Evidence Portfolio – Brain Health Subcommittee, Question 3

What is the relationship between physical activity and (1) affect, (2) anxiety, and (3) depressed mood and depression?

a. Is there a dose-response relationship? If yes, what is the shape of the relationship?
b. Does the relationship vary by age, sex, race/ethnicity, socio-economic status, or weight status?
c. Does the relationship exist across a continuum of mood and affective disorders (i.e., depression)?
d. What is the relationship between physical activity and brain structure and function?

Sources of Evidence: Existing Systematic Reviews and Existing Meta-Analyses

Conclusion Statements and Grades

Strong evidence demonstrates from studies of acute bouts of exercise that negative affect increases as experimentally imposed exercise intensity increases, and that negative affect is greatest when the intensity exceeds the lactate or ventilatory threshold. Such evidence has been demonstrated in acute bouts of exercise in adolescents and in adults up through middle-age. **PAGAC Grade: Strong.**

Strong evidence demonstrates that acute bouts of exercise can reduce state anxiety and that regular participation as well as longer durations of moderate-to-vigorous physical activity can reduce trait anxiety in adults and older adults. **PAGAC Grade: Strong**.

Insufficient evidence is available to determine the relationship between physical activity and anxiety among youth. **PAGAC Grade: Not assignable**.

Insufficient evidence is available to determine whether a relationship exists between physical activity and anxiety among individuals with dementia or intellectual disability. **PAGAC Grade: Not assignable.**

Strong evidence demonstrates that physical activity reduces the risk of experiencing depression. **PAGAC Grade: Strong.**

Strong evidence demonstrates that physical activity interventions reduce depressive symptoms in individuals with and without major depression across the lifespan. **PAGAG Grade: Strong**.

Insufficient evidence is available to determine whether a relationship between physical activity and depression exists among individuals with dementia, stroke, or intellectual disability. **PAGAC Grade: Not assignable.**

Limited evidence suggests a dose-response of effect of physical activity on depression in adults. **PAGAC Grade: Limited.**

Insufficient evidence is available to determine the dose-response of physical activity on depression in youth. **PAGAC Grade: Not assignable.**

Strong evidence demonstrates that experimentally imposed high-intensity physical activity reduces pleasure while exercising. **PAGAC Grade: Strong.**

Insufficient evidence is available on the dose-response of exercise on anxiety. **PAGAC Grade: Not assignable.**

Moderate evidence indicates that depressive symptoms can be reduced by even limited volumes and intensities of physical activity and that greater frequencies and volumes of activity have a larger effect on reducing depressive symptoms. **PAGAC Grade: Moderate.**

Insufficient evidence is available to determine whether sex, race/ethnicity, socioeconomic status, or weight status modify the associations between exercise and affect. **PAGAC Grade: Not assignable.**

Moderate evidence indicates that exercise reduces state anxiety more for females, adults older than age 25 years, and sedentary individuals than for other population subgroups. **PAGAG Grade: Moderate.**

Insufficient evidence is available to determine whether age, sex, race/ethnicity, socioeconomic status, or weight status modify the associations between exercise and trait anxiety. **PAGAC Grade: Not assignable.**

Limited evidence is available that females show greater reduction in depressive symptoms with physical activity than do males. **PAGAG Grade: Limited.**

Strong evidence demonstrates that physical activity reduces anxiety symptoms in individuals with anxiety disorders and reduces depressive symptoms in individuals with major depression. **PAGAC Grade: Strong**.

Insufficient evidence is available to determine whether physical activity influences markers of brain structure and function in the context of affect, anxiety, or depressed mood and depression. **PAGAC Grade: Not assignable**.

Description of the Evidence

An initial search for systematic reviews, meta-analyses, pooled analyses, and reports identified sufficient literature to answer the research question as determined by the Brain Subcommittee. Additional searches for original research were not needed.

AFFECT

Existing Systematic Reviews and Meta-Analysis

Overview

A total of 3 existing reviews were included: 2 systematic reviews[1, 2] and 1 meta-analysis.[3] The reviews were published in 2015 and 2017. The systematic reviews included 14[1] and 42 studies,[2] and covered an extensive search timeframe: from inception to 2015,[1] and 1946 to 2016.[2] The meta-analysis included 10 studies, with a search timeframe from inception to 2014.

Exposures

Stork et al[2] assessed interval exercise training using different modalities of life cycle ergometer, treadmill, and resistance exercise. Interval exercise protocols included high-intensity interval training, sprint interval training, and body-weight interval training. Liao et al[1] examined unspecified physical activity in the free-living environment. The meta-analysis[3] compared self-selected and instructor-imposed exercise programs with varying levels of intensity.

Outcomes

The included reviews addressed affective states or responses, including enjoyment, cognition, executive function, and behavior, using the Feeling Scale, the Physical Activity Enjoyment Scale, and other self-reported tools.

ANXIETY

Existing Systematic Reviews and Meta-Analyses

Overview

A total of 13 existing reviews were included: 8 systematic reviews[4-11] and 5 meta-analyses.[12-16] The reviews were published between 2014 and 2017.

The systematic reviews included a range of 4 to 50 studies and covered an extensive search timeframe: from inception to 2011,[6] inception to 2014,[9] inception to 2015,[4] inception to 2017,[8] 1980 to 2014,[5] 1990 to 2013,[10] and 1980 to 2015.[11] One systematic review did not report search timeframe.[7]

The meta-analyses included a range of 4 to 36 studies. Most meta-analyses covered an extensive timeframe: from inception to 2015,[15, 16] inception to 2017,[14] 1965 to 2013,[12] and 1990 to 2014.[13]

Exposures

The majority of the included reviews examined physical activity interventions that incorporated aerobic exercises[4-7, 9, 11-13, 15, 16] and resistance exercises,[7, 9, 11, 13-15] while others addressed the effects of a mixed aerobic and resistance training.[7, 13] Reviews also examined interventions that incorporated yoga,[8, 15] and 2 reviews examined general physical activity, exercise, or outdoor sports participation interventions.[4, 10]

Outcomes

Included reviews addressed 2 main outcomes, state and trait changes in anxiety[4, 6, 7, 9-14, 16] and post-traumatic stress disorder (PTSD), or symptoms of PTSD.[5, 8, 15] Common tools used to measure anxiety included the Hamilton Scale for Anxiety, State-Trait Anxiety Inventory (STAI-S), profile of mood states-tension (POMS-T), Hopkins symptom checklist (SCL-90), Beck Anxiety Inventory, and others. PTSD tools included PTSD Checklist-Civilian (PCL-C), PTSD Checklist (PCL-17), and the Clinician-Administered PTSD scale.

DEPRESSED MOOD AND DEPRESSION

Existing Systematic Reviews and Meta-Analyses

Overview

A total of 38 existing reviews were included: 12 systematic reviews[4, 17-27] and 26 meta-analyses.[28-53] The reviews were published between 2011 and 2017.

The systematic reviews included a range of 4 to 32 studies. One systematic review[27] did not report the number of included studies. The systematic reviews covered an extensive search timeframe: from inception to 2012,[27] inception to 2014,[20] inception to 2015,[4] inception to 2016,[19, 22] 1975 to 2012,[23] 1976 to 2012,[24] 1990 to 2013,[25] 1990 to 2014,[26] 2002 to 2013,[21] 2009 to 2015,[17] and 2011 to 2016.[18]

The meta-analyses included a range of 3 to 61 studies. Most meta-analyses covered an extensive timeframe: from inception to 2009,[42] inception to 2011,[30] inception to 2012,[36, 46] inception to 2013,[19, 32, 38, 41, 50, 52] inception to 2014,[28, 31, 34, 39, 40, 45, 51, 53] inception to 2015,[29, 43, 47] inception to 2016,[35] 1960 to 2014,[44] 2005 to 2015,[37] and 2013 to 2015.[48, 49]

Exposures

The majority of included reviews examined physical activity interventions that incorporated aerobic exercises,[4, 17, 20, 23-26, 28, 30-32, 34, 36, 40, 45-49, 51] resistance exercises,[20, 23, 25, 26, 28, 31, 32, 34, 42, 45, 48, 49, 51] or a combination of aerobic and resistance training.[26, 28, 29, 31, 32, 43, 45, 48, 49] Reviews also examined interventions that incorporated tai chi,[17, 18, 23, 27, 39, 41, 50, 52] yoga,[18-20, 23, 27, 30, 33] or qigong.[39, 41, 52] Three reviews examined sedentary behavior,[21, 22, 53] while 1 review examined the effects of Bobath exercises.[34] A few reviews examined general physical activity or sports participation interventions.[21, 35, 37, 38, 44]

Outcomes

All reviews addressed depression as an outcome using various tools. The most common tools used in the reviews were the Beck Depression Inventory (BDI), the Hamilton Rating Scale of Depression (HRSD), and the Geriatric Depression Scale (GDS), although others like the Hospital Anxiety and Depression Scale, Center for Epidemiological Study Depression Scale 20 (CES-D 20), and Children's Depression Rating Scale-Revised were reported. In addition to validated questionnaires, some studies used interviews[37] or physician diagnosis[24] to examine depression.

Populations Analyzed

The table below lists the populations analyzed in each article.

Table 1. Populations Analyzed by All Sources of Evidence

	Sex	Race/ Ethnicity	Age	Disability Status	Chronic Conditions	Other
Abraha, 2017			Adults >60	Cognitive disability, dementia		
Adamson, 2015			Adults ≥18			Neurologic disorders
Barreto, 2015				Cognitive disability, dementia		
Bartley, 2013					Anxiety disorder	
Bridges, 2017			Adults			
Brown, 2013			Children and adults 5–19			
Carter, 2016			Adolescents 13–17			Clinical sample (subjects with depression); general population
Cooney, 2013			Adults ≥18		Depression	
Cramer, 2017			Adults 28–43			≥75% participants diagnosed with major depressive disorder
Cramer, 2013			Adults		Depression	
Das, 2016			Children and adults 11–24			
de Souza Moura, 2015			Adults 18–60		Depression	
Eng, 2014			Age ≥18		Stroke	
Ensari, 2015			Adults			
Farah, 2016			Adults ≥18		Unipolar depression	
Gordon, 2017	Male, Female		Adults; mean age 43 (moderator analysis: <25, 25–54, ≥ 55)			Physical illness: (cancer, obesity, ischemic stroke, etc.); Mental illness: (GAD, chemical dependence)
Hall, 2015			Adults			

	Sex	Race/ Ethnicity	Age	Disability Status	Chronic Conditions	Other
Hoare, 2014			Children and adults 10–19			
Hoare, 2016			Children and adults 10–24			
Jayakody, 2014			Adults		Anxiety disorders	
Josefsson, 2014			Adults ≥18		Depression	
Korczak, 2017	Male, Female		Children <18			
Liao, 2015			All ages			
Lindheimer, 2015						
Liu, 2015			All ages; mean age ≥60 vs. <60		Non-depression co-morbidity	
Loi, 2014			Adults >60			
Mammen, 2013			Children and adults 11–100			
Meekums, 2015			Adolescents and adults		Depression	
Mochcovitch, 2016			Older adults			
Mura, 2013			Adults >60		Depression	
Nystrom, 2015			Children and adults 12–84		Depression	
Oliveira, 2015			Age ≥10 years			
Park, 2014			Adults ≥65			
Potter, 2011			Adults ≥60	Cognitive impairment, dementia		
Radovic, 2017			Mean age 15.6–17			Diagnosed with depressive disorders or depressive symptoms above baseline.
Rebar, 2015			Adults			
Rhyner, 2016			Adults ≥60 (60–74, 75+)		Depression	
Robertson, 2012			Adults ≥18		Depression	
Rosenbaum, 2015			Mean age 34–52	Post-traumatic stress disorder		

	Sex	Race/ Ethnicity	Age	Disability Status	Chronic Conditions	Other
Sarris, 2012						
Schuch, 2016a			All ages		Depression	
Schuch, 2016b			Adults			Depression or depressive symptoms
Schuch, 2016c			Adults; mean age 69.5		Depression or dysthymia	
Sciarrino, 2017			Adults ≥18			Post-traumatic stress disorder
Stonerock, 2015			Adults ≥18		Anxiety	
Stork, 2017						
Stubbs, 2017			Adults		Anxiety/ stress disorders	
Wang, 2014						
Wegner, 2014			All ages			Normal/non-clinical; patients with anxiety/ depression disorder
Whitworth, 2016				Post-traumatic stress disorder		
Yan, 2016			University students			
Yin, 2014		Asian	Ages 30; 30–60; >60; <50; >50			
Zhai, 2015						Region: Europe, America, Asia, Australia

Supporting Evidence

Existing Systematic Reviews and Meta-Analyses

Table 2. Existing Systematic Reviews and Meta-Analyses Individual Evidence Summary Tables

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Abraha I, Rimland JM, Trotta FM, et al. Systematic review of systematic reviews of non-pharmacological interventions to treat behavioural disturbances in older patients with dementia. The SENATOR-OnTop series. BMJ Open. 2017;7(3):e012759. doi:10.1136/bmjopen-2016-012759.</td></tr>
<tr><td>Purpose: To assess the evidence supporting non-pharmacological interventions, with a view to providing a working compendium for the non-drug management of behavioral and psychological symptoms in dementia.</td><td rowspan="5">Abstract: OBJECTIVE: To provide an overview of non-pharmacological interventions for behavioural and psychological symptoms in dementia (BPSD). DESIGN: Systematic overview of reviews. DATA SOURCES: PubMed, EMBASE, Cochrane Database of Systematic Reviews, CINAHL and PsycINFO (2009-March 2015). ELIGIBILITY CRITERIA: Systematic reviews (SRs) that included at least one comparative study evaluating any non-pharmacological intervention, to treat BPSD. DATA EXTRACTION: Eligible studies were selected and data extracted independently by 2 reviewers.The AMSTAR checklist was used to assess the quality of the SRs. DATA ANALYSIS: Extracted data were synthesised using a narrative approach. RESULTS: 38 SRs and 142 primary studies were identified, comprising the following categories of non-pharmacological interventions: (1) sensory stimulation interventions (12 SRs, 27 primary studies) that encompassed: acupressure, aromatherapy, massage/touch therapy, light therapy and sensory garden; (2) cognitive/emotion-oriented interventions (33 SRs; 70 primary studies) that included cognitive stimulation, music/dance therapy, dance therapy, snoezelen, transcutaneous electrical nerve stimulation, reminiscence therapy, validation therapy, simulated presence therapy; (3) behaviour management techniques (6 SRs; 32 primary studies) and (4) other therapies (5 SRs, 12 primary studies) comprising exercise therapy, animal-assisted therapy, special care unit and dining room environment-based interventions. Music therapy was effective in reducing agitation (SMD, -0.49; 95% CI -0.82 to -0.17; p=0.003), and anxiety (SMD, -0.64; 95% CI -1.05 to -0.24; p=0.002). Home-based behavioural management techniques, caregiver-based interventions or staff training in communication skills, person-centred care or dementia care mapping with supervision during implementation were found to be effective for symptomatic and severe agitation. CONCLUSIONS: A large number of non-pharmacological interventions for BPSD were identified. The majority of the studies had great variation in how the same type of intervention was defined and applied, the follow-up duration, the type of outcome measured, usually with modest sample size.</td></tr>
<tr><td>Timeframe: 2009–March 2015</td></tr>
<tr><td>Total # of Studies: 38 (5 PA interventions)</td></tr>
<tr><td>Exposure Definition: Music and dance therapy: moving and dancing to music. Dance therapy. Exercise therapy (e.g., walking, tai chi).
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed:
Depression: Geriatric Depression Scale (GDS15), Montgomery-Asberg Depression Rating Scale (MADRS), Cornell Scale for Depression in Dementia (CSDD), a Dutch Evaluation scale for older patients, subscale Beoordelingsschaal voor Oudere Patienten. Behavioral disturbances: Neuropsychiatric Inventory (NPI) and Stockton Geriatric Rating Scale. Apathy: NPI and CSDD. Word list savings score. Visual spatial ability: Clock drawing test. Cookie Theft picture description test from the Boston Diagnostic Aphasia test.</td></tr>
</table>

Nurses' Observation Scale for Geriatric Patients (NOSGER). **Examine Cardiorespiratory Fitness as Outcome:** No	Overall, music therapy and behavioural management techniques were effective for reducing BPSD.
Populations Analyzed: >60 years old, Cognitive disability, Dementia	**Author-Stated Funding Source:** European Union Seventh Framework program.

