Mindfulness Therapies in the Management of Epilepsy

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Declaration

This dissertation contains no material which has been accepted for the award of any other degree or diploma in any University, and, to the best of my knowledge, contains no materials previously published except where due reference is made.

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Author Contributions

TM was responsible for study design, data collection, analysis and interpretation and manuscript drafts; DD contributed to study design and assisted with data interpretation, manuscript draft and revisions. Both authors read and approved the final manuscript.

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Mindfulness Therapies for Epilepsy: A Systematic Review of Randomised Controlled Trials

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CRediT Authorship Contribution Statement

TM: Conceptualisation, Methodology, Data curation, Formal Analysis, Writing – original draft preparation

Disclosures and Acknowledgements

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This article is intended for submission to *Rehabilitation Psychology,* which adheres to the APA reference style. The attached article meets the thesis requirement of 6,000 to 8,000 words but will be condensed when submitted for publication, to meet the 35-page limit for *Rehabilitation Psychology* (including references, tables, figures)

Abstract

Purpose/Objective: Mental health comorbidities are frequent and severe for people with epilepsy. Although psychological interventions, such as mindfulness, have been piloted questions about their effectiveness and potential adverse effects of regular mindful practice remain. This review provides an up-to-date evaluation of controlled research in this area.

Methods: The Embase, PsycINFO, PubMed, Scopus and Web of Science databases were searched for mindfulness studies that evaluated psychological outcomes in adults with epilepsy. The reporting quality of retrieved studies was assessed (*QualSyst* tool) and standardised mean group differences (Hedges' g), with 95% confidence intervals and p values calculated. The results were narratively synthesised.

Results: Eight randomised controlled trials ($N_{participants}$= 783), primarily involving adults with generalised onset seizures, were included. All studies had sound methodological quality. A combination of group and individual mindfulness therapies delivered face-to-face, via telephone and/or online, were examined. Medium to very large gains across psychological outcomes were associated with Mindfulness-Based Cognitive Therapy and Acceptance and Commitment Therapy ($g$range= 2.417 to 0.232, p <.05). Continued improvements in quality of life were reported at 12-month follow-up ($g$range= .269 to 1.58). Although no adverse effects of mindfulness were noted, these data were not routinely reported ($N_{studies}$= 3).

Conclusions: There is preliminary evidence to suggest that mindfulness can bring positive psychological effects for people living with epilepsy. Future controlled trials are needed to clarify the facilitating effects of mindfulness therapies in the seizure process as well as practical issues surrounding their implementation and delivery across clinical settings.

Keywords Systematic review, Mindfulness, Epilepsy, Mental health, Adults

Impact Statement

Impact and Implications

- Preliminary evidence suggests that Mindfulness Based Cognitive Therapy and Acceptance and Commitment Therapy are superior to waitlist or usual treatment in addressing depressive and anxiety symptoms among adults with chronic epilepsy.
- Group-based mindfulness programs provide a valuable opportunity for peer learning, potentially improving self-confidence and self-management of epilepsy.
- Examination of potential adverse effects of mindfulness is needed to better understand the range of experiences that people can have when they mediate

Introduction

Epilepsy: Definition, Aetiology, Epidemiology, Impairment

Epilepsy is a chronic, non-communicable neurological disorder that affects all ages and causes recurrent and unprovoked seizures. Seizures may have a focal (i.e., involving one area of the brain) or generalised onset (i.e., seizure spreads to both parts of the brain) and, depending on severity, may incur unconsciousness and/or disturbances in awareness, sensation (i.e., vision, hearing) or mood (Gavvala & Schuele, 2016; Katyayan & Diaz-Medina, 2021; World Health Organisation, 2019; WHO). According to the International League Against Epilepsy (ILAE), an epilepsy diagnosis is dependent on any of the following conditions being present: (1) occurrence of at least two unprovoked seizures occurring more than 24 hours apart; (2) occurrence of one unprovoked seizure and the likelihood of further seizures occurring over the next 10 years; and/or (3) confirmed medical diagnosis of an epilepsy syndrome, or cluster of features (e.g., age of onset, brain imaging findings, electroencephalogram (EEG) patterns etc; Fisher et al., 2014).

The aetiology of epilepsy is highly variable, with structural (e.g., pre or perinatal brain damage, brain tumour), genetic (i.e., phenylketonuria), infectious (e.g., meningitis), metabolic (e.g., mitochondrial disease) and immunological (e.g., systemic lupus) factors all implicated. In one half of cases, the cause of the disorder is unknown, due to insufficient information to classify the epilepsy (e.g., EEG is normal/uninformative; Beghi, 2020; Miller & Goodkin, 2014; Ridsdale, 2018; WHO, 2019).

Epilepsy is also highly prevalent; currently ranked as the second most burdensome neurological disorder when concerning disability-adjusted life years (Beghi et al., 2019). Globally, approximately five million people are diagnosed with epilepsy each year whilst the proportion of individuals with active epilepsy (i.e., ongoing seizures or the need for treatment) ranges between 4 and 10 per 1000 people (WHO, 2019). The prevalence of epilepsy is higher in developing (139 per 100 000 people) than high-income countries (49 per 100 000 people; Beghi, et al., 2019; WHO, 2019). This figure likely reflects economic and social differences, with low-income populations typically experiencing higher rates of central nervous system infections, perinatal injury, traumatic brain injury and limited access to healthcare (Espinosa-Jovel et al., 2018). Notably, epilepsy carries a greater risk of premature mortality in patients aged less than 50 years in developing countries (Espinosa-Jovel et al., 2018). Additionally, gender differences in the incidence of epilepsy have been noted, with females having a marginally lower incidence than males. This heightened risk is potentially attributed to males having greater exposure to risk factors (e.g., cerebrovascular disease, head trauma, alcohol-related seizures; Fiest et al., 2017).

Resulting impairments of epilepsy are dependent on the localisation and severity of disturbance in the brain. Disturbances may involve relatively benign seizures of minimal frequency but also recurrent, debilitating and even life-threatening events (Blum, 1999). Up to 75% of this patient group will experience seizure-related physical

injuries and hospitalisations, reduced mobility, cognitive difficulties (e.g., problems with attention, concentration, memory, learning), lower academic achievement in comparison to 'healthy' peers, as well as social stigmatisation and isolation (Elger & Hoppe, 2011; Hermann & Jacoby, 2009; Wo et al., 2017).

More recently, psychological comorbidities have been recognised as a significant aspect of epilepsy management, necessitating an emphasis on the maintenance of quality of life between seizures (Vaurio et al., 2016; Stafstrom & Carmant, 2015). Epidemiological studies have found a high prevalence of depression and anxiety in this patient group (Khalid & Aslam, 2011; Wood et al., 2017). Up to 30% of adults with epilepsy are diagnosed with a Major Depressive Disorder over their lifetime (Kanner, 2013; Stafstrom & Carmant, 2015). Approximately 50% will have a depressive episode following their first seizure, with this number increasing to 70% after the second and 90% after the occurrence of a third seizure (Kanner, 2013). Closely followed are anxiety disorders (20% over their lifetime; Scott et al., 2017). Depression and anxiety are also associated with suicide and suicidal ideation. Concerningly, up to 25% of individuals with epilepsy will experience suicidal ideation at some point (Hermann & Jacoby, 2009; Khalid & Aslam, 2011; Wood, et al., 2017). A bi-directional relationship appears to exists, with epilepsy mediating the development of psychological symptoms through chronic stress exposure, which, in turn, increases the potential risk of seizure occurrence and so forth (Fiest et al., 2013). Minimising the psychological burden of epilepsy is therefore a key goal of rehabilitation (Walker et al., 2012).

Epilepsy Treatment and Management

Epilepsy is highly treatable, with up to 80% of people experiencing prolonged periods of seizure remission with the appropriate medication (Beghi, 2020). Contemporary anticonvulsant medications, considered the frontline treatment for epilepsy, have been

shown to reduce or eliminate seizure frequency in 60-70% of cases (Brown, 2016). However, lifelong medication treatment is typically required (Beghi, 2016). Documented side effects of prolonged pharmacological treatment are also significant – more commonly dizziness, fatigue, movement and behavioural disorders, memory issues, poor concentration, weight gain or loss, insomnia and blurred vision (Vaurio et al., 2016; Walia et al., 2004). Medication treatment resistance, or the failure of two appropriately chosen anticonvulsant medication trials (whether as monotherapy or in combination) to achieve sustained seizure freedom, has additionally been observed (Bushra et al., 2021). Moreover, non-adherence to medication is seen in up to 20% of individuals with intractable epilepsy (Bushra et al., 2021; Vaurio et al., 2016). An added concern is access to modern medication, which may be difficult for low socioeconomic communities (Lundgren et al., 2008b).

Given the high prevalence and impact of epilepsy, coupled with the aforementioned difficulties in medical treatment, recent advances in psychological treatments have been pursued. In particular, mindfulness therapies have been increasingly recognised as playing a critical role in the management of epilepsy and its accompanying mental health comorbidities. The suggestion is that mindfulness offers a behavioural and holistic approach to managing this chronic health condition (Wood et al., 2017).

Mindfulness Interventions and Epilepsy

The term 'mindfulness' broadly refers to the practice of mental meditation whereby an individuals' attention is controlled to focus on the present moment in a non-judgmental and accepting way (Leeman-Markowski & Schachter, 2017). Mindfulness-based Interventions (MBIs) typically include a variety of meditation practices (e.g., body scan, mindful movement). Traditional forms of MBI include Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1982) and Mindfulness-Based Cognitive Therapy (MBCT;

Teasdale et al., 1995). MBIs have also been incorporated within other psychotherapy frameworks to create mindfulness-informed interventions (Shapero et al., 2018). Of these, Acceptance and Commitment Therapy (ACT; Hayes, 1987) and Dialectical Behavioural Therapy (DBT; Linehan et al., 1991) are most prominent.

