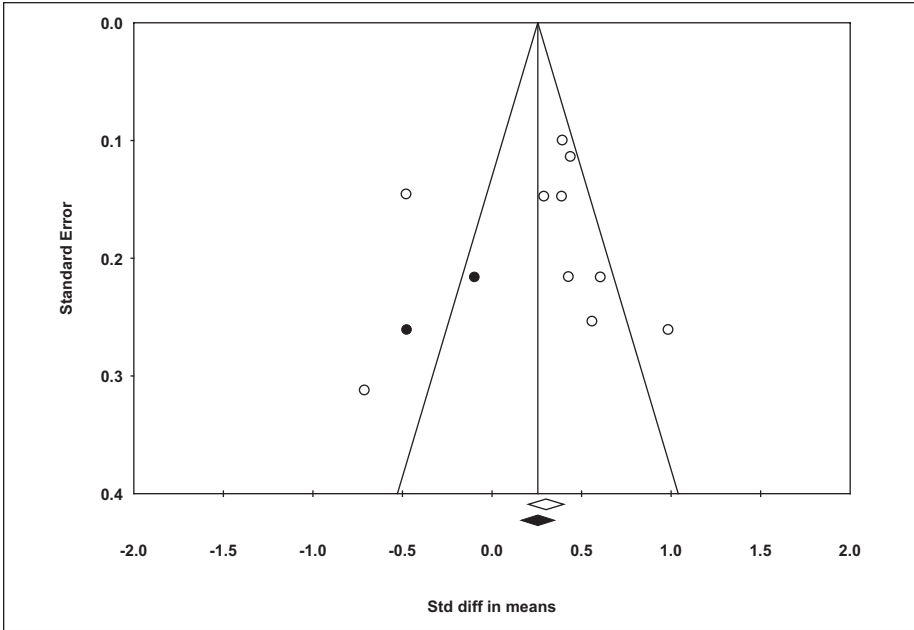
and suggested a little bias (see Figure 5). For the random-effects model, the point estimate and 95% CI for the 8 studies is 0.30 (95% CI = [0.09, 0.57]). Using the Trim and Fill procedure, the imputed point estimate is 0.25 (95% CI = [0.02, 0.28]). Rosenthal’s Fail-Safe *N* is 100, meaning that there would need to be 100 eligible studies showing no effect for the *p* value of this meta-analysis to be rendered non-significant. The results of the Begg and Mazumdar (1994) rank correlation test (Kendall’s tau-*b* correlation coefficient are  $\tau_b = .31$ ;  $p = .13$ , one-tailed; .13, two-tailed) corrected for ties. In summary, the sensitivity tests indicate that there is a little publication bias in this meta-analysis.

## Discussion

Overall, the results from this systematic review and meta-analysis suggest that yoga and meditation programs in prison settings have some positive benefits for participants’ psychological well-being and behavioural functioning. This corresponds with findings from several recent narrative reviews of yoga and meditation programs (Fix & Fix, 2013; Himelstein, 2011a; Lyons & Cantrell, 2015; Shonin et al., 2013) that identify several potential benefits. Furthermore, in this study a larger effect size was demonstrated for psychological well-being (Cohen’s *d* = 0.46), compared with behavioural functioning (*d* = 0.30). This finding could be explained by evidence that yoga and meditation have a more immediate positive effect on brain functioning (Tang et al., 2007; Zylowska et al., 2008) and effects on behaviour, although detectible, may require a longer follow-up period.

The results of our moderator analyses produced a significant difference in effect sizes for programs of longer duration and less intensity, when compared with those that were shorter but more intensive for psychological well-being. This suggests that while programs of longer duration had larger effects on psychological well-being compared with





**Figure 5.** Funnel plot standard error by standard difference in means.

intensive programs, this observed difference was not statistically significant. A significant difference in effect sizes was observed for behavioural functioning, with programs of longer duration having a slightly larger positive effect on behavioural functioning ( $d = 0.42$ ), compared with more intensive programs ( $d = 0.42$ ). This finding supports the previous one as it also suggests that the effects of yoga and meditation programs on behavioural functioning are likely to occur over a longer period rather than a shorter one.