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Adamson BC, Ensari I, Motl RW. Effect of exercise on depressive symptoms in adults with neurologic disorders: a systematic review and meta-analysis. Arch Phys Med Rehabil. 2015;96(7):1329-1338. doi:10.1016/j.apmr.2015.01.005.</td></tr>
<tr><td>Purpose: To review and quantify the effect of exercise on depression in adults with neurological disorders.</td><td rowspan="5">Abstract: OBJECTIVES: To review and quantify the effect of exercise on depression in adults with neurologic disorders. DATA SOURCES: CINAHL, Cochrane Register of Controlled Clinical Trials, EMBASE, ERIC, MEDLINE, PsycINFO, PubMed, and SPORTDiscus were searched, with the last search performed in May 2014. STUDY SELECTION: Included were randomized controlled trials conducted in adults with a diagnosed neurologic disorder that compared an exercise intervention group with a control group and used depression as an outcome measure. DATA EXTRACTION: Depression data were extracted independently by 2 authors. Methodological quality was assessed independently by 2 authors. DATA SYNTHESIS: Forty-three full-length articles were reviewed, and 26 trials met our inclusion criteria. These trials represented 1324 participants with 7 different neurologic disorders: Alzheimer disease (n=4 trials), migraine (n=1), multiple sclerosis (n=13), Parkinson disease (n=2), spinal cord injury (n=1), stroke (n=2), and traumatic brain injury (n=3). Data measuring depression were extracted and effect sizes were computed for 23 trials. Results from a meta-analysis yielded an overall effect size of .28 (SE=.07; 95% confidence interval, .15-.41; P=.00) favoring a reduction in depression outcomes after an exercise intervention compared with the control condition. Of note, interventions that met physical activity guidelines yielded an overall effect of .38 compared with .19 for studies that did not meet physical activity guidelines. CONCLUSIONS: This review provides evidence that exercise, particularly when meeting physical activity guidelines, can improve depressive symptoms in adults with neurologic disorders.</td></tr>
<tr><td>Timeframe: Inception–May 2014</td></tr>
<tr><td>Total # of Studies: 26</td></tr>
<tr><td>Exposure Definition: Exercise programs lasted from 4 weeks to 12 months, and occurred once per week or daily. Modality varied by program: aerobic, strength training, balance, flexibility, or a combination of training was performed. Most were supervised interventions. Intensity varied by program. Subgroups: Meeting physical activity guidelines.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depressive symptoms: various questionnaires, including the Montgomery Ashberg Depression Rating Scale, Levine Piloesky, and Center for Epidemiologic Studies Depression Scale (CES-D).
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Age ≥18, Neurologic disorders</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Barreto Pde S, Demougeot L, Pillard F, Lapeyre-Mestre M, Rolland Y. Exercise training for managing behavioral and psychological symptoms in people with dementia: A systematic review and meta-analysis. Ageing Res Rev. 2015;24(Pt B):274-285. doi:10.1016/j.arr.2015.09.001.</td></tr>
<tr><td>Purpose: To examine the effects of exercise training on behavioral and psychological symptoms of dementia in people with dementia.</td><td rowspan="5">Abstract: This systematic review and meta-analysis of randomized controlled trials assessed the effects of exercise on behavioral and psychological symptoms of dementia (BPSD, including depression) in people with dementia (PWD). Secondary outcomes for the effects of exercise were mortality and antipsychotic use. Twenty studies were included in this review (n=18 in the meta-analysis). Most studies used a multicomponent exercise training (n=13) as intervention; the control group was often a usual care (n=10) or a socially-active (n=8) group. Exercise did not reduce global levels of BPSD (n=4. Weighted mean difference -3.884; 95% CI -8.969-1.201; I(2)=69.4%). Exercise significantly reduced depression levels in PWD (n=7). Standardized mean difference -0.306; 95% CI -0.571 to -0.041; I(2)=46.8%); similar patterns were obtained in sensitivity analysis performed among studies with: institutionalized people (p=0.038), multicomponent training (p=0.056), social control group (p=0.08), and low risk of attrition bias (p=0.11). Exploratory analysis showed that the principal BPSD (other than depression) positively affected by exercise was aberrant motor behavior. Exercise had no effect on mortality. Data on antipsychotics were scarce. In conclusion, exercise reduces depression levels in PWD. Future studies should examine whether exercise reduces the use (and doses) of antipsychotics and other drugs often used to manage BPSD.</td></tr>
<tr><td>Timeframe: Inception–March 2015</td></tr>
<tr><td>Total # of Studies: 20 (18 for meta-analysis)</td></tr>
<tr><td>Exposure Definition: Exercise intervention; the most common type was multicomponent (i.e., 2 or more exercise types grouped together in the same training session).
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Behavioral areas: delusions, hallucinations, agitation/aggression, depression/dysphoria, anxiety, elation/euphoria, apathy/indifference, disinhibition, irritability/lability, and aberrant motor behavior. Neurovegatative areas: sleep and nighttime behavior disorders, and appetite and eating disorders. Measurement instruments included the Neuropsychiatric Inventory (NPI) and others.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Cognitive Disability, Dementia</td><td>Author-Stated Funding Source: No external funding.</td></tr>
</table>

<table>
<tr><th colspan="2">Anxiety</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Bartley CA, Hay M, Bloch MH. Meta-analysis: aerobic exercise for the treatment of anxiety disorders. Prog Neuropsychopharmacol Biol Psychiatry. 2013;45(2):34-39. doi:10.1016/j.pnpbp.2013.04.016.</td></tr>
<tr><td>Purpose: To analyze current studies to determine the efficacy of long-term exercise as a treatment for anxiety disorders.</td><td rowspan="5">Abstract: BACKGROUND: This meta-analysis investigates the efficacy of exercise as a treatment for DSM-IV diagnosed anxiety disorders. METHODS: We searched PubMED and PsycINFO for randomized, controlled trials comparing the anxiolytic effects of aerobic exercise to other treatment conditions for DSM-IV defined anxiety disorders. Seven trials were included in the final analysis, totaling 407 subjects. The control conditions included non-aerobic exercise, waitlist/placebo, cognitive-behavioral therapy, psychoeducation and meditation. A fixed-effects model was used to calculate the standardized mean difference of change in anxiety rating scale scores of aerobic exercise compared to control conditions. Subgroup analyses were performed to examine the effects of (1) comparison condition; (2) whether comparison condition controlled for time spent exercising and (3) diagnostic indication. RESULTS: Aerobic exercise demonstrated no significant effect for the treatment of anxiety disorders (SMD=0.02 (95%CI: -0.20-0.24), z = 0.2, p = 0.85). There was significant heterogeneity between trials (χ(2) test for heterogeneity = 22.7, df = 6, p = 0.001). The reported effect size of aerobic exercise was highly influenced by the type of control condition. Trials utilizing waitlist/placebo controls and trials that did not control for exercise time reported large effects of aerobic exercise while other trials report no effect of aerobic exercise. CONCLUSIONS: Current evidence does not support the use of aerobic exercise as an effective treatment for anxiety disorders as compared to the control conditions. This remains true when controlling for length of exercise sessions and type of anxiety disorder. Future studies evaluating the efficacy of aerobic exercise should employ larger sample sizes and utilize comparison interventions that control for exercise time.</td></tr>
<tr><td>Timeframe: 1965–January 2013</td></tr>
<tr><td>Total # of Studies: 7</td></tr>
<tr><td>Exposure Definition: Aerobic exercise, including walking and jogging, of various duration and intensity.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Anxiety: validated questionnaires.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Anxiety disorder</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Bridges L, Sharma M. The efficacy of yoga as a form of treatment for depression. J Evid Based Complementary Altern Med. January 2017:2156587217715927. doi:10.1177/2156587217715927.</td></tr>
<tr><td>Purpose: To ascertain the efficacy of yoga on depression and create recommendations for future interventions.</td><td rowspan="5">Abstract: The purpose of this article was to systematically review yoga interventions aimed at improving depressive symptoms. A total of 23 interventions published between 2011 and May 2016 were evaluated in this review. Three study designs were used: randomized control trials, quasi-experimental, and pretest/posttest, with majority being randomized control trials. Most of the studies were in the United States. Various yoga schools were used, with the most common being Hatha yoga. The number of participants participating in the studies ranged from 14 to 136, implying that most studies had a small sample. The duration of the intervention period varied greatly, with the majority being 6 weeks or longer. Limitations of the interventions involved the small sample sizes used by the majority of the studies, most studies examining the short-term effect of yoga for depression, and the nonutilization of behavioral theories. Despite the limitations, it can be concluded that the yoga interventions were effective in reducing depression.</td></tr>
<tr><td>Timeframe: 2011–May 2016</td></tr>
<tr><td>Total # of Studies: 23</td></tr>
<tr><td>Exposure Definition: Exercise programs were yoga-based and included integrated yoga, tai chi (with yoga), and other forms. Programs lasted from 1 week to 24 weeks, with varying frequency during the week. Most yoga sessions ranged from 12 to 90 minutes.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Severity of depressive symptoms: use of validated questionnaires such as Beck's Depression Inventory II and The Center for Epidemiological Studies-Depression Scale (CES-DS).
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults</td><td>Author-Stated Funding Source: Jackson State University.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Brown H, Pearson N, Braithwaite R, Brown W, Biddle S. Physical activity interventions and depression in children and adolescents: a systematic review and meta-analysis. J Sci Med Sport. 2012;15(Suppl 1):S343. doi:10.1016/j.jsams.2012.11.834.</td></tr>
<tr><td>Purpose: To determine the overall efficacy of PA interventions on depression in children and adolescents.</td><td rowspan="5">Abstract: Context Evidence suggests chronic physical activity (PA) participation may be both protective against the onset of and beneficial for reducing depressive symptoms.
Objective The aim of this article is to assess the impact of PA interventions on depression in children and adolescents using meta-analysis. Data sources Published English language studies were located from manual and computerized searches of the following databases: PsycInfo, The Cochrane Database of Systematic Reviews and The Cochrane Central Register of Controlled Trials, Trials Register of Promoting Health Interventions (TRoPHI; EPPI Centre), Web of Science and MEDLINE. Study selection Studies meeting inclusion criteria (1) reported on interventions to promote or increase PA; (2) included children aged 5–11 years and/or adolescents aged 12–19 years; (3) reported on results using a quantitative measure of depression; (4) included a non-physical control or comparison group; and (5) were published in peerreviewed journals written in English, up to and including May 2011 (when the search was conducted). Data extraction Studies were coded for methodological, participant and study characteristics. Comprehensive Meta-Analysis version-2 software was used to compute effect sizes, with subgroup analyses to identify moderating characteristics. Study quality was assessed using the Delphi technique. Results Nine studies were included (n = 581); most were school-based randomized controlled trials, randomized by individual. Studies used a variety of measurement tools to assess depressive symptoms. The summary treatment effect was small but significant (Hedges' g = -0.26, standard error = 0.09, 95% confidence intervals = -0.43, -0.08, p = 0.004). Subgroup analyses showed that methodological
(e.g. studies with both education and PA intervention; those with a higher quality score; and less than 3 months in duration) and participant characteristics (e.g. single-gender
studies; those targeting overweight or obese groups) contributed most to the reduction in depression. Conclusions There was a small significant overall effect for PA on depression. More outcome-focused, high-quality trials are required to effectively inform the implementation of programmes to reduce depressive symptoms in children and adolescents.</td></tr>
<tr><td>Timeframe: Inception–May 2011</td></tr>
<tr><td>Total # of Studies: 9</td></tr>
<tr><td>Exposure Definition: Interventions included mainly aerobic exercise, along with sport and physical education lessons and yoga. Intervention periods ranged from 9 to 40 weeks, and sessions lasted between 20 and 90 minutes. Frequency ranged from 1 to 5 days per week.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depression: Beck Depression Inventory and other valid instruments.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Ages 5–19</td><td>Author-Stated Funding Source: Alf Howard International Travel Scholarship; Australian National Health and Medical Research Council.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Carter T, Morres ID, Meade O, Callaghan P. The effect of exercise on depressive symptoms in adolescents: a systematic review and meta-analysis. J Am Acad Child Adolesc Psychiatry. 2016;55(7):580-590. doi:10.1016/j.jaac.2016.04.016.</td></tr>
<tr><td>Purpose: To explore the effect of exercise interventions on depressive symptoms for adolescents ages 13–17 years old.</td><td rowspan="4">Abstract: OBJECTIVE: The purpose of this review was to examine the treatment effect of physical exercise on depressive symptoms for adolescents aged 13 to 17 years. METHOD: A systematic search of 7 electronic databases identified relevant randomized controlled trials. Following removal of duplicates, 543 texts were screened for eligibility. Screening, data extraction, and trial methodological quality assessment (using the Delphi list) were undertaken by 2 independent researchers. Standardized mean differences were used for pooling postintervention depressive symptom scores. RESULTS: Eleven trials met the inclusion criteria, 8 of which provided the necessary data for calculation of standardized effect size. Exercise showed a statistically significant moderate overall effect on depressive symptom reduction (standardized mean difference [SMD] = -0.48, 95% CI = -0.87, -0.10, p = .01, I(2) = 67%). Among trials with higher methodological scoring, a nonsignificant moderate effect was recorded (SMD = -0.41, 95% CI = -0.86, 0.05, p = .08). In trials with exclusively clinical samples, exercise showed a statistically significant moderate effect on depressive symptoms with lower levels of heterogeneity (SMD = -0.43, 95% CI = -0.84, -0.02, p = .04, I(2) = 44%). CONCLUSION: Physical exercise appears to improve depressive symptoms in adolescents, especially in clinical samples in which the moderate antidepressant effect, higher methodological quality, and lowered statistical heterogeneity suggest that exercise may be a useful treatment strategy for depression. Larger trials with clinical samples that adequately minimize the risk of bias are required for firmer conclusions on the effectiveness of exercise as an antidepressant treatment.</td></tr>
<tr><td>Timeframe: Inception–April 2014</td></tr>
<tr><td>Total # of Studies: 11 in qualitative review (8 in meta-analysis)</td></tr>
<tr><td>Exposure Definition: Exercise included either aerobic, strength, or resistance training, or a combination of these exercises. These programs were conducted in school, inpatient settings, or within community-based settings. Programs lasted between 6 and 40 weeks, with many programs occurring 3 times a week. Intensity varied among programs.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depression: various questionnaires, including Beck Depression Inventory (BDI), Children's Depression Rating Scale Revised (CDRS-R), Children's Depression Inventory (CDI), Children's Depression Inventory 2nd Version (CDI-2), and Hamilton Depression Rating Scale. Anxiety and depression: various questionnaires, including Beck Youth Inventory (BYI), and the Hospital Anxiety and Depression Scale (HADS). Depressive symptoms: Behavior Assessment System for Children subscale (BASC-2), Symptom checklist 90 revision (SCL-90-R).
Examine Cardiorespiratory Fitness as Outcome: No</td><td></td></tr>
<tr><td>Populations Analyzed: Ages 13–17, Clinical sample (subjects with depression), General population</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