Therapies such as MBSR and MBCT can help patients living with epilepsy to increase awareness and understanding of their thoughts, feelings and gestures towards their disorder. More specifically, individuals are taught that their illness thoughts are not necessarily factual as well as how to disengage from these negative thoughts in order to manage their distress (Keng et al., 2011). MBSR and MBCT follow a similar structure. Both approaches were developed as intensive group-based interventions, involving weekly 1.5 to 2-hour sessions delivered over two months (Kabat-Zinn, 1982; Teasdale et al., 1995). The small group format, with therapy delivered for up to 10 to 15 individuals at a time, is seen to encourage and facilitate peer support (Kabat-Zinn, 1982; Teasdale et al., 1995). This group work is supplemented with 45 minutes of individual, daily home practice (Kabat-Zinn, 1982; Teasdale et al., 1995).

Evidence for the effectiveness of MBSR for persons with epilepsy is, however, lacking – despite the neuroscience literature highlighting the importance of reducing perceived stress, as a seizure trigger (Novakova et al., 2013). In relation to MBCT, the available data are mixed. In their systematic review of three randomised controlled trails, Wood et al. (2017) found limited evidence for the effectiveness of MBCT. Importantly additional studies have since been published which can add to the evidence base. As an example, Mohamadpour and colleagues (2017) identified significant differences in favour of MBCT for anxiety and self-efficacy, compared to peers that received usual medical care. However, follow-up assessments were not incorporated into their study design hence continued treatment effects over time could not be determined. In one of the largest randomised control trials involving 404 individuals with epilepsy (205 MBCT versus 199 treatment as usual), no significant pre-post change

in quality of life ratings were noted by MBCT participants (Ridsdale et al., 2018). In this same study, however, many found it difficult to attend the two full-day program, suggesting that modifications to the sizeable time commitment required for MBCT are needed to promote treatment engagement and adherence. Indeed, MBCT has been successfully modified for epilepsy populations, typically by reducing the duration of individual sessions (e.g., from 2 hours to 1 hour; Hum et al., 2019). The efficacy of telephone-delivered MBCT has also been endorsed, suggesting that distance delivery is not only feasible but may help to improve access to mental health care (Hum et al., 2019).

The importance of ACT in improving psychological outcomes in epilepsy populations has also received attention. The goal of ACT is to encourage individuals to accept their susceptibility to experience seizures while also accepting any fears, thoughts and memories associated with their disorder (Hayes, 1987). For those with epilepsy, a further ACT goal is to discriminate intrinsic and extrinsic factors associated with seizure onset in order to manage seizure response (Lundgren, 2011; Lundgren et al., 2006). To achieve this, collaborative therapeutic goals are formulated by the therapist and client (Lundgren, 2011). ACT can be flexibly delivered, with both group and individual sessions trialed for persons with epilepsy, resulting in varied degrees of clinician contact: from 12 hours over 4-8 weeks to 20 sessions over 10 to 20 weeks (Alipour, 2019; Dewhurst et al., 2015; Lundgren et al., 2006, 2008b).

Early evidence for ACT in epilepsy management is promising. This includes a series of studies conducted by Lundgren and colleagues (2006, 2008b) involving outpatient populations. Greater improvements in quality of life ratings and seizure frequency were noted by ACT participants, compared to those who received four weeks of supportive therapy (Lundgren et al., 2006). However, group rating across psychological outcomes were comparable for ACT and yoga participants (Lundgren et al., 2008b). This latter finding may be attributed to the similarity of the examined

conditions, with both ACT and yoga both involving mindfulness training alongside other therapy components, such as the inclusion of significant others (e.g., family members) in sessions. These findings do, however, highlight a need to explore context factors, namely the comparison group utilised, when examining the effects of a psychotherapy such as ACT (Enck & Zipfel, 2019). Finally, Dewhurst and colleagues (2015) evaluated the feasibility of ACT for patients with refractory epilepsy using an uncontrolled design. They identified medium to large improvements for depression, anxiety, quality of life and self-esteem – although no significant differences in physical health and functioning, such as seizure frequency. The authors proposed that ACT may be more beneficial to psychosocial than physical functioning (Dewhurst et al., 2015). Whilst promising, the large mean effect estimates may reflect participants' positive (inflated) expectations about ACT as a psychological intervention.

Finally, mindfulness protocols that integrate multiple theoretical frameworks have been trialed to identify and manage seizure triggers (both internal and external), and, ultimately, reduce the likelihood of developing a seizure (Tang et al., 2015). Such interventions are, however, highly variable in their content, duration and delivery. For example, a 5-day intensive program developed by Reiter and Andrews (2000) included a combination of mindfulness-based skills (i.e., relaxation training, cognitive restructuring, biofeedback) delivered individually in four, hour long sessions. They observed reductions in seizure frequency and quality of life improvements for each of their 11 case studies. Whilst this study approach was suitable to evaluate their novel program-based service 'Taking Control of You Epilepsy: A Workbook for Patients and Professionals' in a real-life context, it was unable to answer research questions on intervention effectiveness. In contrast, Tang and colleagues (2015) used a randomised controlled design to evaluate a group-based mindfulness program. Their intervention incorporated mindfulness techniques in conjunction with the concept of accepting seizure-related disturbances and an educational package about epilepsy (i.e.,

aetiological factors, types of seizures, drug adherence). Significantly greater improvement in depressive and anxiety symptoms and seizure frequency were observed in comparison to a social support control condition, although both groups also incurred improvements in quality of life simultaneously (Tang et al., 2015). These findings highlight the flexibility of mindfulness as a psychological treatment, with multiple strategies and frameworks able to be integrated to inform one intervention. In saying this, the comparability of the aforementioned results is limited due to differences in study design and methodology. There remains a need, then, for epilepsy studies to directly compare the effects of specific mindfulness interventions using high-quality, randomised controlled studies across the same set of outcome measures.

Adverse Effects of Mindfulness

Controversy surrounds the safety of mindfulness in the treatment of mental health disorders in epilepsy, with potential for meditation training to induce adverse events – such as seizures (Wood et al., 2017). From a neurological standpoint, the impact of meditation on altering brain states has been of interest for decades (Donaldson & Fenwick, 1982; Jaseja, 2005; Persinger, 1993). Individual case studies have observed that meditation facilitates the firing of neurons in brain areas that are frequently involved in seizure generation (Jaseja, 2005, 2006; Lindsay, 2014). Indeed, Persinger (1993) observed an increase in complex focal epilepsy experiences in their randomised controlled trial involving 221 meditators and 860 non-meditators. Regular practice of meditation may induce epileptic seizures rather than reduce them by "training" neurons to fire within this same fashion (Jaseja, 2006). In their systematic review of this literature, Wong and colleagues (2018) also observed an increase in depression and anxiety ratings among chronic pain patients immediately following MBSR. While multiple factors could contribute to such incidents – especially prior psychiatric morbidity (for a review see Wielgosz et al., 2019), Wong et al.'s (2018) do highlight the

psychological vulnerabilities that patients face when exploring their inner experiences as well as the importance of having access to appropriate psychotherapeutic supports. The aforementioned findings also confirm the need for formal reporting systems for adverse events or effects in psychotherapy research.

Current Study

Mindfulness is an empirically supported psychotherapy which offers promise for patients living with a chronic illness, such as epilepsy. To date, however, the epilepsy literature has produced mixed results for the effectiveness and safety of mindfulness in managing psychological outcomes. This is partly due to epilepsy being a heterogeneous disorder characterised by individual differences in cause, frequency and severity, paired with the high degree of variability in the type, structure and format of available mindfulness frameworks. The available data also need to be interpreted in consideration of the varied format and structure in which mindfulness is delivered.

The current study addresses these research gaps by systematically reviewing available quantitative evidence on the effectiveness of mindfulness-based and mindfulness-informed interventions in managing epilepsy in adult populations, relative to control or comparison conditions. This review extends on the findings of Wood et al. (2017) with the inclusion of additional controlled studies. The aims were threefold:

1. To evaluate the reporting quality of available mindfulness trials conducted with the adult epilepsy population.
2. To examine group differences (if any) in psychological outcomes associated with mindfulness, in comparison to control or comparison conditions. This includes group differences immediately post-mindfulness (i.e., short-term effects) and whether these intervention effects are sustained over time (i.e., at follow-up).
3. To summarise reported adverse effects (if any) resulting from the implementation of mindfulness interventions in this cohort.

Method

Literature Search

In addition to the Google search engine, eligible articles were identified via Embase, PsycINFO, PubMed, Scopus, Web of Science. These electronic databases were searched from inception until 26 February 2021, with bi-monthly alerts activated for each until 1 September 2021. Search terms were tailored to each database, with assistance from two expert Research Librarians. This included a combination of terms relating to epilepsy (e.g., 'seizure disorder') and mindfulness (e.g., acceptance and commitment therapy') (see Appendix A). Additionally, the reference lists of all included studies, in addition to Wood et al's. (2017) systematic review of three mindfulness-based trials, were hand searched. Finally, Scopus citation searching was performed to capture any additional research not retrieved by the initial electronic search strategy. This process did not identify any new articles.

Study Eligibility and Selection

Study screening was undertaken by the author using Endnote X8.2 version software (Clarivate Analytics), using the guidelines outlined by Peters (2017). As per the review protocol (PROSPERO database registration no. CRD42021269882), only journal articles published in the English language, or with English translation available, were eligible for inclusion. In addition studies had to meet the following PICO-D criteria (Population, Intervention, Comparison, Outcome, Design):

Population. Eligible studies needed to recruit a sample of adults (ages ≥ 18 years) with clinically diagnosed epilepsy, as determined by self-reported information (e.g., symptom checklist) or medical diagnosis. Studies that examined a heterogeneous group of people

with chronic illnesses or disabilities, but did not provide outcome data for those with epilepsy separately, were excluded.