The robustness of the finding that yoga and meditation programs have a modest positive effect on the psychological well-being and behavioural functioning of prisoners is reinforced by evidence of consistent positive findings in varied cultural settings; approximately half of the studies were of Western (U.S. and U.K.) prison samples, with the rest of the studies coming from samples of prisoners in India and Taiwan. Prison culture and conditions are known to vary greatly in different countries, so it is interesting to note the homogeneity of findings in light of the variety of national studies. Furthermore, within this national variation, a range of institutional settings were represented, for example, young offenders, female, male, and substance misuse facilities. Some studies suggest that yoga and meditation programs may have particular benefits for substance misusing offenders (Perelman et al., 2012); unfortunately, it was beyond the scope of this analysis to investigate this, but future work should focus on whether particular groups of prisoners benefit most from yoga and meditation.

This study does have some important limitations. When interpreting the findings from this study, it should be borne in mind that while the studies in the meta-analysis

satisfied our criteria for inclusion, many of them had shortcomings with regard to methodological rigour. This follows findings of several other systematic reviews of yoga and meditation programs in other contexts (Balasubramaniam et al., 2013; Field, 2011; Sharma et al., 2012; Uebelacker et al., 2010). To summarise, too few studies utilised large samples or assigned studies randomly to treatment or control conditions. The follow-up periods of the majority of studies was less than 1 year and attrition was a recurring problem due to the nature of the sample. Several unestablished scales were used in some of the older studies; however, this was less of an issue in more recent research studies.

Several of the studies in this meta-analysis reported data for several different outcomes. Following Borenstein et al. (2011), multiple outcomes were grouped into our two broader outcomes, psychological well-being and behavioural functioning. While the measures are diverse for the behavioural functioning outcome, this broad range of measures was grouped together when there was a functional link between the outcome and behaviour that was likely to lead to criminal reoffending (i.e., alcohol use or impulse control). Empirical evidence suggests that a diverse range of behaviours reflect common, underlying core psychopathological processes (externalising behaviour, see Hicks, Krueger, Iacono, McGue, & Patrick, 2004; Krueger, 1999; Krueger, Caspi, Moffitt, & Silva, 1998).

The tests for publication bias revealed some evidence that study results were weighted somewhat in favour of positive findings, both in the case of psychological well-being and behavioural functioning. However, this study included unpublished work in the form of master's and PhD theses ( $n = 2$ ), yet both of these also reported positive effects on the outcomes. Furthermore, other reviews have noted that adverse effects from yoga interventions are rarely observed (Balasubramaniam et al., 2013). Previous research studies of yoga and meditation programs in prison settings may have been rejected by journal editors due to the "New Age" connotations of, or prejudice against, these practices. Despite yoga and meditation being fairly commonplace in the Western world, there is still a certain amount of scepticism surrounding the benefits of these methods. Most recently, yoga is becoming increasingly integrated into sport science and, alongside other aerobic, balance, and stretching exercises, it is recommended by the National Institute for Clinical Excellence as a treatment for multiple sclerosis (MS)-related fatigue (National Institute for Health and Care Excellence [NICE], 2014).

The results of this systematic review and meta-analysis show the significant potential and suitability of yoga and meditation for use in a prison setting. As psychological well-being and behavioural functioning of prisoners are positively affected, yoga and meditation could contribute significantly to improving prisoner quality of life, prison culture, and outcomes. However, the results from this meta-analysis support the introduction and extension of current prison yoga programs.

While we acknowledge the difficulty and appropriateness of conducting randomized controlled trials and studies of similar methodological rigour in prison settings, ideally the next step in this area of practice would be to conduct studies with more robust designs, of different prison populations, with longer follow-up periods, and

making use of standardised assessment tools. Currently, there is sufficient evidence to date to suggest that yoga and meditation practices have promising effects on prison populations.

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### Notes

1. The review protocol was registered in PROSPERO International Prospective Register of Systematic Reviews ([crd.york.ac.uk/PROSPERO/DisplayPDF.php?ID=CRD42013004680](http://crd.york.ac.uk/PROSPERO/DisplayPDF.php?ID=CRD42013004680))
2. One publication (Khurana & Dhar, 2002) reports findings from several studies of different populations. Two of these studies met the criteria for inclusion in the meta-analysis.
3. These supplementary tables are available from the corresponding author.
4. The standardised mean difference (Cohen's *d*) is considered comparable across studies (see Borenstein, Hedges, Higgins, & Rothstein, 2011, for a discussion). For studies that report correlations (between two continuous variables), the effect size would be expressed as Pearson's *r*. See Borenstein et al. (2011).
5. One publication (Khurana & Dhar, 2002) reported findings from several studies, two of which met the criteria for inclusion in the meta-analysis.

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