Depression	
Meta-Analysis **Citation:** Cooney GM, Dwan K, Greig CA, et al. Exercise for depression. *Cochrane Database Syst Rev.* 2013;(9):Cd004366. doi:10.1002/14651858.CD004366.pub6.	
Purpose: To determine the effectiveness of exercise in the treatment of depression in adults compared with no treatment or a comparator intervention.	**Abstract:** BACKGROUND: Depression is a common and important cause of morbidity and mortality worldwide. Depression is commonly treated with antidepressants and/or psychological therapy, but some people may prefer alternative approaches such as exercise. There are a number of theoretical reasons why exercise may improve depression. This is an update of an earlier review first published in 2009. OBJECTIVES: To determine the effectiveness of exercise in the treatment of depression in adults compared with no treatment or a comparator intervention. SEARCH METHODS: We searched the Cochrane Depression, Anxiety and Neurosis Review Group's Controlled Trials Register (CCDANCTR) to 13 July 2012. This register includes relevant randomised controlled trials from the following bibliographic databases: The Cochrane Library (all years); MEDLINE (1950 to date); EMBASE (1974 to date) and PsycINFO (1967 to date). We also searched www.controlled-trials.com, ClinicalTrials.gov and the WHO International Clinical Trials Registry Platform. No date or language restrictions were applied to the search.We conducted an additional search of the CCDANCTR up to 1st March 2013 and any potentially eligible trials not already included are listed as 'awaiting classification.' SELECTION CRITERIA: Randomised controlled trials in which exercise (defined according to American College of Sports Medicine criteria) was compared to standard treatment, no treatment or a placebo treatment, pharmacological treatment, psychological treatment or other active treatment in adults (aged 18 and over) with depression, as defined by trial authors. We included cluster trials and those that randomised individuals. We excluded trials of postnatal depression. DATA COLLECTION AND ANALYSIS: Two review authors extracted data on primary and secondary outcomes at the end of the trial and end of follow-up (if available). We calculated effect sizes for each trial using Hedges' g method and a standardised mean difference (SMD) for the overall pooled effect, using a random-effects model risk ratio for dichotomous data. Where trials used a number of different tools to assess depression, we included the main outcome measure only in the meta-analysis. Where trials provided several 'doses' of exercise, we used data from the biggest 'dose' of exercise, and performed sensitivity analyses using the lower 'dose'. We performed subgroup analyses to explore the influence of method of diagnosis of depression (diagnostic interview or cut-off point on scale), intensity of exercise and the number of sessions of exercise on effect sizes. Two authors performed the 'Risk of bias' assessments. Our sensitivity analyses explored the influence of study quality on outcome. MAIN RESULTS: Thirty-nine trials (2326 participants) fulfilled our inclusion criteria, of which 37 provided data for meta-analyses. There were multiple sources of bias in many of the trials; randomisation was adequately concealed in 14 studies, 15 used intention-to-treat analyses and 12 used blinded outcome assessors.For the 35 trials (1356 participants) comparing exercise with no treatment or a control intervention, the pooled SMD for the primary outcome of depression at the end of treatment was -0.62 (95%
Timeframe: Inception–May 2013	
Total # of Studies: 37	
Exposure Definition: Interventions included aerobic exercise, treadmill walking, walking, strength training, and a combination (strength, aerobic, and flexibility). Interventions ranged from 10 days to 16 weeks. **Measures Steps:** No **Measures Bouts:** No **Examines HIIT:** No	
Outcomes Addressed: Change in depressive symptoms or mood at different time points: various validated questionnaires, including the Beck Depression	

Inventory (BDI) and Hamilton Rating Scale for Depression (HAMD) scores. **Examine Cardiorespiratory Fitness as Outcome:** No	confidence interval (CI) -0.81 to -0.42), indicating a moderate clinical effect. There was moderate heterogeneity (I(2) = 63%).When we included only the six trials (464 participants) with adequate allocation concealment, intention-to-treat analysis and blinded outcome assessment, the pooled SMD for this outcome was not statistically significant (-0.18, 95% CI -0.47 to 0.11). Pooled data from the eight trials (377 participants) providing long-term follow-up data on mood found a small effect in favour of exercise (SMD -0.33, 95% CI -0.63 to -0.03).Twenty-nine trials reported acceptability of treatment, three trials reported quality of life, none reported cost, and six reported adverse events.For acceptability of treatment (assessed by number of drop-outs during the intervention), the risk ratio was 1.00 (95% CI 0.97 to 1.04).Seven trials compared exercise with psychological therapy (189 participants), and found no significant difference (SMD -0.03, 95% CI -0.32 to 0.26). Four trials (n = 300) compared exercise with pharmacological treatment and found no significant difference (SMD -0.11, -0.34, 0.12). One trial (n = 18) reported that exercise was more effective than bright light therapy (MD -6.40, 95% CI -10.20 to -2.60).For each trial that was included, two authors independently assessed for sources of bias in accordance with the Cochrane Collaboration 'Risk of bias' tool. In exercise trials, there are inherent difficulties in blinding both those receiving the intervention and those delivering the intervention. Many trials used participant self-report rating scales as a method for post-intervention analysis, which also has the potential to bias findings. AUTHORS' CONCLUSIONS: Exercise is moderately more effective than a control intervention for reducing symptoms of depression, but analysis of methodologically robust trials only shows a smaller effect in favour of exercise. When compared to psychological or pharmacological therapies, exercise appears to be no more effective, though this conclusion is based on a few small trials.
Populations Analyzed: ≥18 years old, Depression	**Author-Stated Funding Source:** National Institute for Health Research.

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Cramer H, Anheyer D, Lauche R, Dobos G. A systematic review of yoga for major depressive disorder. J Affect Disord. 2017;213:70-77. doi:10.1016/j.jad.2017.02.006.</td></tr>
<tr><td>Purpose: To investigate the efficacy and safety of yoga interventions in treating patients with major depressive disorder.</td><td rowspan="4">Abstract: BACKGROUND: The purpose of this review was to investigate the efficacy and safety of yoga interventions in treating patients with major depressive disorder. METHODS: MEDLINE, Scopus, and the Cochrane Library were screened through December 2016. Randomized controlled trials (RCTs) comparing yoga to inactive or active comparators in patients with major depressive disorder were eligible. Primary outcomes included remission rates and severity of depression. Anxiety and adverse events were secondary outcomes. Risk of bias was assessed using the Cochrane tool. RESULTS: Seven RCTs with 240 participants were included. Risk of bias was unclear for most RCTs. Compared to aerobic exercise, no short- or medium-term group differences in depression severity was found. Higher short-term depression severity was found for yoga compared to electro-convulsive therapy; remission rates did not differ between groups. No short-term group differences occurred when yoga was compared to antidepressant medication. Conflicting evidence was found when yoga was compared to attention-control interventions, or when yoga as an add-on to antidepressant medication was compared to medication alone. Only two RCTs assessed adverse events and reported that no treatment-related adverse events were reported. LIMITATIONS: Few RCTs with low sample size. CONCLUSIONS: This review found some evidence for positive effects beyond placebo and comparable effects compared to evidence-based interventions. However, methodological problems and the unclear risk-benefit ratio preclude definitive recommendations for or against yoga as an adjunct treatment for major depressive disorder. Larger and adequately powered RCTs using non-inferiority designs are needed.</td></tr>
<tr><td>Timeframe: Inception–December 2016</td></tr>
<tr><td>Total # of Studies: 8</td></tr>
<tr><td>Exposure Definition: Yoga (Hatha yoga, mindfulness yoga, LifeForce yoga program, prenatal yoga program, Sudarshan Kriya Yoga), which included yoga postures, breathing exercises, meditation, and relaxation. Delivered for 5–12 weeks. Frequency ranged from 1 to 6 sessions per week and duration ranged from 30 to 210 minutes per session.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depression remission rates: number of patients with a reduction of depression severity below a specific threshold or the number of participants with a reduction of depression severity of >50%. Severity of depression: clinician-assessed instruments such as the Hamilton Rating Scale for Depression, or the Quick Inventory of Depressive Symptoms-Clinician Rating, or patient-reported measures such as the Beck Depression Inventory. Severity of anxiety: Hamilton Rating Scale for Anxiety of the Beck Anxiety Inventory.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Ages 28–43, ≥75% participants diagnosed with major depressive disorder.</td><td>Author-Stated Funding Source: No funding source used.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Cramer H, Lauche R, Langhorst J, Dobos G. Yoga for depression: a systematic review and meta-analysis. Depress Anxiety. 2013;30(11):1068-1083. doi:10.1002/da.22166.</td></tr>
<tr><td>Purpose: To examine the effectiveness and safety of different yoga forms in patients with depressive disorders and individuals with elevated levels of depression.</td><td rowspan="4">Abstract: BACKGROUND: Mind-body medical interventions are commonly used to cope with depression and yoga is one of the most commonly used mind-body interventions. The aim of this review was to systematically assess and meta-analyze the effectiveness of yoga for depression. METHODS: Medline/PubMed, Scopus, the Cochrane Library, PsycINFO, and IndMED were searched through January 2013. Randomized controlled trials (RCTs) of yoga for patients with depressive disorders and individuals with elevated levels of depression were included. Main outcomes were severity of depression and remission rates, secondary outcomes were anxiety, quality of life, and safety. RESULTS: Twelve RCTs with 619 participants were included. Three RCTs had low risk of bias. Regarding severity of depression, there was moderate evidence for short-term effects of yoga compared to usual care (standardized mean difference (SMD) = -0.69; 95% confidence interval (CI) -0.99, -0.39; P < .001), and limited evidence compared to relaxation (SMD = -0.62; 95%CI -1.03, -0.22; P = .003), and aerobic exercise (SMD = -0.59; 95% CI -0.99, -0.18; P = .004). Limited evidence was found for short-term effects of yoga on anxiety compared to relaxation (SMD = -0.79; 95% CI -1.3, -0.26; P = .004). Subgroup analyses revealed evidence for effects in patients with depressive disorders and in individuals with elevated levels of depression. Due to the paucity and heterogeneity of the RCTs, no meta-analyses on long-term effects were possible. No RCT reported safety data. CONCLUSIONS: Despite methodological drawbacks of the included studies, yoga could be considered an ancillary treatment option for patients with depressive disorders and individuals with elevated levels of depression.</td></tr>
<tr><td>Timeframe: Inception–January 2013</td></tr>
<tr><td>Total # of Studies: 12 (9 in meta-analysis)</td></tr>
<tr><td>Exposure Definition: Interventions that included yoga. Interventions lasted for 3 days to 12 weeks, and varied in session length and intensity.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Change in severity of depression or symptoms of depression: various validated questionnaires, including the Beck Depression Inventory (BDI), Hamilton Rating Scale for Depression (HAMD) scores, Yesavage Geriatric Depression Scale, Center for Epidemiological Studies Depression Scale (CES-D), and others. Improvement in anxiety: Beck Anxiety Inventory, the Hamilton Anxiety Rating Scale, or Spielberger's State Anxiety Inventory.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults, Depression</td><td>Author-Stated Funding Source: Rut and Klaus Bahlsen Foundation.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression, Anxiety</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Das JK, Salam RA, Lassi ZS, et al. Interventions for adolescent mental health: an overview of systematic reviews. J Adolesc Health. 2016;59(4S):S49-S60. doi:10.1016/j.jadohealth.2016.06.020.</td></tr>
<tr><td>Purpose: To systematically review the effectiveness of interventions to prevent and manage mental health disorders among adolescents and youth.</td><td rowspan="5">Abstract: Many mental health disorders emerge in late childhood and early adolescence and contribute to the burden of these disorders among young people and later in life. We systematically reviewed literature published up to December 2015 to identify systematic reviews on mental health interventions in adolescent population. A total of 38 systematic reviews were included. We classified the included reviews into the following categories for reporting the findings: school-based interventions (n = 12); community-based interventions (n = 6); digital platforms (n = 8); and individual-/family-based interventions (n = 12). Evidence from school-based interventions suggests that targeted group-based interventions and cognitive behavioral therapy are effective in reducing depressive symptoms (standard mean difference [SMD]: -.16; 95% confidence interval [CI]: -.26 to -.05) and anxiety (SMD: -.33; 95% CI: -.59 to -.06). School-based suicide prevention programs suggest that classroom-based didactic and experiential programs increase short-term knowledge of suicide (SMD: 1.51; 95% CI: .57-2.45) and knowledge of suicide prevention (SMD: .72; 95% CI: .36-1.07) with no evidence of an effect on suicide-related attitudes or behaviors. Community-based creative activities have some positive effect on behavioral changes, self-confidence, self-esteem, levels of knowledge, and physical activity. Evidence from digital platforms supports Internet-based prevention and treatment programs for anxiety and depression; however, more extensive and rigorous research is warranted to further establish the conditions. Among individual- and family-based interventions, interventions focusing on eating attitudes and behaviors show no impact on body mass index (SMD: -.10; 95% CI: -.45 to .25); Eating Attitude Test (SMD: .01; 95% CI: -.13 to .15); and bulimia (SMD: -.03; 95% CI: -.16 to .10). Exercise is found to be effective in improving self-esteem (SMD: .49; 95% CI: .16-.81) and reducing depression score (SMD: -.66; 95% CI: -1.25 to -.08) with no impact on anxiety scores. Cognitive behavioral therapy compared to waitlist is effective in reducing remission (odds ratio: 7.85; 95% CI: 5.31-11.6). Psychological therapy when compared to antidepressants have comparable effect on remission, dropouts, and depression symptoms. The studies evaluating mental health interventions among adolescents were reported to be very heterogeneous, statistically, in their populations, interventions, and outcomes; hence, meta-analysis could not be conducted in most of the included reviews. Future trials should also focus on standardized interventions and outcomes for synthesizing the exiting body of knowledge. There is a need to report differential effects for gender, age groups, socioeconomic status, and geographic settings since the impact of mental health interventions might vary according to various contextual factors.</td></tr>
<tr><td>Timeframe: Inception–December 2015</td></tr>
<tr><td>Total # of Studies: 38 (4 PA intervention)</td></tr>
<tr><td>Exposure Definition: Dance. Exercise and physical activity, alone or as a part of other comprehensive interventions. Included PA programs (e.g., outdoor adventure, sport) and vigorous exercise.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depression. Anxiety. Self-esteem. Self-confidence.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Ages 11–24</td><td>Author-Stated Funding Source: Bill and Melinda Gates Foundation.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Systematic Review
Citation: de Souza Moura AM, Lamego MK, Paes F, et al. Effects of aerobic exercise on anxiety disorders: a systematic review. CNS Neurol Disord Drug Targets. 2015;14(9):1184-1193. doi:10.2174/1871527315666151111121259.</td></tr>
<tr><td>Purpose: To evaluate current research and main findings related to the potential therapeutic effects of aerobic exercise, compared to other types of interventions to treat depression that can become viable as clinical applications in the coming years.</td><td rowspan="4">Abstract: Depression is a common and disabling disease that affects over 100 million people worldwide and can have a significant impact on physical and mental health, reducing their quality of life. Thus, the aim of this article was to provide information on research results and key chains related to the therapeutic effects of chronic aerobic exercise compared with other types of interventions to treat depression, which may become a useful clinical application in a near future. Researches have shown the effectiveness of alternative treatments, such as physical exercise, minimizing high financial costs and minimizing side effects. In this review, the data analyzed allows us to claim that alternative therapies, such as exercise, are effective on controlling and reducing symptoms. 69.3% of the studies that investigated the antidepressant effects of exercise on depressive were significant, and the other 30.7% of the studies improved only in general physiological aspects, such as increased oxygen uptake, increased use of blood glucose and decreased body fat percentage, with no improvement on symptoms of depression. From the sample analyzed, 71.4% was composed of women, and regarding the severity of symptoms, 85% had mild to moderate depression and only 15% had moderate to severe depression. However, there is still disagreement regarding the effect of exercise compared to the use of antidepressants in symptomatology and cognitive function in depression, this suggests that there is no consensus on the correct intensity of aerobic exercise as to achieve the best dose-response, with intensities high to moderate or moderate to mild.</td></tr>
<tr><td>Timeframe: Inception–June 2014</td></tr>
<tr><td>Total # of Studies: 13</td></tr>
<tr><td>Exposure Definition: Exercise programs included aerobic, strength training, and stretching/yoga. Programs lasted for at least 8 weeks and occurred at least 3 times a week. Intensity and time varied by program.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depression: Center for Epidemiology Studies Depression Scale (CESD), Beck Depression Inventory (BDI), Hamilton Rating Scale for Depression (HAM-D), and Depression Adjective Check List (DACL).
Examine Cardiorespiratory Fitness as Outcome: Yes</td></tr>
<tr><td>Populations Analyzed: Ages 18–60, Depression</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Eng JJ, Reime B. Exercise for depressive symptoms in stroke patients: a systematic review and meta-analysis. Clin Rehabil. 2014;28(8):731-739. doi:10.1177/0269215514523631.</td></tr>
<tr><td>Purpose: To examine the evidence on the effects of physical exercise for depressive symptoms in stroke patients by performing a systematic review and meta analysis of relevant randomized controlled trials.</td><td rowspan="4">Abstract: OBJECTIVE:
The objective was to conduct a systematic review and meta-analysis of studies that examined the effects of structured exercise on depressive symptoms in stroke patients.
METHODS:
We searched for published randomized controlled trials that evaluated the effect of structured exercise programs (e.g. functional, resistance, or aerobic training) on depressive symptoms. The mean effect size, a 95% confidence interval (CI) and I-squared (I2) for heterogeneity were estimated. Sensitivity analyses were conducted.
RESULTS:
Thirteen studies (n = 1022) were included in the meta-analysis. Exercise resulted in less depressive symptoms immediately after the exercise program ended, standardized mean difference = -0.13 [95% CI = -0.26, -0.01], I2 = 6%, p = 0.03, but these effects were not retained with longer term follow-up. Exercise appeared to have a positive effect on depressive symptoms across both the subacute (≤6 months post stroke) and chronic stage of recovery (>6 months). There was a significant effect of exercise on depressive symptoms when higher intensity studies were pooled, but not for lower intensity exercise protocols. Antidepressant medication use was not documented in the majority of studies and thus, its potential confounding interaction with exercise could not be assessed.
CONCLUSIONS:
Exercise may be a potential treatment to prevent or reduce depressive symptoms in individuals with subacute and chronic stroke.</td></tr>
<tr><td>Timeframe: Inception–January 2014</td></tr>
<tr><td>Total # of Studies: 13</td></tr>
<tr><td>Exposure Definition: Physical exercise included progressive resistance training, functional and aerobic exercises, treadmill exercises, Bobath exercises, individualized exercises with education, and community-based rehabilitation services, including physical therapy and occupational therapy. Interventions ranged from 4 to 12 weeks. Most interventions had a frequency of at least 2 sessions per week for at least 4 weeks.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depressive symptoms: use of validated questionnaires.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Age ≥18, Stroke</td><td>Author-Stated Funding Source: Canadian Institutes of Health Research.</td></tr>
</table>