Intervention. Studies had to evaluate one of the following recognised therapy models that incorporate mindfulness practice: Mindfulness-based Cognitive Therapy (MBCT; Teasdale et al., 1995), Mindfulness-based Stress Reduction (MBSR; Kabat-Zinn, 1982), Acceptance and Commitment Therapy (ACT; Hayes, 1987), or Dialectical Behaviour Therapy (DBT; Linehan et al., 1991). The intervention had to be delivered by a trained practitioner (e.g., psychologist, psychiatrist, nurse, meditation teacher) using individual and/or group format and involving some therapist-client interaction, whether face-to-face, via telephone or online chat.

Comparison. Mindfulness could be compared to an inactive (e.g., waitlist) or active treatment (e.g., self-management educational program, supportive counselling).

Outcome. Studies had to administer an established self-reported or clinician-based psychological measure (i.e., depression, anxiety, stress, distress, quality of life) both pre- and post-intervention.

Design. Only randomised controlled trial designs, considered to represent the 'gold standard' for treatment efficacy studies, were eligible for inclusion (Hariton & Locascio, 2018). Non-experimental (i.e., single group) designs were excluded as they can introduce validity concerns and inflate treatment effects in psychotherapy (Hariton & Locascio, 2018). Studies were also required to provide sufficient quantitative data (e.g., group means and standard deviations pre-and post-intervention) to permit the calculation of effect sizes (Hedges' *g*). Qualitative studies (e.g., case studies, ethnographic, discourse analysis) were therefore excluded. Conference abstracts or

poster presentations were also ineligible as the focus was on primary, peer reviewed quantitative data.

Study screening was undertaken by the author. To ensure reliability of the selection process, a subset of 30 studies randomly selected by the author were screened against the eligibility criteria by an independent researcher (a postgraduate psychology student), with good inter-rater agreement (75%). Discrepancies between the reviewers were resolved by consensus discussion.

Data Collection and Preparation

Consistent with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA; Page et al., 2020 and Appendix B), key information was extracted from eligible studies using a pre-piloted Microsoft Excel sheet. These data included: study characteristics (e.g., country, recruitment source); sample demographics (e.g., age, gender); epilepsy characteristics (e.g., seizure frequency); intervention characteristics (e.g., form and duration of mindfulness) and data to allow the calculation of standardised mean group differences (i.e., group means, SDs at each assessment time point). Two of three authors responded to requests for additional information (Tang et al., 2015; Walker et al., 2012). Some data conversion was required: standard deviations were obtained from standard errors for Hum et al., 2019 and least squares means were adjusted to means for Thompson et al's (2015) trial of MBCT (Higgins & Green, 2011).

Study Reporting Quality

Methodological bias was assessed by the author using the *QualSyst* quantitative quality appraisal tool (Kmet et al., 2004). This 14-item tool rates studies on key sources of methodological bias (e.g., adequate description of study objective, appropriate sample size, conclusions supported by results). For each item, studies were rated as 'Yes' (score of 2; sufficiently addressed), 'Partial' (score of 1; partially addressed), or 'No' (score of 0; not applicable). Item scores are summed and then divided by the total possible score (score range: 0-1). The overall proportion of studies meeting each quality rating was additionally calculated.

Statistical Analyses

Statistical data were entered into, and analysed using Comprehensive Meta-Analysis Software (Version 3.0, Englewood, NJL Biostat Inc). The extent to which epilepsy and control/comparison groups differed in psychological ratings was determined by calculating Hedges' *g* (Hedges & Olkin, 1985). To calculate *g*, a pre-post correlation is required. As many studies did not provide this information, a value of .70 was imputed; considered to be a conservative value for studies with a repeated measures design (Estrada et al., 2019). Both immediate (i.e., group mean differences from baseline to post-intervention) and longer-term (i.e., group mean differences from baseline to follow up) effects were calculated. The direction of *g* was standardised so that a positive value reflected improvement with mindfulness therapies, or greater benefit compared to controls: the larger the *g* value, the greater the intervention effect. Ninety-five percent confidence intervals determined the precision of each *g* with statistical significance then examined using *p* values.

Due to significant heterogeneity amongst mindfulness interventions (including mindfulness components, format, delivery), as well as comparison groups and outcome

measures, pooling of effect sizes was not appropriate. Rather, a narrative synthesis was conducted to describe, organise, explore and interpret the study findings, focusing on the impact of mindfulness therapies on psychological symptoms and sequelae of epilepsy. These outcomes were categorised into four domains or constructs: depression, anxiety, quality of life, self-efficacy. The synthesis considered methodological strengths and weaknesses as well as intervention format (i.e., group vs. individual) and delivery medium (i.e., face-to-face vs. telephone vs. online).

Results

Study Selection

The systematic search yielded 7,916 potentially relevant records, of which 881 were duplicates. Titles and abstracts of the remaining 7,035 records were screened against the eligibility criteria. During this screening process, seven studies with overlapping data were identified: two studies led by Lundgren and colleagues (2008a, 2008b), two by Tang et al. (Tang and Hing, 2015; Tang et al., 2015) and three studies by Thompson et al. (2010, 2015) or Walker et al. (2012). The study with the most comprehensive dataset (i.e., data provided on request, or largest epilepsy sample size) was considered the lead study for the purpose of this review. The final sample therefore comprised of eight independent RCTs (see Figure 1).

Study Characteristics

The eight included RCTs were published from 2006 to 2019, and represented seven countries (see Table 1). Aside from three studies based in Iran (Alipour, 2019; Mohamadpour et al., 2015) or South Africa (Lundgren et al., 2006), Western countries featured prominently. Sample sizes varied from pilot trials to multi-centre studies. The

two largest samples (Ridsdale et al., 2018; Thompson et al., 2015) comprised 73% of the overall pooled sample. Recruitment sources included inpatient ($N_{studies}$ = 2) and outpatient epilepsy clinics ($N_{studies}$ = 5) and/or the general population ($N_{studies}$ = 2).

Psychological outcomes were all self-reported. Measures typically included an assessment of quality of life ($N_{studies}$ = 5), operationalised with generic rather than disease-specific instruments (e.g., 26-item WHOQOL-BREF). Symptoms of depression ($N_{studies}$ = 4) and anxiety ($N_{studies}$= 2) were also considered. To a lesser extent, self-efficacy or self-confidence in one's ability to manage life demands was examined (i.e., the 10-item General Self-Efficacy Scale, GSE; $N_{studies}$ = 1). Four studies explicitly evaluated or discussed adverse health events or health changes experienced by trial participants (Lundgren et al., 2006, 2008b; Ridsdale et al., 2018; Tang et al., 2015).

Sample Characteristics

Mindfulness Group

A pooled sample of 383 individuals with an overall mean age of 33 years (SD = 7.66) were assigned to a mindfulness intervention (see Table 2). There was a higher proportion of females (54%) than males (46%) within this group, most of whom reported having generalised onset seizures, or seizures that affect both hemispheres of the brain (Holmes et al., 2004). This pattern is consistent with the broader epilepsy literature: generalised epilepsies, which represent some 20% of all epilepsies, are more common among females (Carlson et al., 2014).

Control Group

Three hundred and sixty-eight individuals with epilepsy were assigned to medical treatment as usual (i.e., antiepileptic or antidepressant medication; $N_{studies}$= 2), a waitlist

control ($N_{studies}$= 2), or an active comparison ($N_{studies}$= 4). The latter included a range of conditions: an epilepsy-specific self-management program, group therapy with a trained therapist, peer support and group-based yoga to teach controlled deep breathing, physical postures, meditation and self-acceptance.

Baseline Comparisons

The intervention and control groups were statistically comparable, on enrollment, on key demographic parameters (age $t(631)= 0.48$, $p = 0.63$; gender $t(716) = 1.60$, $p = 0.11$).

Intervention Characteristics

The most common therapeutic intervention frameworks were MBCT ($N_{studies}$= 4) and ACT ($N_{studies}$= 3). Hum et al. (2015) and Thompson et al. (2015) described their programs as MBCT, with components borrowed from ACT and MBSR, whilst Tang et al. (2015) described their study as a 'mindfulness' intervention without reference to a specific theoretical paradigm. Intensive programs involving 8 weekly sessions were described ($N_{studies}$ = 4), as were shortened interventions involving 15 hours delivered over two days ($N_{studies}$ = 1), 12 hours delivered over five weeks ($N_{studies}$ = 2) or 10 hours delivered over four weeks ($N_{s\ ud\ es}$ = 1). All were delivered by trained health professionals (e.g., psychologist, social worker, mental health worker). Individual sessions typically ranged from one hour to a full-day session (6 hours), with clinician contact time equating to 8-16 hours in total. Participants were provided additional resources to practice and consolidate mindfulness skills at home (e.g., meditation recordings on CDs, videotapes of yoga practices, information leaflets).

Intervention format was similar across studies, although modality varied. Five studies utilised a small group format (i.e., 6 to 12 participants), whilst three included a

combination of individual and group work, consistent with literature demonstrating the effectiveness of both (Schroevers et al., 2016). Six studies conducted their sessions exclusively face-to-face. Hum et al. (2019) and Thompson et al. (2015) delivered MBCT via phone, supplemented with web content.

Four studies modified their interventions to the specific needs of their epilepsy group. This included adapting program content to a cultural context (e.g., altering examples of famous person's with epilepsy to be recognisable to a UK sample; Lundgren et al., 2008b; Ridsdale et al., 2018), or modifying content to include a focus on depression prevention (Thompson et al., 2015). Ridsdale et al. (2018) included trained EEG clinicians as group facilitators to monitor and manage any adverse medical effects (i.e., potential seizures) of their face-to-face mindfulness intervention, whilst Hum et al. (2019) included a lay-person with epilepsy as their support group facilitator. Ridsdale et al. (2018) encouraged participants to have a significant other accompany them to group sessions, to contribute family/carer perspectives to group conversations, whilst Hum et al. (2019) maintained research participation by reducing the duration of their MBCT phone sessions from two hours to one.

Retention was generally high, with participants attending the requisite number of sessions and a low dropout rate of 7.9% (SD= 18.97) reported across all eight studies. Factors associated with loss to follow-up included fewer years in education and more comorbidity (Ridsdale et al., 2018). Other cited reasons for study withdrawal included competing time commitments, poor health, and disinterest ($N_{studies}$= 3). Participants felt that they benefited from the group structure and from listening to the experiences of peers (Lundgren et al., 2006; Ridsdale et al., 2018; Tang et al, 2015). Many also felt that the knowledge they gained improved their ability to self-manage their epilepsy (Hum et al., 2019; Ridsdale et al., 2018; Tang et al., 2015). However, some also had difficulty applying program exercises and strategies at follow-up, without continued guided instruction (Hum et al., 2019).

Study Reporting Quality

The average *QualSyst* score was 0.80 (SD= 0.09, range 0.68 – 0.96) with the majority of studies providing sufficient detail relating to their procedure and statistical analyses (see Figure 2 and Table 3). All studies outlined their research rationale and objectives (*item 1:* 100%) with explicit reference to their study design (*item 2:* 100%) and key sample parameters (e.g., age, gender, seizure type; *item 4:* 75%). Most utilised inpatient populations as their recruitment source, thereby limiting the overall generalisability of their research findings to the broader epilepsy population (*item 3:* 50%). The majority of studies described their process of randomisation in sufficient detail (*item 5:* 63%) although, as is typical in psychotherapy research, it was not possible to blind both investigators and research participants to the intervention under investigation (*item 6:* 25%; *item 7:* 0%; Munder & Barth, 2017). The selection of outcome measures was explained and their psychometric properties reported (*item 8:* 100%). Sample sizes included feasibility and pilot trials, with only half of the studies conducting an a priori or post-hoc power analysis (*item 9:* 50%). Statistical analyses (e.g., group comparisons; *item 10:* 89%) were justified and consistent with each study's focus on treatment effectiveness. Some form of estimated variance was also reported (i.e., SDs, 95% CIs; *item 11: 100%*). Potential sample confounds were controlled by recruiting age and gender matched controls (*item 12:* 38%). Both significant and non-significant findings for all outcomes were described (*item 13:* 100%) and the majority of studies provided an adequate and balanced summary of their findings (*item 14:* 63%). In sum, the included studies attempted to minimise key sources and impacts of methodological bias when designing and implementing their mindfulness interventions, resulting in sound internal and external validity.

Effectiveness of Mindfulness

Short and longer-term effect estimates for individual studies are listed in Tables 4 and 5. Estimates are grouped according to their theoretical framework and outcome measure and rank ordered from largest to smallest *g* for each construct.

MBCT

The effectiveness of MBCT was evaluated by four studies, with three reporting significant improvements in one or more psychological outcomes (Table 4). This included small to very large improvements in self-efficacy, anxiety, depression and quality of life (*g* range = 0.23 to 2.42) compared to waitlisted peers (Mohamadpour et al., 2017) or those receiving treatment as usual (Ridsdale et al., 2018; Thompson et al., 2015). The largest gains were associated with an 8-week face-to-face intervention (Mohamadpour et al., 2017), although the effect estimates for this study were imprecise (i.e., wide CI) – likely due to the study's small sample (*N* = 30). Thompson et al. (2015) reported mixed findings with their combined web and phone-based intervention, including improvements in life satisfaction, as a general quality of life component, but not mental health quality of life or depression specifically. Finally, Hum et al. (2019) reported no change in depression symptom severity among their MBCT group compared to information only or wait-list controls.

Sustained effects of MBCT were examined by two studies with both reporting non-significant, small to medium group differences in quality of life and anxiety at 12-month follow up in comparison to waitlist or usual care (Table 5; Mohamadpour et al., 2017; Ridsdale et al., 2018). Although Mohamadpour et al. (2017) identified a trend towards reduced quality of life scores among their mindfulness group, they also reported marked within-group differences in participants' responses to mindfulness, as suggested by the wide CI.

ACT

Three studies evaluated the effectiveness of ACT, delivered face-to-face, as a psychological treatment for epilepsy, with two identifying very large group differences (Table 4). This included significant improvements in depression symptomology in comparison to no treatment controls for group-based ACT (Alipour, 2019), as well as large improvements in self-reported quality of life when ACT involved a combination of group and individual therapies (Lundgren et al., 2006). Comparable changes in quality of life were noted by ACT and yoga participants (Lundgren et al., 2008b).

Follow-up quality of life data were provided by two studies (Lundgren et al., 2006, 2008b). Only Lundgren et al. (2006) identified sustained or continued effects for their mindfulness group compared to supportive therapy at 12 months. This finding does, however, need to be interpreted cautiously given it was based on a single study, involving 27 participants in total (14 mindfulness, 13 controls).

Mindfulness

A single study evaluated the short-term effects of mindfulness on depression, anxiety and quality of life, noting small and non-significant group differences (Tang et al., 2015). Mindfulness participants benefited to the same degree as peers who received a group-based social support. Follow-up data were not provided by this study.

Adverse Effects

Across all studies, no adverse effects were noted with mindfulness – at least not in the short-term. Where negative psychological effects were reported, these were all at follow-up and none reached statistical significance. Mohamadpour et al. (2017) observed lowered self-efficacy in their MBCT group at 12-months post, compared to wait-listed controls. Small negative effects in quality of life were also observed with

individual and group-based ACT (Lundgren et al., 2008b). Whilst Tang et al. (2015) and Lundgren et al. (2006, 2008b) noted small within-group improvements in seizure control and seizure frequency among their mindfulness and ACT groups, Ridsdale at al. (2018) made a note of *not* classifying seizures as an adverse event, arguing that these are also expected events that can occur with poorly controlled epilepsy. Ridsdale et al. (2018) also reported severe distress among 2.6% of their sample (4/154 participants, 2.6%) – although emphasised that this negative effect was unrelated to their MBCT.

Discussion

This systematic review synthesised the data from eight independent studies, which evaluated the effectiveness of mindfulness-based and mindfulness-informed interventions across inpatient and outpatient settings. Preliminary evidence for MBCT and ACT was found, with both frameworks producing immediate improvements in depression, anxiety and quality of life. Whether effects were maintained over time could not be determined, due to limited follow-up data. There also remains a need to define the frequency, nature and severity of adverse health effects that occur in parallel to or following mindfulness. The findings are critiqued, and implications for future research and practice discussed below.

MBCT

Consistent with broader literature on the psychological benefits of MBCT, persons with chronic epilepsy reported reduced anxiety and depression symptoms, alongside positive self-efficacy and quality of life immediately after MBCT (Hofmann & Gomez, 2017; Mohamadpour et al., 2017; Ridsdale et al., 2018; Thompson et al., 2015) with some benefits to quality of life sustained over time (Ridsdale et al., 2018). However, whilst

MBCT was superior to no treatment (Mohamadpour et al., 2017) and usual care (Thompson et al., 2015; Ridsdale et al., 2018), effects were comparable to disease-specific health education (Hum et al., 2019), highlighting the critical role of education programs in improving patient outcomes (May & Pfaffin, 2005). MBCT delivered via telecommunication technology (i.e., telephone, internet) was also successful (Hum et al., 2019; Thompson et al., 2015). Given that limitations with mobility (i.e., transportation, physical health difficulties) can negatively impact on treatment adherence within this population, flexible treatment delivery options need to be considered (Krumholz, 2009). Reported effect sizes for the telephone trials evaluated by Hum et al., (2019) and Thompson et al., (2015) were, however, much smaller than the large effects associated with face to face MBCT. Distance delivery might therefore be a useful supplement to, but not necessarily a replacement for, face-to-face psychotherapy (Wrede et al., 2020). Clinicians have certainly expressed concerns about the quality of psychotherapy when delivered remotely, including possible negative impact on the quality of care as well as questions about whether a therapeutic relationship can be established (Lattie et al, 2020). Such concerns must be respected and explored, ensuring that new technologies are supported by strong research evidence.

Interestingly, modifications to the structure of traditional MBCT (i.e., from 8 weeks duration to 2 days) still presented favourable outcomes in quality of life (Ridsdale et al., 2018). This is consistent with evidence that abbreviated MBCT can be effective (Burgess et al., 2021). These findings also highlight the importance of tailoring intervention content and delivery to account for sequalae and complications associated with epilepsy (e.g., problems with fatigue, memory). Such modifications are particularly critical for those with recurrent seizures or mood disturbance; a subgroup who may find it difficult not only to remember new information but to also incorporate learnt strategies in practice (Ridsdale et al., 2018).