<table>
<tr><th colspan="2">Anxiety</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Ensari I, Greenlee TA, Motl RW, Petruzzello SJ. Meta-analysis of acute exercise effects on state anxiety: an update of randomized controlled trials over the past 25 years. Depress Anxiety. 2015;32(8):624-634. doi:10.1002/da.22370.</td></tr>
<tr><td>Purpose: To examine the effect of acute exercise compared with control for improving state anxiety in adults.</td><td rowspan="5">Abstract: BACKGROUND: One prominent and well-cited meta-analysis published nearly 25 years ago reported that an acute or single bout of exercise reduced state anxiety by approximately (1/4) standard deviation. We conducted a meta-analysis of randomized controlled trials (RCTs) published after that meta-analysis for updating our understanding of the acute effects of exercise on state anxiety. METHODS: We searched PubMed, EBSCOHost, Medline, PsycINFO, ERIC, and ScienceDirect for RCTs of acute exercise and state anxiety as an outcome. There were 36 RCTs that met inclusion criteria and yielded data for effect size (ES) generation (Cohen's d). An overall ES was calculated using a random effects model and expressed as Hedge's g. RESULTS: The weighted mean ES was small (Hedge's g = 0.16, standard error (SE) = 0.06), but statistically significant (P < 0.05), and indicated that a single bout of exercise resulted in an improvement in state anxiety compared with control. The overall ES was heterogeneous and post hoc, exploratory analyses using both random- and fixed-effects models identified several variables as moderators including sample age, sex and health status, baseline activity levels, exercise intensity, modality and control condition, randomization, overall study quality, and the anxiety measure (P < 0.05). CONCLUSION: The cumulative evidence from high quality studies indicates that acute bouts of exercise can yield a small reduction in state anxiety. The research is still plagued by floor effects associated with recruiting persons with normal or lower levels of state anxiety, and this should be overcome in subsequent trials.</td></tr>
<tr><td>Timeframe: 1990 and after</td></tr>
<tr><td>Total # of Studies: 36</td></tr>
<tr><td>Exposure Definition: Acute exercise sessions, including aerobic, resistance, or mixed-training.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: State anxiety measures: use of validated questionnaires.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Farah WH, Alsawas M, Mainou M, et al. Non-pharmacological treatment of depression: a systematic review and evidence map. Evid Based Med. 2016;21(6):214-221. doi:10.1136/ebmed-2016-110522.</td></tr>
<tr><td>Purpose: To summarize the best available evidence about the comparative effectiveness of the various non-pharmacological interventions available for the treatment of depression.</td><td rowspan="4">Abstract: BACKGROUND: The comparative effectiveness of non-pharmacological treatments of depression remains unclear. METHODS: We conducted an overview of systematic reviews to identify randomised controlled trials (RCTs) that compared the efficacy and adverse effects of non-pharmacological treatments of depression. We searched multiple electronic databases through February 2016 without language restrictions. Pairs of reviewers determined eligibility, extracted data and assessed risk of bias. Meta-analyses were conducted when appropriate. RESULT: We included 367 RCTs enrolling approximately 20 000 patients treated with 11 treatments leading to 17 unique head-to-head comparisons. Cognitive behavioural therapy, naturopathic therapy, biological interventions and physical activity interventions reduced depression severity as measured using standardised scales. However, the relative efficacy among these non-pharmacological interventions was lacking. The effect of these interventions on clinical response and remission was unclear. Adverse events were lower than antidepressants. LIMITATION: The quality of evidence was low to moderate due to inconsistency and unclear or high risk of bias, limiting our confidence in findings. CONCLUSIONS: Non-pharmacological therapies of depression reduce depression symptoms and should be considered along with antidepressant therapy for the treatment of mild-to-severe depression. A shared decision-making approach is needed to choose between non-pharmacological therapies based on values, preferences, clinical and social context.</td></tr>
<tr><td>Timeframe: Inception–February 2016</td></tr>
<tr><td>Total # of Studies: 61</td></tr>
<tr><td>Exposure Definition: Physical activity.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Efficacy depression symptoms (response, remission, relapse).
Examine Cardiorespiratory Fitness as Outcome: No</td><td></td></tr>
<tr><td>Populations Analyzed: Age ≥18, Unipolar depression</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Anxiety</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Gordon BR, McDowell CP, Lyons M, Herring MP. The effects of resistance exercise training on anxiety: a meta-analysis and meta-regression analysis of randomized controlled trials. Sports Med. August 2017. doi:10.1007/s40279-017-0769-0.</td></tr>
<tr><td>Purpose: To estimate the population effect size for resistance exercise training effects on anxiety, and to determine whether variables of logical, theoretical, and/or prior empirical relation to anxiety moderate the overall effect.</td><td rowspan="5">Abstract: BACKGROUND: The salutary effects of resistance exercise training (RET) are well established, including increased strength and function; however, less is known regarding the effects of RET on mental health outcomes. Aerobic exercise has well-documented positive effects on anxiety, but a quantitative synthesis of RET effects on anxiety is needed. OBJECTIVES: To estimate the population effect size for resistance exercise training (RET) effects on anxiety and to determine whether variables of logical, theoretical, and/or prior empirical relation to anxiety moderate the overall effect. METHODS: Thirty-one effects were derived from 16 articles published before February 2017, located using Google Scholar, MEDLINE, PsycINFO, PubMed, and Web of Science. Trials involved 922 participants (mean age = 43 +/- 21 years, 68% female/32% male) and included both randomization to RET (n = 486) or a non-active control condition (n = 436), and a validated anxiety outcome measured at baseline, mid-, and/or post-intervention. Hedges' d effect sizes were computed and random effects models were used for all analyses. Meta-regression quantified the extent to which participant and trial characteristics moderated the mean effect. RESULTS: RET significantly reduced anxiety symptoms (Delta = 0.31, 95% CI 0.17-0.44; z = 4.43; p < 0.001). Significant heterogeneity was not indicated (Q T(30) = 40.5, p > 0.09; I 2 = 28.3%, 95% CI 10.17-42.81); sampling error accounted for 77.7% of observed variance. Larger effects were found among healthy participants (Delta = 0.50, 95% CI 0.22-0.78) compared to participants with a physical or mental illness (Delta = 0.19, 95% CI 0.06-0.31, z = 2.16, p < 0.04). Effect sizes did not significantly vary according to sex (beta = -0.31), age (beta = -0.10), control condition (beta = 0.08), program length (beta = 0.07), session duration (beta = 0.08), frequency (beta = -0.10), intensity (beta = -0.18), anxiety recall time frame (beta = 0.21), or whether strength significantly improved (beta = 0.19) (all p >/= 0.06). CONCLUSIONS: RET significantly improves anxiety symptoms among both healthy participants and participants with a physical or mental illness. Improvements were not moderated by sex, or based on features of RET. Future trials should compare RET to other empirically-supported therapies for anxiety.</td></tr>
<tr><td>Timeframe: Inception–February 2017</td></tr>
<tr><td>Total # of Studies: 16</td></tr>
<tr><td>Exposure Definition: Resistance exercise training intervention for a mean length of 11 weeks, ranging in frequency from 2 to 5 days per week. Supervision status varied among studies.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Anxiety: State-Trait Anxiety Inventory (STAI-S), profile of mood states-tension (POMS-T), Hopkins symptom checklist (SCL-90), State-Trait Anxiety Inventory Trait (STAI-T), Mental Health Functioning Index-Anxiety (MHFI-A), Hospital Anxiety and Depression Scales-Anxiety (HADS-A), Depression Anxiety and Stress Scale-21 (DASS-21), and Brunel Mood Scale-Tension (BRUMS-T).
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
</table>

Populations Analyzed: Male, Female; Mean age 43 (moderator analysis: <25, 25–54, ≥55); Physical illness: cancer, obesity, ischemic stroke, etc.; Mental illness: GAD, chemical dependence	**Author-Stated Funding Source:** No funding source used.