ACT

Consistent with the guiding principles of ACT, this therapy was associated with positive effects on quality of life and depression symptomology (Bramwell & Richardson, 2018; Dindo et al., 2017; Hacker et al., 2016; Hayes, 1987). Learning to accept one's circumstance can help create a more positive outlook, including flexibility around seizure experiences, with subsequent effects on overall psychological health and quality of life more broadly (Lundgren, 2011). The 12-month follow-up effects noted by Lundgren et al. (2006) also suggest that altering the context around seizures and an individuals' reaction to them may help foster longer-term positive behavioural change. In comparison to yoga, however, mindfulness-based ACT produced similar effects (Lundgren et al., 2008b). Yoga, which combines physical activity with mindfulness meditation practice, has been demonstrated to be an effective treatment for depression (Crammer et al., 2013). Yoga also has conceptual overlaps with ACT and its focus on the present moment.

Mindfulness

The single study that incorporated multiple theoretical frameworks to inform one mindfulness protocol observed no significant intervention effects (Tang et al., 2015). This same study incorporated a social support group as their comparison. The addition of group-based work has been shown to further improve affects and quality of life within chronic illness populations, including epilepsy (Jackson et al., 2019). Social support acts a protective "buffer" for psychological distress and promotes inclusivity, shared understanding and unity between individuals (Reblin & Uchino, 2009). Tang et al. (2015) also incorporated a written educational package in their mindfulness and social support interventions, highlighting the importance of education about one's disorder on improving patient outcomes alone (May & Pfafflin, 2005).

Adverse Effects

In line with previous literature on the safety of mindfulness within epilepsy populations, no significant adverse psychological effects were noted for MBCT, ACT or mindfulness in general – although few studies examined whether mindfulness incurred health risks (Lundgren et al., 2006, 2008b; Tang et al., 2015; Ridsdale et al., 2018). This is consistent with the broader mindfulness literature: the reporting of adverse events or effects is not routinely mentioned (Gordon et al., 2017). For some, the practice of mindfulness may cause agitation, anxiety or discomfort as the process of distancing oneself from their own thoughts may be a difficult task, particularly for those who are more severely distressed (Clarke & Draper, 2020). Additionally, an individuals' self-confidence in being able to effectively manage and employ mindfulness practice may require additional 'booster' sessions, after the completion of a mindfulness program, to ensure continued independent practice of skills learnt – particularly for individuals with limited previous exposure to such interventions but also for those with cognitive impairment (de Vibe et al., 2018; Kechter, et al., 2019). Further research is, however, needed to determine which strategies best promote independent mindfulness practice.

Clinical and Research Implications

The results of this systematic review have a number of broad practice implications, particularly the importance of considering psychological outcomes within epilepsy management. This includes a need for clinicians to identify clinical symptoms of concern, such as depression and anxiety, that may exacerbate an individual's ability to self-manage their condition (Shawyer et al., 2016). MBCT and ACT, in particular, might be considered as adjunctive to standard medication treatment. Developing and employing a comprehensive referral system, whereby individuals are routinely monitored from the early stages of diagnosis would provide opportunity for a flexible intervention such as mindfulness to be adopted at the primary care level (Shawyer et al.,

2016). The importance of group work to foster learning through peers, in addition to social, informational and emotional support, is also evident (Strom & Egede, 2012) – although the establishment of a therapy group needs careful consideration of each individual's needs and preferences (Chung et al., 2012; Modi et al., 2017).

The role of telecommunication technology in mental health care delivery also requires consideration. Two trials examined in this review focused on telephone and web-based content, specifically. More recently, mindfulness applications or 'apps' that can be downloaded on a smartphone (e.g., *Calm, Smiling Mind*) have been used to improve psychological self-management and monitoring in the general population (Clarke & Draper, 2020; Spijkerman & Bohlmeijer, 2016). Whilst apps have demonstrated utility in self-management and seizure control (Si et al., 2020) their role in mental health care, more broadly, remains problematic largely due to issues with participant engagement and perceived utility among consumers (Torous et al., 2018).

The ideal intervention format (i.e., individual, group) and delivery method (i.e., face to face, telephone) for mindfulness, in order to best meet the unique needs of a patient population such as epilepsy and to ensure longer-term treatment adherence, also requires exploration. Future controlled trials that evaluate specific aspects of mindfulness with varying epilepsy severity types and/or stages (i.e., early vs late stage diagnosis) is recommended to determine if certain therapeutic strategies are more or less beneficial in improving psychological outcomes. This should include trials involving participants from developing countries, in order to potentially provide time and cost-effective options to those individuals who may not be able to access extensive psychological and/or pharmacological treatments (Wrede et al., 2020).

Limitations

The current findings must be considered in the context of several methodological limitations encountered during the data collection and analysis. First, all outcomes were

reliant on self-reported data. The reliance may have resulted in response artifacts – with individuals under-reporting symptoms of depression, anxiety (i.e., social undesirable attributes and behaviours) and over-reporting more desirable attributes (e.g., quality of life and general wellbeing; Paulhaus, 1984). Future research might consider supplementing self-reported data with clinician-based assessments (e.g., diagnostic interview) to determine the accuracy of reported outcomes. Moreover, no studies included epilepsy-specific tools to measure psychological functioning. Generic tools, such as WHOQOL-BREF may not include critical information exclusive to epilepsy (i.e., anticonvulsant medication side effects, seizure activity; Modi et al., 2017). Second, studies did not consistently provide details relating to epilepsy type and severity, despite these characteristics being significant moderators of psychosocial outcomes in this population (Kimiskidis et al., 2007). The reporting of these key parameters would allow for moderator analyses, to determine how effective mindfulness interventions are across the specific subtypes of epilepsy and, in turn, whether the findings are generalisable to the wider epilepsy population (Unalan et al., 2015). Finally, follow-up assessments and the incidence of adverse effects were not consistently included in majority of intervention protocols. There remains, then, a need to better consider which individuals may benefit most from mindfulness and in what circumstances or contexts (Farias et al., 2016a, 2016b).

Conclusions

Findings in favour of the effectiveness and safety of mindfulness-based and informed interventions in managing psychosocial outcomes in adults with epilepsy is preliminary but promising. The suggestion is that healthcare professionals can effectively integrate mindfulness with treatment as usual approaches. Further controlled trials are, however, needed to determine how best to deliver mindfulness interventions to meet the unique

needs of the epilepsy population, including strategies to ensure treatment adherence and successful application of mindfulness techniques by patients in their everyday life.

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Figure 1. Study selection process adapted from PRISMA (Page et al., 2020)