<table>
<tr><th colspan="2">Anxiety</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Hall KS, Hoerster KD, Yancy WS. Post-traumatic stress disorder, physical activity, and eating behaviors. Epidemiol Rev. 2015;37:103-115. doi:10.1093/epirev/mxu011.</td></tr>
<tr><td>Purpose: To provide a narrative review of the existing published data regarding post-traumatic stress disorder (PTSD), physical activity, and eating behaviors.</td><td rowspan="5">Abstract: Post-traumatic stress disorder (PTSD), a prevalent and costly psychiatric disorder, is associated with high rates of obesity and cardiometabolic diseases. Many studies have examined PTSD and risky behaviors (e.g., smoking, alcohol/substance abuse); far fewer have examined the relationship between PTSD and health-promoting behaviors. Physical activity and eating behaviors are 2 lifestyle factors that impact cardiometabolic risk and long-term health. This comprehensive review of the literature (1980-2014) examined studies that reported physical activity and eating behaviors in adults with PTSD or PTSD symptoms. A systematic search of electronic databases identified 15 articles on PTSD-physical activity and 10 articles on PTSD-eating behaviors in adults. These studies suggest that there may be a negative association among PTSD, physical activity, and eating behaviors. Preliminary evidence from 3 pilot intervention studies suggests that changes in physical activity or diet may have beneficial effects on PTSD symptoms. There was considerable heterogeneity in the study designs and sample populations, and many of the studies had methodological and reporting limitations. More evidence in representative samples, using multivariable analytical techniques, is needed to identify a definitive relationship between PTSD and these health behaviors. Intervention studies for PTSD that examine secondary effects on physical activity/eating behaviors, as well as interventions to change physical activity/eating behaviors that examine change in PTSD, are also of interest.</td></tr>
<tr><td>Timeframe: 1980–July 2014</td></tr>
<tr><td>Total # of Studies: 25 (15 associating PTSD and PA)</td></tr>
<tr><td>Exposure Definition: Any type and any intensity of physical activity or exercise. Aerobic exercise sessions in the intervention studies.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Risk of PTSD and PTSD symptoms.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults</td><td>Author-Stated Funding Source: U.S. Department of Veterans' Affairs.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Hoare E, Milton K, Foster C, Allender S. The associations between sedentary behaviour and mental health among adolescents: a systematic review. Int J Behav Nutr Phys Act. 2016;13(1):108. doi:10.1186/s12966-016-0432-4.</td></tr>
<tr><td>Purpose: To synthesize all available evidence on the associations between different types of sedentary behavior and mental health among adolescent populations.</td><td rowspan="5">Abstract: BACKGROUND: With technological developments and modernised sedentary lifestyles has come an increase in diseases associated with inactivity such as obesity and other non-communicable diseases. Emerging evidence suggests that time spent sedentary may also interact with mental health. This systematic review examined the associations between sedentary behaviour and mental health problems among adolescents. METHODS: This systematic review followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses, and applied a quality assessment tool for quantitative studies to identity best available evidence. Following stringent search strategy of the databases; Cumulative Index to Nursing and Allied Health Literature, Global Health, Health Source: Nursing and Academic Edition, MEDLINE, PsychARTICLES and PsycINFO, we identified 32 articles eligible for review. RESULTS: All studies reported leisure screen time among adolescents, and two thirds of identified studies examined depressive symptomatology. Other mental health measures were; anxiety symptoms, self-esteem, suicide ideation, loneliness, stress, and psychological distress. Strong consistent evidence was found for the relationship between both depressive symptomatology and psychological distress, and time spent using screens for leisure. Moderate evidence supported the relationship between low self-esteem and screen use. Poorer mental health status was found among adolescents using screen time more than 2-3 h per day, and gender differences exist. Essential information was missing for quality of evidence including heterogeneity in mental health and screen time-based measures, and self-report data collection methods. CONCLUSIONS: The findings are of particular significance given the global public health concern of lifestyle-attributed diseases and the possibility for novel approaches to mental health. Future research should examine the psychological impact of reducing time spent using screens for leisure among adolescents, whilst accounting for possible confounding factors such as physical activity and dietary behaviours. It is critical that the reciprocal relationship between lifestyle behaviours and mental health is represented in both the psychiatric and public health forum.</td></tr>
<tr><td>Timeframe: Inception–January 2016</td></tr>
<tr><td>Total # of Studies: 32</td></tr>
<tr><td>Exposure Definition:
Sedentary behavior: activities that require little energy expenditure, including sitting or lying down while watching television or playing electronic games, reading, studying, writing, or working at a desk or computer.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed:
Depression or depressive symptomatology. Other mental health outcomes: anxiety, self-esteem, suicide ideation, loneliness, stress, and psychological distress.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Ages 10–24</td><td>Author-Stated Funding Source: Australian Endeavour Research Fellowship and Australian Postgraduate Award.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Hoare E, Skouteris H, Fuller-Tyszkiewicz M, Millar L, Allender S. Associations between obesogenic risk factors and depression among adolescents: a systematic review. Obes Rev. 2014;15(1):40-51. doi:10.1111/obr.12069.</td></tr>
<tr><td>Purpose: To systematically review the literature on the relationships between adolescent obesogenic risk factors (PA, sedentary behavior, diet intake and knowledge, weight status/body mass index, and depression).</td><td rowspan="5">Abstract: Adolescence is a transitional life phase that is associated with heightened risk for two major health conditions - obesity and mental health problems. Given the established comorbidity of obesity and depression, one avenue that warrants further exploration is the association between obesogenic risk and obesity in the expression and maintenance of depressive symptoms. The aim of the current systematic review was to identify and evaluate the empirical literature reporting the relationships between obesogenic risk factors (physical activity, sedentary behaviour, diet and weight status) and depression in adolescents. A search of five databases for studies published over the last decade found 24 studies eligible for review. Relationships were found between lack of physical exercise, heightened sedentary behaviour, poor diet quality, obese or overweight and depression in adolescence. However, the finding that obesogenic risk factors are associated with poor adolescent mental health should be interpreted with caution as data typically come from non-representative samples with less than optimal study design and methodology.</td></tr>
<tr><td>Timeframe: 2002–April 2013</td></tr>
<tr><td>Total # of Studies: 24</td></tr>
<tr><td>Exposure Definition: Involvement with sport club, screen-based behaviors, and self-reported PA behaviors.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depressive symptoms or mood: questionnaires/inventories.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Ages 10–19</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Anxiety</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Jayakody K, Gunadasa S, Hosker C. Exercise for anxiety disorders: systematic review. Br J Sports Med. 2014;48(3):187-196. doi:10.1136/bjsports-2012-091287.</td></tr>
<tr><td>Purpose: To examine the treatment effect of exercise on clinically diagnosed anxiety disorders where the diagnosis has been made following a formal assessment.</td><td rowspan="5">Abstract: BACKGROUND: Anxiety disorders are commonly treated with antidepressants and psychological treatments. Some patients may prefer alternative approaches such as exercise. OBJECTIVE: To investigate the treatment effects of exercise compared with other treatments for anxiety disorders. DATA SOURCES: Randomised controlled trials (RCTs) of exercise interventions for anxiety disorders were identified by searching six online databases (July 2011). A number of journals were also hand searched. MAIN RESULTS: Eight RCTs were included. For panic disorder: exercise appears to reduce anxiety symptoms but it is less effective than antidepressant medication (1 RCT); exercise combined with antidepressant medication improves the Clinical Global Impression outcomes (1 RCT, p<0.05); exercise combined with occupational therapy and lifestyle changes reduces Beck Anxiety Inventory outcomes (1 RCT, p=0.0002). For social phobias, added benefits of exercise when combined with group cognitive behavioural therapy (CBT) were shown (p<0.05). There was no significant difference between aerobic and anaerobic exercise groups (1 RCT, p>0.1) with both seeming to reduce anxiety symptoms (1 RCT, p<0.001). It remains unclear as to which type of exercise; moderate to hard or very light to light, is more effective in anxiety reduction (2 RCTs). CONCLUSIONS: Exercise seems to be effective as an adjunctive treatment for anxiety disorders but it is less effective compared with antidepressant treatment. Both aerobic and non-aerobic exercise seems to reduce anxiety symptoms. Social phobics may benefit from exercise when combined with group CBT. Further well-conducted RCTs are needed.</td></tr>
<tr><td>Timeframe: Inception–July 2011</td></tr>
<tr><td>Total # of Studies: 8</td></tr>
<tr><td>Exposure Definition: Various duration and types of exercise, including aerobic and nonaerobic. Intensity varied from very light to hard/strenuous.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Anxiety and depression measures using validated questionnaires.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults, Anxiety disorders</td><td>Author-Stated Funding Source: No funding source used.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Josefsson T, Lindwall M, Archer T. Physical exercise intervention in depressive disorders: meta-analysis and systematic review. Scand J Med Sci Sports. 2014;24(2):259-272. doi:10.1111/sms.12050.</td></tr>
<tr><td>Purpose: To evaluate the results of exercise intervention in clinical depression, using only one pure control group.</td><td rowspan="4">Abstract: Previous meta-analyses investigating the effect of exercise on depression have included trials where the control condition has been categorized as placebo despite the fact that this particular placebo intervention (e.g., meditation, relaxation) has been recognized as having an antidepressant effect. Because meditation and mindfulness-based interventions are associated with depression reduction, it is impossible to separate the effect of the physical exercise from the meditation-related parts. The present study determined the efficacy of exercise in reducing symptoms of depression compared with no treatment, placebo conditions or usual care among clinically defined depressed adults. Of 89 retrieved studies, 15 passed the inclusion criteria of which 13 studies presented sufficient information for calculating effect sizes. The main result showed a significant large overall effect favoring exercise intervention. The effect size was even larger when only trials that had used no treatment or placebo conditions were analyzed. Nevertheless, effect size was reduced to a moderate level when only studies with high methodological quality were included in the analysis. Exercise may be recommended for people with mild and moderate depression who are willing, motivated, and physically healthy enough to engage in such a program.</td></tr>
<tr><td>Timeframe: Inception–April 2012</td></tr>
<tr><td>Total # of Studies: 15 (13 in meta-analysis)</td></tr>
<tr><td>Exposure Definition: Exercise programs were supervised and aerobic exercise based. The median exercise frequency was 3 times per week. The mean length of exercise sessions was 36.4 minutes/session, and exercise duration was 9.4 weeks.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depression: clinical interview, general practitioner diagnosis, diagnostic manual system, or depression scale (such as Beck Depression Inventory).
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Age ≥18, Depression</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Korczak DJ, Madigan S, Colasanto M. Children's physical activity and depression: a meta-analysis. Pediatrics. 2017;139(4):1-14.</td></tr>
<tr><td>Purpose: To investigate the potential preventative effect of child and adolescent PA on depression.</td><td rowspan="4">Abstract: CONTEXT: Research regarding the protective effects of early physical activity on depression has abstract yielded conflicting results. OBJECTIVE: Our objective was to synthesize observational studies examining the association of physical activity in childhood and adolescence with depression. DATA SOURCES: Studies (from 2005 to 2015) were identified by using a comprehensive search strategy. STUDY SELECTION: The included studies measured physical activity in childhood or adolescence and examined its association with depression. DATA EXTRACTION: Data were extracted by 2 independent coders. Estimates were examined by using random-effects meta-analysis. RESULTS: Fifty independent samples (89 894 participants) were included, and the mean effect size was significant (r = -0.14; 95% confidence interval [CI] = -0.19 to -0.10). Moderator analyses revealed stronger effect sizes in studies with cross-sectional versus longitudinal designs (k = 36, r = -0.17; 95% CI = -0.23 to -0.10 vs k = 14, r = -0.07; 95% CI = -0.10 to -0.04); using depression self-report versus interview (k = 46, r = -0.15; 95% CI = -0.20 to -0.10 vs k = 4, r = -0.05; 95% CI = -0.09 to -0.01); using validated versus nonvalidated physical activity measures (k = 29, r = -0.18; 95% CI = -0.26 to -0.09 vs k = 21, r = -0.08; 95% CI = -0.11 to -0.05); and using measures of frequency and intensity of physical activity versus intensity alone (k = 27, r = -0.17; 95% CI = -0.25 to -0.09 vs k = 7, r = -0.05; 95% CI = -0.09 to -0.01). LIMITATIONS: Limitations included a lack of standardized measures of physical activity; use of self-report of depression in majority of studies; and a small number of longitudinal studies. CONCLUSIONS: Physical activity is associated with decreased concurrent depressive symptoms; the association with future depressive symptoms is weak.</td></tr>
<tr><td>Timeframe: 2005–October 2015</td></tr>
<tr><td>Total # of Studies: 40</td></tr>
<tr><td>Exposure Definition: Participation in PA, including leisure time PA and participation in sport.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depressive symptoms: Use of validated questionnaires or interviews.
Examine Cardiorespiratory Fitness as Outcome: No</td><td></td></tr>
<tr><td>Populations Analyzed: Male, Female, Age <18</td><td>Author-Stated Funding Source: Alberta Children’s Hospital Foundation and the Canada Research Chairs program.</td></tr>
</table>