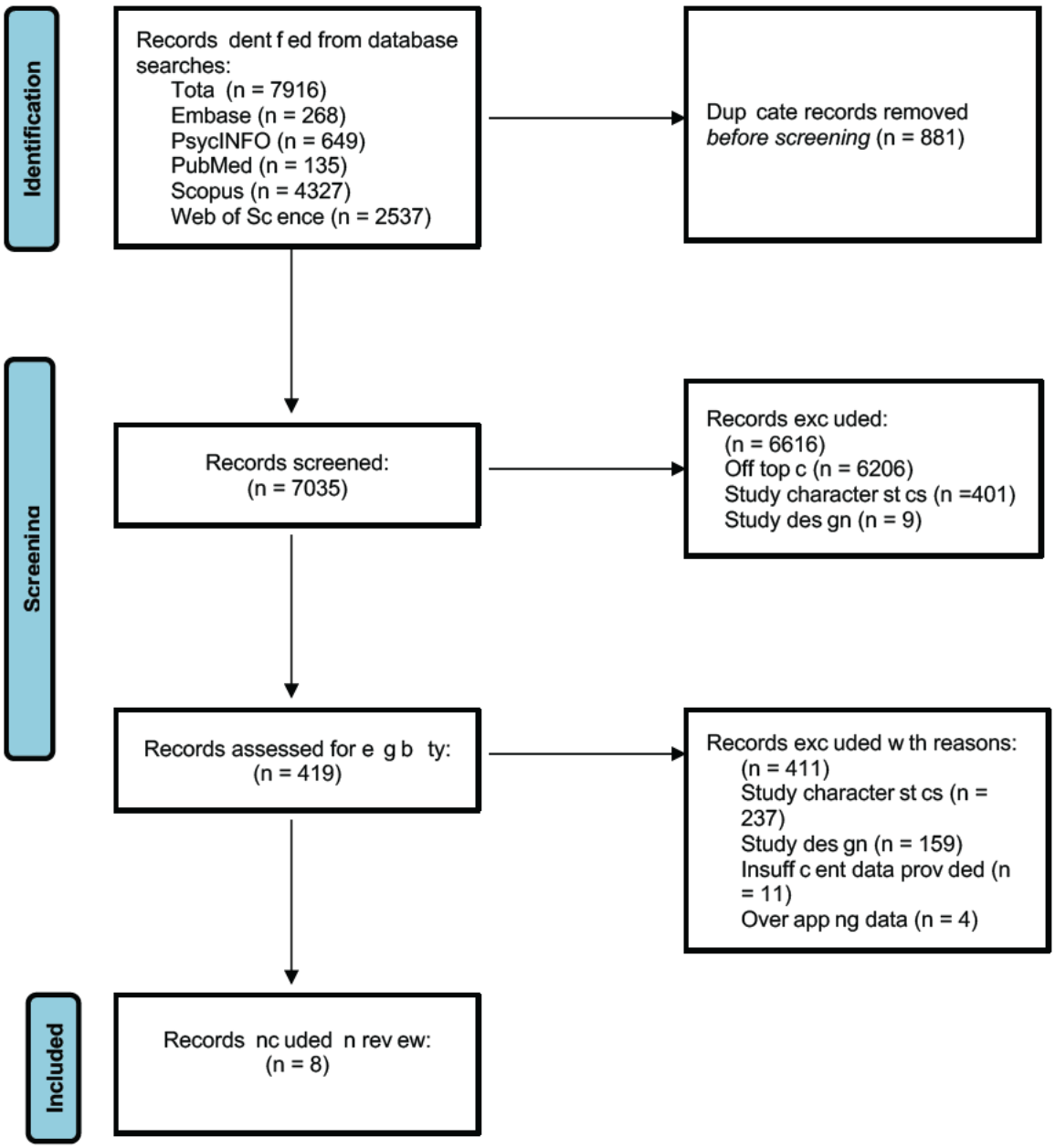

Table 1. Study Characteristics

Lead author (year)	Country	Target outcome(s)	*N* [I C]	Mean age (SD) [range]	Intervention					
					Framework	Duration	Measure [a]	Format	Medium	Control
Alipour (2019)	Iran	Depression	30 [15 15]	27.9 (4.5) [20 35]	ACT	8 x 1.5 hr/week	BDI II	Group	Face	Social support
Hum (2019)	Canada	Depression Quality of Life	31 [20 11]	33.1 (2.6)	MBCT	8 x 1hr/week	QIDS NDDIE WHOQOL BREF	Group	Phone	Wait list
Lundgren (2006)	South Africa	Quality of Life	27 [14 13]	40.7 [21 55]	ACT	2 x 1.5 hr (individual) + 2 x 3 hr (group)	WHOQOL BREF SWLS	Group + Individual	Face	Supportive therapy
Lundgren (2008b)	Sweden	Quality of Life	18 [10 8]	23.9 [18 55]	ACT	2 x 1.5 hr (individual) + 2 x 3 hr (group)	WHOQOL BREF SWLS	Group + Individual	Face	Yoga
Mohamadpour (2017)	Iran	Anxiety Self Efficacy	30 [15 15]	33.78 (6.9) [20 45]	MBCT	8 x 2 hr/ week	GSES Zung SAS	Group	Face	Wait list
Ridsdale (2018)	England	Anxiety Depression Quality of Life	404 [205 199]	41.7 (14.1) [16 85]	MBCT	2 x 7.5 hrs each	QOLIE 31 P HADS	Group	Face	Usual care
Tang (2015)	Australia	Anxiety Depression Quality of Life	60 [30 30	35.12 (10.7)	Mindfulness	4 x 2.5 hr/week	QOLIE 31 P BDI II BAI	Group	Face	Social support
Thompson (2015)	USA	Depression Quality of Life	118 [62 56]	41.2 [21 70]	MBCT	8 x 1hr/week	mBDI/BDI NDDI E PHQ 9 SWLS	Group + Individual	Web + Phone	Usual care

N Total number of participants at baseline, I intervention group, C control group, ACT Acceptance Commitment Therapy, mCBT Mindfulness Based Cognitive Therapy [a] measures specific to this review.

Measure abbreviations BDI II Beck Depression Inventory II QIDS Quality Improvement Data System, NDDI E Neurological Disorders Depression Inventory for Epilepsy, WHOQOL BREF World Health Organisation Quality of Life Short Form, SWLS Satisfaction with Life Scale, GSES General Self Efficacy Scale, SAS Zung Self Rating Anxiety Scale, QOLIE 31 P Patient Weighted Quality of Life in Epilepsy, HADS Hospital Anxiety and Depression Scale, BAI Beck Anxiety Inventory, PHQ 9 Patient Health Questionnaire 9 item, SLS Satisfaction with Life Scale

Table 2. Sample Characteristics

Variable	Total		Epilepsy		Controls	
	*N*studies	*N*participants	*N*studies	*N*participants	*N*studies	*N*participants
Sample size	8	718	8	383	8	368
Age (SD) in years	8	35.3 (8.19)	7	32.74 (7.66)	7	32.42 (8.64)
Gender						
Male	8	325	7	141	7	143
Female	8	393	7	168	7	148
Seizure type						
Generalised	3	51	3	26	3	25
Focal	3	11	3	17	3	4
Mixed	3	18	1	2	1	6
Unknown	3	6	1	3	1	3
Marital status						
Married	4	178	4	95	4	83
Single	4	299	4	148	4	151
Education						
Primary	4	106	4	60	4	58
Secondary	4	200	4	102	4	92
Tertiary	2	215	2	106	2	109
Anticonvulsants	3	118	3	63	3	55
Employment status						
Full-time	2	121	2	59	2	62
Part-time	1	53	1	22	1	31
Not currently working	1	182	1	99	1	83

Abbreviations: $N_{stud\ es}$ = number of studies providing these data; $N_{part\ c\ pants}$= number of participants providing these data; SD = standard deviation

Table 3. Reporting quality within studies based on *QualSyst* (Kmet et al., 2004)

Lead author (date)	1: Question/objective sufficiently described	2: Study design evident and appropriate	3: Method of subject/comparison group selection or source of information/input variables described/appropriate	4. Subject (and comparison group) characteristics sufficiently described	5. Random allocation to treatment group described	6. Blinding of investigators to intervention	7. Blinding of subjects to intervention	8: Outcome(s) well defined and robust to measurement/misclassification bias. Means of assessment reported.	9: Sample size appropriate	10: Analytic methods described/justified/ appropriate	11: Some estimate of variance reported	12: Controlled for confounding	13: Results reported in sufficient detail	14: Conclusions supported by results	Total (0-1)
Alipour (2019)	●	●	◗	◗	◗	○	◗	●	●	◗	●	◗	●	◗	0.68
Hum (2019)	●	●	●	●	●	○	○	●	◗	●	●	●	●	◗	0.79
Lundgren (2006)	●	●	◗	●	●	○	◗	●	◗	●	●	◗	●	◗	0.75
Lundgren (2008b)	●	●	◗	●	●	○	○	●	●	●	●	◗	●	●	0.75
Mohamadpour (2017)	●	●	◗	●	◗	○	◗	●	◗	●	●	◗	●	●	0.75
Ridsdale (2018)	●	●	●	●	●	●	◗	●	●	●	●	●	●	●	0.96
Tang (2015)	●	●	●	◗	●	●	◗	●	●	●	●	●	●	●	0.89
Thompson (2015)	●	●	●	●	◗	○	◗	●	●	●	●	●	●	●	0.86

Legend: ● = 2 points; ◗ = 1 point; ○ = 0 points or N/A

Figure 2. Percentage of included studies meeting each criterion on the *QualSyst* (Kmet et al., 2004)