<table>
<tr><th colspan="2">Affect</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Liao Y, Shonkoff ET, Dunton GF. The acute relationships between affect, physical feeling states, and physical activity in daily life: a review of current evidence. Front Psychol. 2015;6:1975. doi:10.3389/fpsyg.2015.01975.</td></tr>
<tr><td>Purpose: To synthesize current evidence on the acute relationships between affective and physical feeling states and PA from studies conducted in free-living, naturalistic settings in nonclinical populations.</td><td rowspan="4">Abstract: Until recently, most studies investigating the acute relationships between affective and physical feeling states and physical activity were conducted in controlled laboratory settings, whose results might not translate well to everyday life. This review was among the first attempts to synthesize current evidence on the acute (e.g., within a few hours) relationships between affective and physical feeling states and physical activity from studies conducted in free-living, naturalistic settings in non-clinical populations. A systematic literature search yielded 14 eligible studies for review. Six studies tested the relationship between affective states and subsequent physical activity; findings from these studies suggest that positive affective states were positively associated with physical activity over the next few hours while negative affective states had no significant association. Twelve studies tested affective states after physical activity and yielded consistent evidence for physical activity predicting higher positive affect over the next few hours. Further, there was some evidence that physical activity was followed by a higher level of energetic feelings in the next few hours. The evidence for physical activity reducing negative affect in the next few hours was inconsistent and inconclusive. Future research in this area should consider recruiting more representative study participants, utilizing higher methodological standards for assessment (i.e., electronic devices combined with accelerometry), reporting patterns of missing data, and investigating pertinent moderators and mediators (e.g., social and physical context, intensity, psychological variables). Knowledge gained from this topic could offer valuable insights for promoting daily physical activity adoption and maintenance in non-clinical populations.</td></tr>
<tr><td>Timeframe: Inception–November 2015</td></tr>
<tr><td>Total # of Studies: 14</td></tr>
<tr><td>Exposure Definition: Exercise was defined as PA in free-living environment. The evaluated exercise differed by frequency, time, type, and intensity.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Affective states: questionnaires (varied by study).
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: All ages</td><td>Author-Stated Funding Source: American Cancer Society; National Instritutes of Health.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Lindheimer JB, O'Connor PJ, Dishman RK. Quantifying the placebo effect in psychological outcomes of exercise training: a meta-analysis of randomized trials. Sports Med. 2015;45(5):693-711. doi:10.1007/s40279-015-0303-1.</td></tr>
<tr><td>Purpose: To estimate the magnitude of the population placebo effect in psychological outcomes from placebo conditions used in exercise training studies, and to compare it with the effect of exercise training.</td><td rowspan="5">Abstract: BACKGROUND: The placebo effect could account for some or all of the psychological benefits attributed to exercise training. The magnitude of the placebo effect in psychological outcomes of randomized controlled exercise training trials has not been quantified. The aim of this investigation was to estimate the magnitude of the population placebo effect in psychological outcomes from placebo conditions used in exercise training studies and compare it to the observed effect of exercise training. METHODS: Articles published before 1 July 2013 were located using Google Scholar, MEDLINE, PsycINFO, and The Cochrane Library. To be included in the analysis, studies were required to have (1) a design that randomly assigned participants to exercise training, placebo, and control conditions and (2) an assessment of a subjective (i.e., anxiety, depression, energy, fatigue) or an objective (i.e., cognitive) psychological outcome. Meta-analytic and multi-level modeling techniques were used to analyze effects from nine studies involving 661 participants. Hedges' d effect sizes were calculated, and random effects models were used to estimate the overall magnitude of the placebo and exercise training effects. RESULTS: After adjusting for nesting effects, the placebo mean effect size was 0.20 (95% confidence interval [CI] -0.02, 0.41) and the observed effect of exercise training was 0.37 (95% CI 0.11, 0.63). CONCLUSION: A small body of research suggests both that (1) the placebo effect is approximately half of the observed psychological benefits of exercise training and (2) there is an urgent need for creative research specifically aimed at better understanding the role of the placebo effect in the mental health consequences of exercise training.</td></tr>
<tr><td>Timeframe: Inception–July 2013</td></tr>
<tr><td>Total # of Studies: 9</td></tr>
<tr><td>Exposure Definition: Exercise training of greater than 4 weeks in duration. Exercise was planned and structured, and repetitive bodily movement was performed to improve or maintain 1 or more components of physical fitness.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Anxiety and depression: Hospital Anxiety and Depression Scale. Vitality: SF-36 Vitality Scale. Beck Depression Inventory.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Not reported</td><td>Author-Stated Funding Source: No funding source used.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Liu X, Clark J, Siskind D, et al. A systematic review and meta-analysis of the effects of Qigong and Tai Chi for depressive symptoms. Complement Ther Med. 2015;23(4):516-534. doi:10.1016/j.ctim.2015.05.001.</td></tr>
<tr><td>Purpose: To evaluate the effect of qigong and tai chi on depressive symptoms and to compare the effect of qigong and tai chi with changes seen in control groups that include usual care, other exercises, and education.</td><td rowspan="4">Abstract: BACKGROUND: Qigong and Tai Chi are the two most popular traditional Chinese exercises, known as mind-body movement therapies. Previous studies suggest that Qigong and Tai Chi may be beneficial in reducing depressive symptoms. This was the first study to systematically review and compare the effects of Qigong and Tai Chi on depressive symptoms. METHODS: A systematic search of six electronic databases was undertaken through to February 2014, for randomized controlled trials (RCTs) which reported depressive symptoms measured by a depressive symptom rating scale. The standardized mean difference in depressive symptoms score between Qigong or Tai Chi and a control group (at the end of follow-up) was extracted as a primary outcome. The secondary outcome was the standardized mean gain in symptom score (SMG) relative to the baseline from individual arms of the RCTs for various forms of care including Qigong, Tai Chi, usual care, other exercise, education and miscellaneous interventions. RESULTS: Thirty studies with a total of 2328 participants (823 males and 1505 females) were included. A significant effect was found for the Qigong interventions (Cohen's d -0.48 95% CI -0.48 to -0.12; SMG -0.52, 95% CI -0.79 to -0.26). There was no significant effect seen for Tai Chi for the primary endpoint. No mean change in symptom scores were seen for Tai Chi, usual care, other exercises, education and the 'miscellaneous' group in pre-post assessment in single arms. The Qigong results were found to be robust in sensitivity analyses. CONCLUSIONS: Qigong appears to be beneficial for reducing depressive symptom severity. However, given the low quality of the included studies and the documented evidence of publication bias, these results should be viewed cautiously.</td></tr>
<tr><td>Timeframe: Inception–February 2014</td></tr>
<tr><td>Total # of Studies: 30</td></tr>
<tr><td>Exposure Definition: Modalities included qigong and tai chi. The qigong programs ranged between 10 days and 24 weeks and were delivered across all studies for 1–21 sessions per week (3 sessions daily), with a session duration of 5–120 minutes. Tai chi programs ranged from 8 to 20 weeks with 1 to ≥3 sessions per week and a session duration of 30–120 minutes.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depressive symptoms: Geriatric Depression Score (GDS), Cornell Depression Score (CDS), Hamilton Rating Scale of Depression (HRSD), Center for Epidemiological Study Depression Scale 20 (CES-D 20), Beck Depression Inventory (BDI), Profile of Mood States Depression (PMSD), and Depression Anxiety Stress Scale 21 (DASS -21).
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: All ages; Mean age ≥60 vs. <60; Non-depression comorbidity</td><td>Author-Stated Funding Source: Australia National Heart Foundation and the National Depression Initiative.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Loi SM, Dow B, Ames D, et al. Physical activity in caregivers: What are the psychological benefits? Arch Gerontol Geriatr. 2014;59(2):204-210. doi:10.1016/j.archger.2014.04.001.</td></tr>
<tr><td>Purpose: To examine the psychological benefits of PA in caregivers, what types of PA interventions have resulted in psychological benefits, and the limitations of study results obtained to date.</td><td rowspan="5">Abstract: Previous research demonstrates that physical activity has psychological benefits for people of all ages. However, it is unclear whether people caring for a frail or ill relative would derive similar psychological benefits, considering the potentially stressful caregiver role. This article reviews the current literature describing the effect of physical activity interventions on the psychological status of caregivers. A search from January 1975 to December 2012 identified five intervention studies investigating physical activity and psychological status in caregivers. These focused on female Caucasian caregivers who were older than 60 years. The physical activity interventions improved stress, depression and burden in caregivers, but small sample sizes, short-term follow up and varying results limited the generalizability of the findings. There were few trials investigating male caregivers, and most care-recipients were people with dementia. Studies with caregivers of different ages and gender, with a range of physical activity interventions, are needed to clarify whether physical activity has psychological benefits for caregivers.</td></tr>
<tr><td>Timeframe: 1975–December 2012</td></tr>
<tr><td>Total # of Studies: 5</td></tr>
<tr><td>Exposure Definition: PA in various settings: brisk walking, strength training, tai chi, and Hatha yoga from 1 hour 1–2 times/week to 30–40 minutes 4 times/week, ranging from 7 weeks to 12 months.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Psychological outcomes: depression (Beck Depression Inventory and Geriatric Depression Scale), burden (Screen for Caregiver Burden and Zarit Burden Inventory), stress (Perceived Stress Scale), anxiety (Total Manifest Anxiety Scale), strain (Caregiver Strain Index), and anger (Anger Expression).
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults >60 years old</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Mammen G, Faulkner G. Physical activity and the prevention of depression: a systematic review of prospective studies. Am J Prev Med. 2013;45(5):649-657. doi:10.1016/j.amepre.2013.08.001.</td></tr>
<tr><td>Purpose: To examine whether PA is protective against the onset of depression.</td><td rowspan="5">Abstract: CONTEXT: Given its high prevalence and impact on quality of life, more research is needed in identifying factors that may prevent depression. This review examined whether physical activity (PA) is protective against the onset of depression. EVIDENCE ACQUISITION: A comprehensive search was conducted up until December 2012 in the following databases: MEDLINE, Embase, PubMed, PsycINFO, SPORTDiscus, and Cochrane Database of Systematic Reviews. Data were analyzed between July 2012 and February 2013. Articles were chosen for the review if the study used a prospective-based, longitudinal design and examined relationships between PA and depression over at least two time intervals. A formal quality assessment for each study also was conducted independently by the two reviewers. EVIDENCE SYNTHESIS: The initial search yielded a total of 6363 citations. After a thorough selection process, 30 studies were included for analyses. Among these, 25 studies demonstrated that baseline PA was negatively associated with a risk of subsequent depression. The majority of these studies were of high methodologic quality, providing consistent evidence that PA may prevent future depression. There is promising evidence that any level of PA, including low levels (e.g., walking <150 minutes/weeks), can prevent future depression. CONCLUSIONS: From a population health perspective, promoting PA may serve as a valuable mental health promotion strategy in reducing the risk of developing depression.</td></tr>
<tr><td>Timeframe: 1976–December 2012</td></tr>
<tr><td>Total # of Studies: 30</td></tr>
<tr><td>Exposure Definition: Exercise performed was mainly aerobic activity, including cycling. Programs varied in time, frequency, intensity, and duration. The evaluated programs were <150 minutes/week compared to ≥150 minutes/week.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depression symptoms: questionnaires, such as Center for Epidemiologic Studies Depression Scale (CES-D), DSM-IV, physician diagnosis, hospital discharge, or use of antidepressants.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Ages 11–100</td><td>Author-Stated Funding Source: Canadian Institute for Health Research (CIHR).</td></tr>
</table>

Depression	
Meta-Analysis **Citation:** Meekums B, Karkou V, Nelson EA. Dance movement therapy for depression. *Cochrane Database Syst Rev.* 2015;(2):CD009895. doi:10.1002/14651858.CD009895.pub2.	
Purpose: To examine the effects of dance movement therapy (DMT) for depression with or without standard care, compared to no treatment or standard care alone, psychological therapies, drug treatment, or other physical interventions. Also, to compare the effectiveness of different DMT approaches.	**Abstract:** Background: Depression is a debilitating condition affecting more than 350 million people worldwide (WHO 2012) with a limited number of evidence-based treatments. Drug treatments may be inappropriate due to side effects and cost, and not everyone can use talking therapies.There is a need for evidence-based treatments that can be applied across cultures and with people who find it difficult to verbally articulate thoughts and feelings. Dance movement therapy (DMT) is used with people from a range of cultural and intellectual backgrounds, but effectiveness remains unclear.Objectives: To examine the effects of DMT for depression with or without standard care, compared to no treatment or standard care alone, psychological therapies, drug treatment, or other physical interventions. Also, to compare the effectiveness of different DMT approaches.Search methods: The Cochrane Depression, Anxiety and Neurosis Review Group's Specialised Register (CCDANCTR-Studies and CCDANCTR-References) and CINAHL were searched (to 2 Oct 2014) together with the World Health Organization's International Clinical Trials Registry Platform (WHO ICTRP) and ClinicalTrials.gov. The review authors also searched the Allied and Complementary Medicine Database (AMED), the Education Resources Information Center (ERIC) and Dissertation Abstracts (to August 2013), handsearched bibliographies, contacted professional associations, educational programmes and dance therapy experts worldwide.Selection criteria: Inclusion criteria were: randomised controlled trials (RCTs) studying outcomes for people of any age with depression as defined by the trialist, with at least one group being DMT. DMT was defined as: participatory dance movement with clear psychotherapeutic intent, facilitated by an individual with a level of training that could be reasonably expected within the country in which the trial was conducted. For example, in the USA this would either be a trainee, or qualified and credentialed by the American Dance Therapy Association (ADTA). In the UK, the therapist would either be in training with, or accredited by, the Association for Dance Movement Psychotherapy (ADMP, UK). Similar professional bodies exist in Europe, but in some countries (e.g. China) where the profession is in development, a lower level of qualification would mirror the situation some decades previously in the USA or UK. Hence, the review authors accepted a relevant professional qualification (e.g. nursing or psychodynamic therapies) plus a clear description of the treatment that would indicate its adherence to published guidelines including Levy 1992, ADMP UK 2015, Meekums 2002, and Karkou 2006.Data collection and analysis: Study methodological quality was evaluated and data were extracted independently by the first two review authors using a data extraction form, the third author acting as an arbitrator.Main results:
Timeframe: Inception–October 2014	
Total # of Studies: 3	
Exposure Definition: Dance movement interventions, which could be either improvisatory or structured, with or without music. Interventions lasted from 4 to 12 weeks and the number of sessions ranged from 20 to 36. The frequency varied from 2 to 5 times per week, with session length equally diverse from 45 minutes to 2 hours each. **Measures Steps:** No **Measures Bouts:** No **Examines HIIT:** No	
Outcomes Addressed: Level of depression: Beck Depression Inventory, Hamilton Rating Scale for Depression, or Symptom Checklist-90-Revised.	

Examine Cardiorespiratory Fitness as Outcome: No	Three studies totalling 147 participants (107 adults and 40 adolescents) met the inclusion criteria. Seventy-four participants took part in DMT treatment, while 73 comprised the control groups. Two studies included male and female adults with depression. One of these studies included outpatient participants; the other study was conducted with inpatients at an urban hospital. The third study reported findings with female adolescents in a middle-school setting. All included studies collected continuous data using two different depression measures: the clinician-completed Hamilton Depression Rating Scale (HAM-D); and the Symptom Checklist-90-R (SCL-90-R) (self-rating scale).Statistical heterogeneity was identified between the three studies. There was no reliable effect of DMT on depression (SMD -0.67 95% CI -1.40 to 0.05; very low quality evidence). A planned subgroup analysis indicated a positive effect in adults, across two studies, 107 participants, but this failed to meet clinical significance (SMD -7.33 95% CI -9.92 to -4.73).One adult study reported drop-out rates, found to be non-significant with an odds ratio of 1.82 [95% CI 0.35 to 9.45]; low quality evidence. One stu y measured social functioning, demonstrating a large positive effect (MD -6.80 95 % CI -11.44 to -2.16; very low quality evidence), but this result was imprecise. One study showed no effect in either direction for quality of life (0.30 95% CI -0.60 to 1.20; low quality evidence) or self esteem (1.70 95% CI -2.36 to 5.76; low quality evidence).Authors' conclusions: The low-quality evidence from three small trials with 147 participants does not allow any firm conclusions to be drawn regarding the effectiveness of DMT for depression. Larger trials of high methodological quality are needed to assess DMT for depression, with economic analyses and acceptability measures and for all age groups.
Populations Analyzed: Adolescents, Adults; Depression	**Author-Stated Funding Source:** National Institute for Health Research.