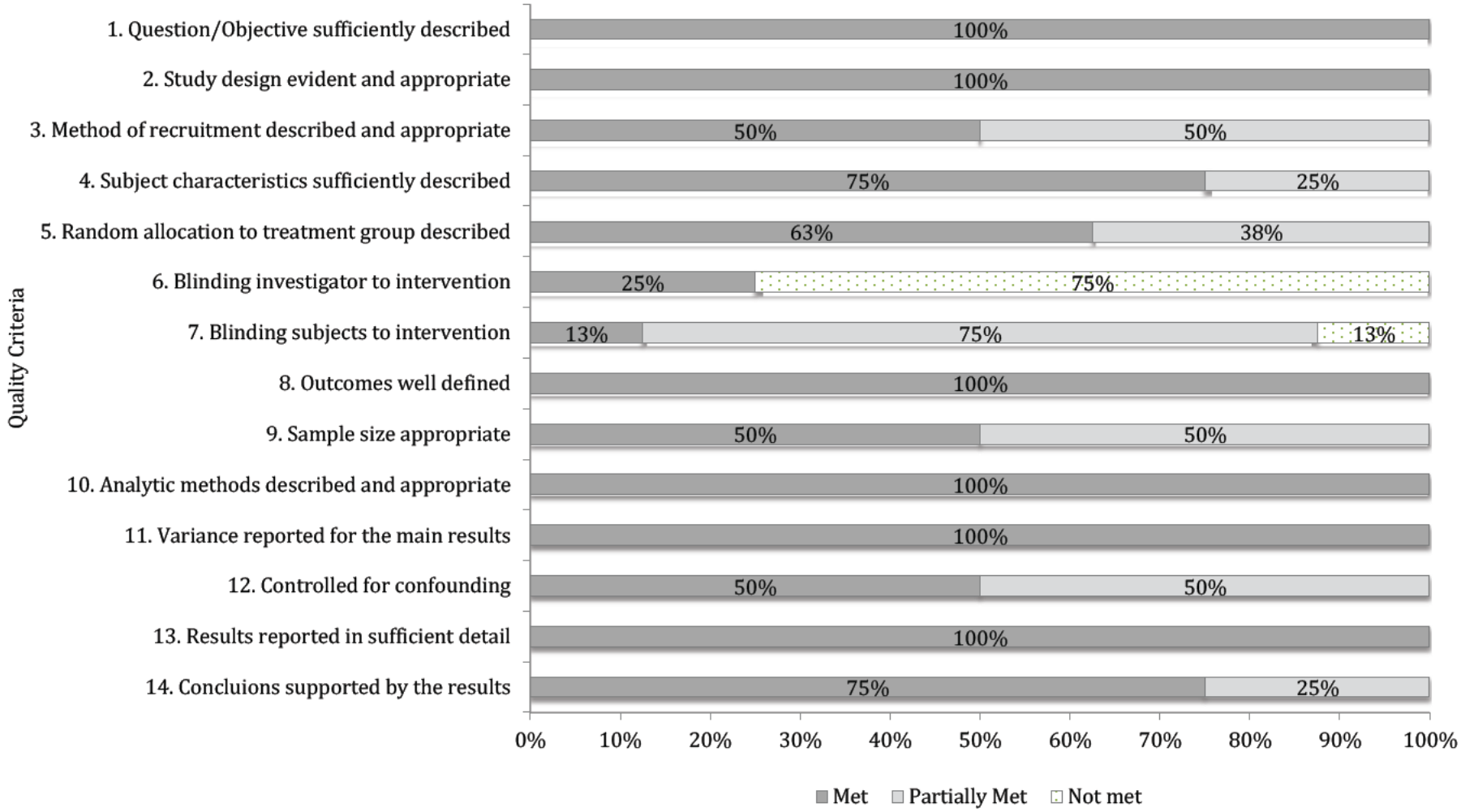

Table 4. Short-term effects associated with mindfulness

Framework	Control	*N*	Measure	Outcome	*g*	95% CI	*p*	Format	Medium	Lead author (date)
MBCT	Wait-list	30	Self-efficacy	GSES	**2.42**	0.82 – 2.48	0.00	Group	Face	Mohamadpour (2017)
	Wait-list	30	Anxiety	SAS	**1.60**	1.53 – 3.44	0.00	Group	Face	Mohamadpour (2017)
	Usual care	118	Quality of life	SWLS	**0.52**	0.16 – 0.89	0.01	Group + Individual	Web + Phone	Thompson (2015)
	Usual care	118	Quality of life	Mental QOL	0.10	-0.26 – 0.46	0.60	Group + Individual	Web + Phone	Thompson (2015)
	Usual care	404	Quality of life	QOLIE-P	**0.23**	0.04 – 0.43	0.02	Group	Face	Ridsdale (2018)
	Usual care	118	Depression	BDI-II	**0.39**	0.04 – 0.03	0.04	Group + Individual	Web + Phone	Thompson (2015)
	Usual care	118	Depression	PHQ-9	0.30	-0.06 – 0.67	0.10	Group + Individual	Web + Phone	Thompson (2015)
	Usual care	118	Depression	NDDI-E	0.11	-0.25 – 0.47	0.55	Group + Individual	Web + Phone	Thompson (2015)
	Information	31	Depression	QIDS	0.11	-0.48 – 0.71	0.71	Group	Phone	Hum (2019)
	Wait-list	31	Depression	QIDS	0.06	-0.68 – 0.80	0.88	Group	Phone	Hum (2019)
ACT	No intervention	30	Depression	BDI-II	**2.16**	1.31 - 3.13	0.00	Group	Face	Alipour (2019)
	Supportive therapy	27	Quality of life	SWLS	**2.28**	1.37 – 3.33	0.00	Group + Individual	Face	Lundgren (2006)
	Supportive therapy	27	Quality of life	WHOQOL	**0.81**	0.05 – 1.62	0.04	Group + individual	Face	Lundgren (2006)
	Yoga	18	Quality of life	WHOQOL	0.80	-0.13 – 1.81	0.09	Group + individual	Face	Lundgren (2008b)
	Yoga	18	Quality of life	SWLS	0.02	-0.91 – 0.95	0.97	Group + individual	Face	Lundgren (2008b)
Mindfulness	Social support	60	Depression	BDI-II	0.22	-0.29 – 0.73	0.39	Group	Face	Tang (2015)
	Social support	60	Anxiety	BAI	0.31	-0.19 – 0.83	0.22	Group	Face	Tang (2015)
	Social support	60	Quality of Life	QOLIE-P	0.29	-0.22 – 0.80	0.26	Group	Face	Tang (2015)

Abbreviations. Control= control group N= number of participants *g*= Hedges *g* effect size 95% CI= confidence interval (with lower and upper limits) *p*= significance value associated with *g*.

Measure abbreviations GSES General Self Efficacy Scale, SAS Zung Self Rating Anxiety Scale, SWLS Satisfaction with Life Scale, QOLIE 31 P Patient Weighted Quality of Life in Epilepsy, BDI II Beck Depression Inventory II, PHQ 9 Patient Health Questionnaire 9 item, NDDI E Neurological Disorders Depression Inventory for Epilepsy, QIDS Quality Improvement Data System, WHOQOL BREF World Health Organisation Quality of Life Short Form, BAI Beck Anxiety Inventory

Bold font denotes significant group difference (p <0.05, CIs ≠ 0)

Table 5. Longer-term effects at follow up associated with mindfulness programs

Framework	Control	*N*	Construct	Measure	Time (months)	*g*	95% CI	*p*	Format	Medium	Lead author (date)
MBCT	Wait-list	30	Self-efficacy	GSES	12	-0.47	-1.23 – 0.23	0.18	Group	Face	Mohamadpour (2017)
	Usual care	404	Quality of life	QOLIE-P	12	**0.27**	0.05 – 0.49	0.02	Group	Face	Ridsdale (2018)
	Wait-list	30	Anxiety	SAS	12	0.02	-0.70 – 0.74	0.96	Group	Face	Mohamadpour (2017)
ACT	Supportive therapy	27	Quality of Life	WHOQOL	12	**1.58**	0.76 – 2.45	0.00	Group + Individual	Face	Lundgren (2006)
	Supportive therapy	27	Quality of Life	SWLS	6	0.72	-0.04 – 1.52	0.06	Group + Individual	Face	Lundgren (2006)
	Supportive therapy	27	Quality of Life	SWLS	12	0.44	-0.31 – 1.22	0.24	Group + Individual	Face	Lundgren (2006)
	Supportive therapy	27	Quality of Life	WHOQOL	6	0.30	-0.45 – 1.07	0.42	Group + Individual	Face	Lundgren (2006)
	Yoga	18	Quality of Life	SWLS	6	-0.52	-1.50 – 0.40	0.26	Group + Individual	Face	Lundgren (2008b)
	Yoga	18	Quality of Life	SWLS	12	0.13	-0.80 – 1.07	0.77	Group + Individual	Face	Lundgren (2008b)
	Yoga	18	Quality of Life	WHOQOL	6	0.23	-0.69 – 1.18	0.61	Group + Individual	Face	Lundgren (2008b)
	Yoga	18	Quality of Life	WHOQOL	12	-0.02	-0.95 – 0.91	0.97	Group + Individual	Face	Lundgren (2008b)

Abbreviations. Control= control group; N= number of participants; *g*= Hedges' *g* effect size; 95% CI= confidence interval (with lower and upper limits); *p*= significance value associated with *g.*

Measure abbreviations: GSES: General Self-Efficacy Scale, QOLIE-31-P: Patient Weighted Quality of Life in Epilepsy, SAS: Zung Self-Rating Anxiety Scale, WHOQOL-BREF: World Health Organisation Quality of Life Short Form, SWLS: Satisfaction with Life Scale

Bold font denotes significant group difference ($p < 0.05$, CIs $\neq 0$)

Appendix A

Electronic Database Searches

	Epilepsy	AND	Mindfulness
PubMed	"epilepsy"[mh] OR epilepsy[tw] OR epileptic[tw] OR "epileptic seizure"[mh] OR seizure[mh] OR seizure*[tw]		"mindfulness"[mh] OR micbt OR mindful* OR mbsr OR mindfulness based stress reduction OR mindfulness based cognitive therap* OR mindfulness-integrated cbt OR acceptance and commitment therapy OR meditation OR mindfulness [mh] OR acceptance and commitment therapy [mh] OR mindful*[tw] OR meditation*[tw] OR acceptance and commitment therap*[tw] OR dialectical behavior?r therap*[tw] OR ACT[tw]
PsycINFO	exp epilepsy OR epilepsy.tw OR epileptic.tw OR exp epileptic seizure$ OR epileptic seizure.tw OR seizure$.tw		exp mindfulness OR mindfulness.tw OR micbt.tw OR exp mindful* OR mindful*.tw OR mbsr.tw OR mindfulness based stress reduction.tw OR exp mindfulness based cognitive therapy OR mindfulness based cognitive therapy.tw OR mindfulness-integrated cbt.tw OR exp acceptance and commitment therapy OR acceptance and commitment therapy.tw OR ACT.tw OR meditation.tw OR "dialectical behavio?r therap*".tw
Embase	epilepsy'/exp OR epilepsy':de OR epilepsy': ti,ab OR epileptic':ti,ab OR epileptic seizure':ti,ab OR seizure':de OR seizure*':ti,ab		mindfulness'/de OR mindfulness':ti,ab OR meditation':ti,ab OR mindful':ti,ab OR acceptance and commitment therapy':ti,ab OR mindfulness-based stress reduction':ti,ab OR mindfulness based cognitive therapy'/de OR mindfulness based cognitive therapy':ti,ab OR mindful*':ti,ab OR meditation*':ti,ab OR acceptance and commitment therap*'/de OR acceptance and commitment therap*':ti,ab OR dialectical behavior?r therap*':ti,ab
Scopus	"epilepsy" OR "epileptic" OR "epileptic seizure*" OR "seizure*" OR "temporal lobe epilepsy" OR "psychogenic seizure*" OR "idiopathic epilepsy"		"mindfulness" OR "mindful*" OR "meditation*" OR "acceptance and commitment therap*" OR "dialectical behavio?r therap*" OR "mindfulness-based cognitive therapy" OR "mbsr" OR "mindfulness-based stress reduction" OR "mindfulness-integrated cbt" OR "ACT"

Web of Science	“epilepsy” OR “epileptic” OR “epileptic seizure*” OR “seizure*” OR “temporal lobe epilepsy” OR “psychogenic seizure*” OR “idiopathic epilepsy”	“mindfulness” OR "mindful*" OR "meditation*" OR "acceptance and commitment therap*" OR "dialectical behavio?r therap*" OR “mindfulness-based cognitive therapy” OR “mbsr” OR “mindfulness-based stress reduction” OR “mindfulness-integrated cbt” OR “ACT”

Appendix B

PRISMA Check List (Page et al., 2020)

Section and Topic	Item #	Checklist item	Page(s) where item is reported
TITLE			
T t e	1	Ident fy the report as a systemat c rev ew.	6
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts check st.	
INTRODUCTION			
Rat ona e	3	Descr be the rat ona e for the rev ew n the context of ex st ng know edge.	8-17
Object ves	4	Prov de an exp c t statement of the object ve(s) or quest on(s) the rev ew addresses.	16-17
METHODS			
E g b ty cr ter a	5	Spec fy the nc us on and exc us on cr ter a for the rev ew and how stud es were grouped for the syntheses.	17-19
Informat on sources	6	Spec fy a databases, reg sters, webs tes, organ sat ons, reference sts and other sources searched or consu ted to dent fy stud es. Spec fy the date when each source was ast searched or consu ted.	17
Search strategy	7	Present the fu search strateg es for a databases, reg sters and webs tes, nc ud ng any f ters and m ts used.	Append x A
Se ect on process	8	Spec fy the methods used to dec de whether a study met the nc us on cr ter a of the rev ew, nc ud ng how many rev ewers screened each record and each report retr eved, whether they worked ndependent y, and f app cab e, deta s of automat on too s used n the process.	17-19
Data co ect on process	9	Spec fy the methods used to co ect data from reports, nc ud ng how many rev ewers co ected data from each report, whether they worked ndependent y, any processes for obta n ng or conf rm ng data from study nvest gators, and f app cab e, deta s of automat on too s used n the process.	17-21
Data tems	10a	L st and def ne a outcomes for wh ch data were sought. Spec fy whether a resu ts that were compat b e w th each outcome doma n n each study were sought (e.g. for a measures, t me po nts, ana yses), and f not, the methods used to dec de wh ch resu ts to co ect.	17-21
	10b	L st and def ne a other var ab es for wh ch data were sought (e.g. part c pant and ntervent on character st cs, fund ng sources). Descr be any assumpt ons made about any m ss ng or unc ear nformat on.	17-21
Study r sk of b as assessment	11	Spec fy the methods used to assess r sk of b as n the nc uded stud es, nc ud ng deta s of the too (s) used, how many rev ewers assessed each study and whether they worked ndependent y, and f app cab e, deta s of automat on too s used n the process.	20
Effect measures	12	Spec fy for each outcome the effect measure(s) (e.g. r sk rat o, mean d fference) used n the synthes s or presentat on of resu ts.	19-21

Synthes s methods	13a	Descr be the processes used to dec de wh ch stud es were e g b e for each synthes s (e.g. tabu at ng the study ntervent on character st cs and compar ng aga nst the p anned groups for each synthes s (tem #5)).	17-19
	13b	Descr be any methods requ red to prepare the data for presentat on or synthes s, such as hand ng of m ss ng summary stat st cs, or data convers ons.	19-20
	13c	Descr be any methods used to tabu ate or v sua y d sp ay resu ts of nd v dua stud es and syntheses.	19-20
	13d	Descr be any methods used to synthes ze resu ts and prov de a rat ona e for the cho ce(s). If meta-ana ys s was performed, descr be the mode (s), method(s) to dent fy the presence and extent of stat st ca heterogene ty, and software package(s) used.	19-21
	13e	Descr be any methods used to exp ore poss b e causes of heterogene ty among study resu ts (e.g. subgroup ana ys s, meta-regress on).	N/A
	13f	Descr be any sens t v ty ana yses conducted to assess robustness of the synthes zed resu ts.	N/A
Report ng b as assessment	14	Descr be any methods used to assess r sk of b as due to m ss ng resu ts n a synthes s (ar s ng from report ng b ases).	N/A
Certa nty assessment	15	Descr be any methods used to assess certa nty (or conf dence) n the body of ev dence for an outcome.	N/A
RESULTS			
Study se ect on	16a	Descr be the resu ts of the search and se ect on process, from the number of records dent f ed n the search to the number of stud es nc uded n the rev ew, dea y us ng a f ow d agram.	21 & 50
	16b	C te stud es that m ght appear to meet the nc us on cr ter a, but wh ch were exc uded, and exp a n why they were exc uded.	21
Study character st cs	17	C te each nc uded study and present ts character st cs.	51-52
R sk of b as n stud es	18	Present assessments of r sk of b as for each nc uded study.	25, 53-54
Resu ts of nd v dua stud es	19	For a outcomes, present, for each study: (a) summary stat st cs for each group (where appropr ate) and (b) an effect est mate and ts prec s on (e.g. conf dence/cred b e nterva), dea y us ng structured tab es or p ots.	55-56
Resu ts of syntheses	20a	For each synthes s, br ef y summar se the character st cs and r sk of b as among contr but ng stud es.	25-28
	20b	Present resu ts of a stat st ca syntheses conducted. If meta-ana ys s was done, present for each the summary est mate and ts prec s on (e.g. conf dence/cred b e nterva) and measures of stat st ca heterogene ty. If compar ng groups, descr be the d rect on of the effect.	25-28, 53-54
	20c	Present resu ts of a nvest gat ons of poss b e causes of heterogene ty among study resu ts.	N/A
	20d	Present resu ts of a sens t v ty ana yses conducted to assess the robustness of the synthes zed resu ts.	N/A
Report ng b ases	21	Present assessments of r sk of b as due to m ss ng resu ts (ar s ng from report ng b ases) for each synthes s assessed.	N/A
Certa nty of ev dence	22	Present assessments of certa nty (or conf dence) n the body of ev dence for each outcome assessed.	25-28

DISCUSSION			
D scuss on	23a	Prov de a genera nterpretat on of the resu ts n the context of other ev dence.	28-31
	23b	D scuss any m tat ons of the ev dence nc uded n the rev ew.	33
	23c	D scuss any m tat ons of the rev ew processes used.	33
	23d	D scuss mp cat ons of the resu ts for pract ce, po cy, and future research.	31-32
OTHER INFORMATION			
Reg strat on and protoco	24a	Prov de reg strat on nformat on for the rev ew, nc ud ng reg ster name and reg strat on number, or state that the rev ew was not reg stered.	6
	24b	Ind cate where the rev ew protoco can be accessed, or state that a protoco was not prepared.	6
	24c	Descr be and exp a n any amendments to nformat on prov ded at reg strat on or n the protoco .	N/A
Support	25	Descr be sources of f nanc a or non-f nanc a support for the rev ew, and the ro e of the funders or sponsors n the rev ew.	N/A
Compet ng nterests	26	Dec are any compet ng nterests of rev ew authors.	6
Ava ab ty of data, code and other mater a s	27	Report wh ch of the fo ow ng are pub c y ava ab e and where they can be found: temp ate data co ect on forms; data extracted from nc uded stud es; data used for a ana yses; ana yt c code; any other mater a s used n the rev ew.	N/A

Appendix C

Rehabilitation Psychology Guidelines

Manuscripts

Double-space all copy. Include line numbers and page numbers in the manuscript. Other formatting instructions, as well as instructions on preparing tables, figures, references, metrics, and abstracts, appear in the *Manual*. Additional guidance on APA Style available on the APA Style website.

Title Page

The title should be accurate, descriptive, and no longer than 12 words; it should include the study design such as “a randomised controlled trial.” “a systematic review” or “a longitudinal observational study” as appropriate. The title page should adhere to APA Style and include an APA-Style author note. The APA-Style author notes include the following information:

- Paragraph 1: Authors’ ORCID iDs, if available. Authors will be asked to identify the contributions of all authors at submission using the Contributor Roles Taxonomy (CRediT). All authors should have reviewed and agreed to their individual contribution(s) before submission. Authors may claim credit for more than one role, and the same role can be attributed to more than one author.
- Paragraph 2: Changes, if any, in author affiliations that occurred after the study ended.
- Paragraph 3: Disclosures and acknowledgements, if any, including: a) study preregistration information including registry name and record number, e.g., “Trial registration: ClinicalTrials.gov Identifier NCT999999.” ; b) links to data, materials, and code; c) financial support including funding agencies and grant

numbers; d) disclosure of any real or potentially perceived conflicts of interest including financial interests or affiliations that might be seen as influencing the research – if there are no conflicts of interest, this should be clearly stated; and e) acknowledgements of nonfinancial assistance such as staff or student contributions to the research.

- Paragraph 4: Corresponding authors' contact information, including an email address.

Abstract and Keywords

All manuscripts must include a structured abstract containing a maximum of 250 words typed on a separate page (page 2 of the manuscript). Abstracts must contain each of the follow subheadings:

- Purpose/Objective
- Research method/Design – including the number and type of participants
- Results
- Conclusions/Implications

After the abstract, please supply up to five keywords, using the National Library of Medicine medical subject heading (MeSH) vocabulary or APA psychological index terms.

Impact and implications statement

At the start of each paper, the authors should provide 2-3 bullet points, with the header "Impact" that states what the current paper adds to the literature and one to two practice policy implications of the findings. This is not a statement of the conclusions, but rather a thoughtful series of statements highlighting the novel contribution of the work and translation of the findings for practice or policy. This section should be no more than 200 words.

Body of the manuscript

In addition to adhering to APA Style and the appropriate reporting standards (details, below), empirical manuscripts should include:

- a clear statement of the specific aims, study hypotheses, research question(s), or purpose of the study in the introduction
- essential information about the methods, even if a separate methods or protocol article is published and cited
- a statement indicating the name of the institutional review board (with appropriate masking) that provided oversight for the research in the methods; if exempt, an explanation of why should be provided
- the source of the study's data

a. If the paper is based on secondary data analyses of data collected for another purpose, please indicate that in the methods.

b. If the data used in the current manuscript was also used in previous publications, please include these citations when describing the methods in this submission.

- a participant flow diagram (e.g., a CONSORT-style diagram), if appropriate
- disclosure of the study's limitations in the discussion section
- discussion of how the study's findings are relevant to rehabilitation psychology

Statistical methods should adhere to the APA Task Force on Statistical Inference guidelines. Statistical results, tables and figures should adhere to APA Style guidelines.