<table>
<tr><th colspan="2">Anxiety</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Mochcovitch MD, Deslandes AC, Freire RC, Garcia RF, Nardi AE. The effects of regular physical activity on anxiety symptoms in healthy older adults: a systematic review. Rev Bras Psiquiatr. 2016;38(3):255-261.</td></tr>
<tr><td>Purpose: To evaluate the efficacy of regular PA on improving anxiety symptoms in older adults without anxiety disorders.</td><td rowspan="4">Abstract: OBJECTIVE: Anxiety symptoms are common in older adults with or without anxiety disorders. Pharmacological options may be limited for these patients. Alternative treatments, such as physical activity (PA), are often indicated, although few trials have evaluated their efficacy. The aim of this review was to evaluate the efficacy of regular PA on improving anxiety symptoms in older adults without anxiety disorders. Potential neuroendocrine, inflammatory, and oxidative mechanisms, as well as cognitive factors to explain these effects are also discussed. METHODS: A systematic literature review was performed to identify randomized controlled trials, cross-sectional, cohort, and case-control studies, as well as case series including healthy previously sedentary older adults. We searched the PubMed and Web of Science databases for articles published in English, with no set time limits. RESULTS: Eight studies evaluating the effect of PA on anxiety symptoms in healthy older adults were included in this review. In all studies, regular and supervised PA was directly related to decreased anxiety symptoms in older individuals. CONCLUSION: Regular PA may be effective for improving anxiety symptoms in older adults. More studies are needed to identify the ideal PA modality, frequency, duration, and intensity for optimizing the positive effects of exercise on anxiety in this population.</td></tr>
<tr><td>Timeframe: No set time limits</td></tr>
<tr><td>Total # of Studies: 8</td></tr>
<tr><td>Exposure Definition: PA, including aerobic training, resistance training, or mixed training.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Change in anxiety and depression symptoms: variety of instruments, including Hamilton Scale for Anxiety, Beck Anxiety Inventory, and Beck Depression Inventory.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Older adults</td><td>Author-Stated Funding Source: Conselho Nacional de Desenvolvimento Científico e Tecnológico</td></tr>
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<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Mura G, Carta MG. Physical activity in depressed elderly. a systematic review. Clin Pract Epidemiol Ment Health. 2013;9:125-135. doi:10.2174/1745017901309010125.</td></tr>
<tr><td>Purpose: To evaluate literature on PA and its effect on outcomes of depression in late life.</td><td rowspan="5">Abstract: BACKGROUND: exercise may reduce depressive symptoms both in healthy aged populations and in old patients diagnosed with MDD, but few specific analysis were conducted on the efficacy of exercise as an adjunctive treatment with antidepressants, which may be probably more useful in clinical practice, considered the high prevalence of treatment resistant depression in late life, the low cost and safety of physical activity interventions. OBJECTIVE: to establish the new findings on the effectiveness of exercise on depression in elderlies, with particular focus on the efficacy of the exercise as an adjunctive treatment with antidepressants drug therapy. METHOD: THE SEARCH OF SIGNIFICANT ARTICLES WAS CARRIED OUT IN PUBMED/MEDLINE WITH THE FOLLOWING KEY WORDS: "exercise", "physical activity", "physical fitness", "depressive disorder", "depression", "depressive symptoms", "late life", "old people", and "elderly". RESULTS: 44 papers were retrieved by the search. Among the 10 included randomized controlled trials, treatment allocation was adequately conceived in 4 studies, intention-to-treat analysis was performed in 6 studies, but no study had a double-blinded assessment. We examined and discussed the results of all these trials. CONCLUSION: in the last 20 years, few progresses were done in showing the efficacy of exercise on depression, due in part to the persistent lack of high quality research, in part to clinical issues of management of depression in late life, in part to the difficult to establish the real effectiveness of exercise on depressive symptoms in elderlies. However, there are some promising findings on physical activity combined with antidepressants in treatment resistant late life depression.</td></tr>
<tr><td>Timeframe: 1990–January 2013</td></tr>
<tr><td>Total # of Studies: 10</td></tr>
<tr><td>Exposure Definition: Exercise programs varied in mode; most included aerobic exercise, supervised lifting, or strengthening exercises. Programs varied in frequency and intensity. Programs ranged from 6 weeks to 12 months.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed:
Depressive symptoms: various validated questionnaires, including the Beck Depression Inventory and Hamilton Rating Scale for Depression (HAMD).
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Age >60, Depression</td><td>Author-Stated Funding Source: Not reported.</td></tr>
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<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Nystrom MB, Neely G, Hassmen P, Carlbring P. Treating major depression with physical activity: a systematic overview with recommendations. Cogn Behav Ther. 2015;44(4):341-352. doi:10.1080/16506073.2015.1015440.</td></tr>
<tr><td>Purpose: To determine the most effective mode and dose of PA for treating major depressive disorder, and to suggest guidelines and recommendations for clinicians.</td><td rowspan="4">Abstract: UNLABELLED: The purpose of this systematic overview was to determine the most effective mode and dose of physical activity (PA) for treating major depressive disorder (MDD), and to suggest guidelines and recommendations for clinicians. The selection process consisted of a comprehensive search that was conducted up until April 2014 in the following databases: PsycINFO, Medline, PubMed and Scopus. The inclusion criteria were: (1) a randomized controlled trial (RCT) design, (2) complete description of intensity, duration and frequency of the PA, (3) the participants had to be diagnosed with MDD according to Diagnostic Statistical Manual 4 th edition (DSM-IV) or International Classification of Disease tenth Revision (ICD-10) criteria (4) if the controls received any treatment, it had to be specified, (5) published after 1990, (6) consist of aerobic or anaerobic treatment PA, and (7) not be a pilotor preliminary study. A quality assessment of each study was conducted independently by two reviewers; this stringent selection process resulted in 12 reviewed studies. CONCLUSION: individually customized PA, for at least 30 minutes, preferably performed under supervision and with a frequency of at least three times per week is recommended when treating MDD. These recommendations must be viewed in light of the relatively few studies matching the inclusion criteria.</td></tr>
<tr><td>Timeframe: 1990–April 2014</td></tr>
<tr><td>Total # of Studies: 12</td></tr>
<tr><td>Exposure Definition: Modalities included aerobic, anaerobic, and mixed programs. Most programs had a frequency of 3 times per week and intensity of 65–85%, and lasted for 12–16 weeks.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depression: DSM-IV or ICD-10.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Ages 12–84, Depression</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Affect</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Oliveira BR, Deslandes AC, Santos TM. Differences in exercise intensity seems to influence the affective responses in self-selected and imposed exercise: a meta-analysis. Front Psychol. 2015;6:1105. doi:10.3389/fpsyg.2015.01105.</td></tr>
<tr><td>Purpose: To determine the magnitude of differences between affective responses of self-selected and imposed exercise sessions.</td><td rowspan="4">Abstract: Self-selected exercise seems to promote positive affective responses due to the perceived autonomy associated with it. The objective of the present study was to determine the magnitude of differences in Feeling Scale (FS) responses during self-selected and imposed exercise sessions. The PRISMA Statement was adopted for this meta-analysis. The search used PubMed, Scopus, PsycINFO, and ISI Web of Knowledge databases. A total of 10 studies that compared the effects of self-selected and imposed exercise sessions on acute FS responses were included. The screening strategy included: exclusion of studies that were duplicated between databases, abstract screening, and text screening. The standardized mean difference (SMD) between self-selected and imposed exercise sessions categorized in five intensities (equal intensity: both exercises were performed at the same intensity, below lactate/ventilatory threshold (LT/VT): imposed exercise was performed at an intensity below the LT/VT, at LT/VT: imposed exercise was performed at the LT/VT intensity, above LT/VT: imposed exercise was performed at an intensity above the LT/VT, and different intensity: both exercises were performed at different intensities and the intensity of imposed session was not reported relative to LT/VT) and an overall SMD were calculated. Self-selected exercise was used as the reference condition. The subtotal SMD values were as follows: -0.10 (equal intensity), -0.36 (below LT/VT), -0.57 (at LT/VT), -1.30 (above LT/VT), and -0.09 (different intensity) and the overall SMD was -0.41. The results of the present study indicate that the difference between affective responses in self-selected and imposed exercise sessions is dependent on the intensity of the imposed exercise session.</td></tr>
<tr><td>Timeframe: Inception–December 2014</td></tr>
<tr><td>Total # of Studies: 10</td></tr>
<tr><td>Exposure Definition: Exercise programs either self-selected (in which the exercise intensity is regulated by the individual) or imposed (in which the exercise intensity is regulated externally, usually by a fitness professional). Sessions lasted 15 minutes or longer, and used a treadmill or cycle ergometer. Subgroups: equal intensity, differing intensities, below lactate/ventilatory threshold (LVTV), at LVTV , and above LVTV.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Affective response: Feeling Scale responses.
Examine Cardiorespiratory Fitness as Outcome: Yes</td></tr>
<tr><td>Populations Analyzed: Age ≥10 years</td><td>Author-Stated Funding Source: National Council for Scientific Technological Development, FAPERJ JCNE, PROPESQ-UFPE.</td></tr>
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<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Park SH, Han KS, Kang CB. Effects of exercise programs on depressive symptoms, quality of life, and self-esteem in older people: a systematic review of randomized controlled trials. Appl Nurs Res. 2014;27(4):219-226. doi:10.1016/j.apnr.2014.01.004.</td></tr>
<tr><td>Purpose: To explore evidence of exercise programs as interventions to decrease depressive symptoms and to improve quality of life and self-esteem in older people.</td><td rowspan="5">Abstract: OBJECTIVE: This study attempted to show evidence of exercise programs as intervention to decrease depressive symptoms and to improve quality of life and self-esteem in older people. DESIGN: Systematic review of randomized controlled trials. DATA SOURCES: Electronic databases of KoreaMed, Korea Scientific and Technological Intelligence Center, Korean Society of Nursing Science, Korean Academy of Psychiatric Mental Health Nursing, Ovid-Medline and Embase were searched up to May 25th, 2012 for relevant articles. REVIEW: We searched studies of randomized controlled trials involving exercise programs administered to participants aged 65 years or over. Of 461 publications identified, 18 met the inclusion criteria for the meta-analysis. Quality assessment of the studies utilized Cochrane's Risk of Bias. RESULTS: Exercise therapy in older people was effective, as evidenced by a decrease in depressive symptoms [standardized mean difference (SMD) -0.36; 95% confidence interval (CI) -0.64, -0.08], and improvements in quality of life (SMD 0.86; 95% CI 0.11, 1.62) and self-esteem (SMD 0.49; 95% CI 0.09, 0.88). The changes were significant statistically, with no heterogeneity. CONCLUSIONS: Exercise programs in older people are effective in improving depressive symptoms, quality of life and self-esteem. Development and efficient use of tailored exercise programs for elderly people is a prudent strategy.</td></tr>
<tr><td>Timeframe: Inception–May 2013</td></tr>
<tr><td>Total # of Studies: 18</td></tr>
<tr><td>Exposure Definition: Exercise programs included mainly walking, muscle strengthening, balance-keeping, qigong exercise, tai chi, dance, and others. Exercise sessions were 30–60 minutes long, and were performed 1 to 3 times per week. Most of the programs continued for 3 months or more. Intensity varied by program.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depressive symptoms at various time points: various questionnaires, including the Geriatric Depression Scale (GDS), Hospital Anxiety and Depression Scale (HAD-S), Center for Epidemiological Studies Depression Scale (CES), and Zung Self-Rating Depression Scale (ZSDS). Quality of life: measured by various questionnaires, including Short Form 36 (SF-36) and the World Health Organization quality of life assessment.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Age ≥65</td><td>Author-Stated Funding Source: Not reported.</td></tr>
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<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Potter R, Ellard D, Rees K, Thorogood M. A systematic review of the effects of physical activity on physical functioning, quality of life and depression in older people with dementia. Int J Geriatr Psychiatry. 2011;26(10):1000-1011. doi:10.1002/gps.2641.</td></tr>
<tr><td>Purpose: To evaluate the evidence of PA interventions that address physical functioning, quality of life, and depression in people with cognitive impairment or dementia.</td><td rowspan="4">Abstract: BACKGROUND: Depression is common in older people with dementia. Physical activity is effective in reducing depression in adults but there is limited evidence about its effectiveness in people with dementia. DESIGN AND METHODS: A systematic review and partial meta-analysis of physical activity interventions in people with dementia is reported. We searched eight databases for English language papers and reference lists of relevant papers. Included studies reported a physical activity intervention lasting at least 12 weeks in which participants were older and had a diagnosis of dementia. Studies compared the intervention with a non-active or a no-intervention control and reported at least one outcome related to physical function, quality of life or depression. At least two authors independently assessed each paper for inclusion and for study quality and extracted data. RESULTS: We included 13 randomised controlled trials with 896 participants. Three of six trials that reported walking as an outcome found an improvement, as did four of the five trials reporting timed get up and go tests. Only one of the four trials that reported depression as an outcome found a positive effect. Both trials that reported quality of life found an improvement. CONCLUSIONS: There is some evidence that physical activity interventions improve physical function in older people with dementia. Evidence for an effect on depression and quality of life is limited.</td></tr>
<tr><td>Timeframe: Inception–February 2009</td></tr>
<tr><td>Total # of Studies: 15</td></tr>
<tr><td>Exposure Definition: Interventions including either strength, flexibility, or balance training were included. Most interventions lasted 12 to 16 weeks, but intensity and frequency of the sessions varied. Exercise sessions ranged from 2 times per week to every day, with a duration of 30 to 75 minutes.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Quality of life: observed affect scale, Short Form-36 health survey, dementia mood assessment scale, and Alzheimer's mood scale.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: ≥60 years old, Cognitive impairment, dementia</td><td>Author-Stated Funding Source: Advantage West Midlands.</td></tr>
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<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Radovic S, Gordon MS, Melvin GA. Should we recommend exercise to adolescents with depressive symptoms? A meta-analysis. J Paediatr Child Health. 2017;53(3):214-220. doi:10.1111/jpc.13426.</td></tr>
<tr><td>Purpose: To establish whether exercise is effective in reducing depressive symptoms among adolescents with clinical levels of depressive symptoms or diagnosed depressive disorders, and to determine whether doses of exercise moderated reduction in depressive symptoms.</td><td rowspan="5">Abstract: There is growing interest in the potential role of exercise in the reduction of depressive symptoms. The aim of this meta-analysis was to examine whether exercise reduces depressive symptoms amongst depressed adolescents. The following databases were searched on 30 January 2015: MEDLINE, PsychINFO, SPORTDiscuss and PUBMED. Studies were included if they examined exercise interventions amongst adolescents with clinical levels of depressive symptoms, were published in peer-reviewed journals in the English language and contained a control/comparison group. Of 6631 retrieved studies, eight studies were included in the meta-analysis. Meta-analysis was conducted using a random effects model due to the high level of heterogeneity identified amongst studies (I 2 = 65.1, P < .005). The analysis revealed a moderate reduction in depressive symptoms post-intervention (Hedge's g = -0.61, P = .007). This analysis provides preliminary evidence that exercise is effective in reducing symptoms of depression among adolescents with clinical levels of depressive symptoms. The present meta-analysis, however, is limited by the generally low quality of included studies, high level of between-study heterogeneity and restriction of inclusion criteria to published studies. Further high-quality trials with depressed adolescents are needed to determine the efficacy of exercise in the reduction of depressive symptoms and the exercise parameters associated with the antidepressant effects of exercise.</td></tr>
<tr><td>Timeframe: Inception–January 2015</td></tr>
<tr><td>Total # of Studies: 8</td></tr>
<tr><td>Exposure Definition: Exercise intervention (aerobic exercise, mixed aerobic exercise and sports training, mixed aerobic and resistance exercise training) defined as at least twice a week for a minimum duration of 20 minutes throughout the intervention period. All types of exercise were eligible for inclusion; for example, aerobic exercise, yoga. Frequency was 2–5 sessions per week, duration was 25–90 minutes per session, and the overall duration was 4–20 weeks. The majority of interventions were in group-supervised settings. The exercise dose was calculated by multiplying the frequency of exercise sessions engaged in per week by the total length of the exercise intervention.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depressive symptoms: measured by the Beck Depression Inventory, Children's Depression Rating Scale-Revised, Center for Epidemiological Studies Depression Scale, and the Hamilton Rating Scale for Depression.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Mean age 15.6–17, Diagnosed with depressive disorders or depressive symptoms above baseline.</td><td>Author-Stated Funding Source: Not reported.</td></tr>
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<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Rebar AL, Stanton R, Geard D, Short C, Duncan MJ, Vandelanotte C. A meta-meta-analysis of the effect of physical activity on depression and anxiety in non-clinical adult populations. Health Psychol Rev. 2015;9(3):366-378. doi:10.1080/17437199.2015.1022901.</td></tr>
<tr><td>Purpose: To evaluate and quantify high quality meta-analytic findings of effects of PA on depression and anxiety for nonclinical populations.</td><td rowspan="5">Abstract: Amidst strong efforts to promote the therapeutic benefits of physical activity for reducing depression and anxiety in clinical populations, little focus has been directed towards the mental health benefits of activity for non-clinical populations. The objective of this meta-meta-analysis was to systematically aggregate and quantify high-quality meta-analytic findings of the effects of physical activity on depression and anxiety for non-clinical populations. A systematic search identified eight meta-analytic outcomes of randomised trials that investigated the effects of physical activity on depression or anxiety. The subsequent meta-meta-analyses were based on a total of 92 studies with 4310 participants for the effect of physical activity on depression and 306 study effects with 10,755 participants for the effect of physical activity on anxiety. Physical activity reduced depression by a medium effect [standardised mean difference (SMD) = -0.50; 95% CI: -0.93 to -0.06] and anxiety by a small effect (SMD = -0.38; 95% CI: -0.66 to -0.11). Neither effect showed significant heterogeneity across meta-analyses. These findings represent a comprehensive body of high-quality evidence that physical activity reduces depression and anxiety in non-clinical populations.</td></tr>
<tr><td>Timeframe: 1960–November 2014</td></tr>
<tr><td>Total # of Studies: 6</td></tr>
<tr><td>Exposure Definition: Exercise programs varied in frequency, intensity, type, and time.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed:
Depression and anxiety.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults</td><td>Author-Stated Funding Source: CQUniversity HEALTH CRN and the Australian Government's Collaborative Research Networks program.</td></tr>
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<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Rhyner KT, Watts A. Exercise and depressive symptoms in older adults: a systematic meta-analytic review. J Aging Phys Act. 2016;24(2):234-246. doi:10.1123/japa.2015-0146.</td></tr>
<tr><td>Purpose: To evaluate the literature on the effect of exercise interventions on depressive symptoms in older adults.</td><td rowspan="4">Abstract: Depressive symptoms are common in older adults, but antidepressant medications may be contraindicated or poorly tolerated in this population. Intervention studies demonstrate that exercise may be an effective alternative. This meta-analysis included 41 randomized controlled trials of aerobic and nonaerobic exercise interventions investigating the effect of exercise on depressive symptoms in adults aged 60 or older. A random effects model demonstrated that exercise was associated with significantly lower depression severity (SMD = 0.57, 95% CI 0.36-0.78). This effect was not significantly different for different ages of participants, types of control groups, or types of exercise interventions. Studies requiring a diagnosis of depression had significantly greater mean effect sizes than studies that did not require a depression diagnosis (Qbet = 6.843, df = 1, p = .009). These findings suggest that exercise is an effective treatment option for older individuals with depressive symptoms.</td></tr>
<tr><td>Timeframe: Inception–January 2014</td></tr>
<tr><td>Total # of Studies: 41</td></tr>
<tr><td>Exposure Definition: Exercise included aerobic exercise only, resistance/strength training only, combination of aerobic and strength exercise, and mind/body exercises. Frequency was at least once a week, at least 20 minutes per session, and programs lasted greater than 6 weeks.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depressive symptoms: Beck Depression Inventory (BDI) and BDI-II, Center for Epidemiological Studies Depression Scale (CES-D), Geriatric Depression Scale (GDS) and GDS short form.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Age ≥60 (60–74, 75+), Depression</td><td>Author-Stated Funding Source: Not reported.</td></tr>
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<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Robertson R, Robertson A, Jepson R, Maxwell M. Walking for depression or depressive symptoms: a systematic review and meta-analysis. Ment Health Phys Act. 2012;5(1):66-75.</td></tr>
<tr><td>Purpose: To examine the effectiveness of walking as an intervention for alleviating depression in adults, and to perform a meta-analysis on relevant data.</td><td rowspan="5">Abstract: Problem: Depression is a common disorder worldwide. Most patients are treated within primary care and antidepressant treatment is not recommended for people with mild depression. Physical activity has been shown to alleviate depression but it is not known whether the less vigorous activity of walking - a potentially widely acceptable and safe intervention - confers such benefit. Method: Eleven databases were systematically searched for randomised, controlled trials of walking as a treatment intervention for depression, from database inception until January 2012. Meta-analyses were carried out on all trials eligible for inclusion and on sub-groups of outdoor, indoor and group walking. Results: Of the 14,672 articles retrieved, eight trials met the inclusion criteria. The pooled standardised mean difference (effect size) was _0.86 [_1.12, _0.61] showing that walking has a statistically significant, large effect on symptoms of depression. However, there was considerable heterogeneity amongst the interventions and research populations and it is uncertain whether the results can be generalised to specific populations such as primary care patients. Conclusions: Walking has a statistically significant, large effect on the symptoms of depression in some populations, but the current evidence base from randomised, controlled trials is limited. Thus, while
walking is a promising treatment for depression or depressive symptoms with few, if any, contraindications, further investigations to establish the frequency, intensity, duration and type(s) of effective walking interventions particularly in primary care populations would be beneficial for providing further recommendations to clinical practitioners.</td></tr>
<tr><td>Timeframe: Inception–January 2012</td></tr>
<tr><td>Total # of Studies: 8</td></tr>
<tr><td>Exposure Definition: Walking interventions with lengths that varied from an average of 3.5 sessions over 6.2 days to 6 months. The length of individual sessions ranged from 20 to 50 minutes.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Changes in depression using validated questionnaires.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Age ≥18, Depression</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Anxiety</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Rosenbaum S, Vancampfort D, Steel Z, Newby J, Ward PB, Stubbs B. Physical activity in the treatment of Post-traumatic stress disorder: a systematic review and meta-analysis. Psychiatry Res. 2015;230(2):130-136. doi:10.1016/j.psychres.2015.10.017.</td></tr>
<tr><td>Purpose: To evaluate the impact of PA and exercise interventions on post-traumatic stress disorder (PTSD) symptoms among adults.</td><td rowspan="4">Abstract: People with PTSD experience high levels of cardiovascular disease and comorbid mental health problems. Physical activity (PA) is an effective intervention in the general population. We conducted the first systematic review and meta-analysis to determine the effect of PA on PTSD. We searched major electronic databases from inception till 03/2015 for RCTs of PA interventions among people with PTSD. A random effects meta-analysis calculating hedges g was conducted. From a potential of 812 hits, four unique RCTs met the inclusion criteria (n=200, mean age of participants 34-52 years). The methodological quality of included trials was satisfactory, and no major adverse events were reported. PA was significantly more effective compared to control conditions at decreasing PTSD and depressive symptoms among people with PTSD. There was insufficient data to investigate the effect on anthropometric or cardiometabolic outcomes. Results suggest that PA may be a useful adjunct to usual care to improve the health of people with PTSD. Although there is a relative paucity of data, there is reason to be optimistic for including PA as an intervention for people with PTSD, particularly given the overwhelming evidence of the benefits of PA in the general population. Robust effectiveness and implementation studies are required.</td></tr>
<tr><td>Timeframe: Inception–March 2015</td></tr>
<tr><td>Total # of Studies: 4</td></tr>
<tr><td>Exposure Definition: PA or exercise interventions defined as any interventions that use bodily movement produced by skeletal muscles and which require energy expenditure. Included yoga and aerobic and resistance exercise; length of interventions ranged from 6 to 12 weeks, with frequency of 1–2 sessions per week.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Symptoms of PTSD. Functional and psychological outcomes: depression and sleep behavior.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Mean age 34–52, PTSD</td><td>Author-Stated Funding Source: Research Foundation Flanders.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Sarris J, Moylan S, Camfield DA, et al. Complementary medicine, exercise, meditation, diet, and lifestyle modification for anxiety disorders: a review of current evidence. Evid Based Complement Alternat Med. 2012. 2012:809653. doi:10.1155/2012/809653.</td></tr>
<tr><td>Purpose: To examine the current evidence base for nonconventional treatments of anxiety disorders, including discussion of their neurobiological underpinnings, and to provide considerations for their potential integration into clinical practice.</td><td rowspan="5">Abstract: Use of complementary medicines and therapies (CAM) and modification of lifestyle factors such as physical activity, exercise, and diet are being increasingly considered as potential therapeutic options for anxiety disorders. The objective of this metareview was to examine evidence across a broad range of CAM and lifestyle interventions in the treatment of anxiety disorders. In early 2012 we conducted a literature search of PubMed, Scopus, CINAHL, Web of Science, PsycInfo, and the Cochrane Library, for key studies, systematic reviews, and metaanalyses in the area. Our paper found that in respect to treatment of generalized anxiety or specific disorders, CAM evidence revealed current support for the herbal medicine Kava. One isolated study shows benefit for naturopathic medicine, whereas acupuncture, yoga, and Tai chi have tentative supportive evidence, which is hampered by overall poor methodology. The breadth of evidence does not support homeopathy for treating anxiety. Strong support exists for lifestyle modifications including adoption of moderate exercise and mindfulness meditation, whereas dietary improvement, avoidance of caffeine, alcohol, and nicotine offer encouraging preliminary data. In conclusion, certain lifestyle modifications and some CAMs may provide a beneficial role in the treatment of anxiety disorders.</td></tr>
<tr><td>Timeframe: Inception–2012</td></tr>
<tr><td>Total # of Studies: Not reported</td></tr>
<tr><td>Exposure Definition: PA including yoga and tai chi.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Symptoms of anxiety.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Not reported</td><td>Author-Stated Funding Source: Australian National Health and Medical Research Council Fellowship.</td></tr>
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<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Schuch FB, Deslandes AC, Stubbs B, Gosmann NP, Silva CT, Fleck MP. Neurobiological effects of exercise on major depressive disorder: a systematic review. Neurosci Biobehav Rev. 2016a;61:1-11. doi:10.1016/j.neubiorev.2015.11.012.</td></tr>
<tr><td>Purpose: To review studies that have evaluated acute and chronic biomarker responses to exercise across 5 current biological hypotheses to explain the major depressive disorder etiology, including neuroendocrine, neurogenesis, oxidative stress, inflammation, and</td><td rowspan="5">Abstract: Exercise displays promise as an efficacious treatment for people with depression. However, no systematic review has evaluated the neurobiological effects of exercise among people with major depressive disorder (MDD). The aim of this article was to systematically review the acute and chronic biological responses to exercise in people with MDD. Two authors conducted searches using Medline (PubMed), EMBASE and PsycINFO. From the searches, twenty studies were included within the review, representing 1353 people with MDD. The results demonstrate that a single bout of exercise increases atrial natriuretic peptide (ANP), brain natriuretic peptide (BNP), copepetin and growth hormone among people with MDD. Exercise also potentially promotes long-term adaptations of copeptin, thiobarbituric acid reactive species (TBARS) and total mean frequency (TMF). However, there is limited evidence that exercise promotes adaptations on neurogenesis, inflammation biomarkers and brain structure. Associations between depressive symptoms improvement and hippocampus volume and IL-1beta were found. Nevertheless, the paucity of studies and limitations presented within, precludes a more definitive conclusion of the underlying neurobiological explanation for the antidepressant effect of exercise in people with MDD. Further trials should utilize appropriate assessments of neurobiological markers in order to build upon the results of our review and further clarify the potential mechanisms associated with the antidepressant effects of exercise.</td></tr>
<tr><td>Timeframe: Inception–January 2015</td></tr>
<tr><td>Total # of Studies: 20 (15 in meta-analysis)</td></tr>
<tr><td>Exposure Definition: Exercise programs were mainly aerobic based and occurred 2 or more times a week. Programs lasted for at least 1 week, and varied in intensity. Evaluated as acute exercise (single bout of exercise, e.g., bike or treadmill) or chronic exercise (adaptations in longer interventions of 2 or more sessions of exercise).
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Improvement in depressive symptoms: symptom severity checklist.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: All ages, Depression</td><td>Author-Stated Funding Source: Not reported.</td></tr>
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<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Schuch FB, Vancampfort D, Richards J, Rosenbaum S, Ward PB, Stubbs B. Exercise as a treatment for depression: a meta-analysis adjusting for publication bias. J Psychiatr Res. 2016b;77:42-51. doi:10.1016/j.jpsychires.2016.02.023.</td></tr>
<tr><td>Purpose: To establish the updated effects of exercise on depression, comparing exercise versus nonactive control groups, and to identify moderators (such as sex, use of medication, and exercise components) that could impact the effects of exercise on depression.</td><td rowspan="4">Abstract: The effects of exercise on depression have been a source of contentious debate. Meta-analyses have demonstrated a range of effect sizes. Both inclusion criteria and heterogeneity may influence the effect sizes reported. The extent and influence of publication bias is also unknown. Randomized controlled trials (RCTs) were identified from a recent Cochrane review and searches of major electronic databases from 01/2013 to 08/2015. We included RCTs of exercise interventions in people with depression (including those with a diagnosis of major depressive disorder (MDD) or ratings on depressive symptoms), comparing exercise versus control conditions. A random effects meta-analysis calculating the standardized mean difference (SMD, 95% confidence interval; CI), meta-regressions, trim and fill and fail-safe n analyses were conducted. Twenty-five RCTs were included comparing exercise versus control comparison groups, including 9 examining participants with MDD. Overall, exercise had a large and significant effect on depression (SMD adjusted for publication bias = 1.11 (95% CI 0.79-1.43)) with a fail-safe number of 1057. Most adjusted analyses suggested publication bias led to an underestimated SMD. Larger effects were found for interventions in MDD, utilising aerobic exercise, at moderate and vigorous intensities, in a supervised and unsupervised format. In MDD, larger effects were found for moderate intensity, aerobic exercise, and interventions supervised by exercise professionals. Exercise has a large and significant antidepressant effect in people with depression (including MDD). Previous meta-analyses may have underestimated the benefits of exercise due to publication bias. Our data strongly support the claim that exercise is an evidence-based treatment for depression.</td></tr>
<tr><td>Timeframe: January 2013–August 2015</td></tr>
<tr><td>Total # of Studies: 25</td></tr>
<tr><td>Exposure Definition: Programs included aerobic, resistance, and mixed modalities, with intensities ranging from light to vigorous. Exercise programs varied in frequency and time. Subgroups: study settings (outpatient/inpatient/nursing home), intensity of exercise (light to moderate/moderate/vigorous), exercise type (aerobic only/resistance only/mixed), group settings, and supervised.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Change in depressive symptoms: Beck Depression Inventory (BDI), Cornel Scale for Depression in Dementia (CSDD), Geriatric Depression Scale (GDS), Hamilton Depressive Disorder (HAM-D), Montgomery-Asberg Depresson Rating Scale (MADRS), and CES-D.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults, Depression or depressive symptoms</td><td>Author-Stated Funding Source: Research Foundation Flanders.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Schuch FB, Vancampfort D, Rosenbaum S, et al. Exercise for depression in older adults: a meta-analysis of randomized controlled trials adjusting for publication bias. Rev Bras Psiquiatr. 2016c;38(3):247-254. doi:10.1590/1516-4446-2016-1915.</td></tr>
<tr><td>Purpose: To establish the effects of exercise on depression in older people with depression.</td><td rowspan="4">Abstract: OBJECTIVE: To evaluate the antidepressant effects of exercise in older adults, using randomized controlled trial (RCT) data. METHODS: We conducted a meta-analysis of exercise in older adults, addressing limitations of previous works. RCTs of exercise interventions in older people with depression (>/= 60 years) comparing exercise vs. control were eligible. A random-effects meta-analysis calculating the standardized mean difference (SMD) (95% confidence interval [95%CI]), meta-regressions, and trim, fill, and fail-safe number analyses were conducted. RESULTS: Eight RCTs were included, representing 138 participants in exercise arms and 129 controls. Exercise had a large and significant effect on depression (SMD = -0.90 [95%CI -0.29 to -1.51]), with a fail-safe number of 71 studies. Significant effects were found for 1) mixed aerobic and anaerobic interventions, 2) at moderate intensity, 3) that were group-based, 4) that utilized mixed supervised and unsupervised formats, and 5) in people without other clinical comorbidities. CONCLUSION: Adjusting for publication bias increased the beneficial effects of exercise in three subgroup analysis, suggesting that previous meta-analyses have underestimated the benefits of exercise due to publication bias. We advocate that exercise be considered as a routine component of the management of depression in older adults.</td></tr>
<tr><td>Timeframe: 2013–August 2015</td></tr>
<tr><td>Total # of Studies: 8</td></tr>
<tr><td>Exposure Definition: Exercise: planned, structured, repetitive, and purposeful PA. Aerobic or endurance. Mean duration of 12 weeks. Subgroups: Moderate vs. vigorous intensity; Exercise type (aerobic, resistance, or mixed); Group vs. non-group exercise; supervised vs. unsupervised.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depressive symptoms: Hamilton Depression Scale, Beck Depression Inventory, and Geriatric Depression Scale.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults; mean age 69.5, Depression or dysthymia</td><td>Author-Stated Funding Source: Coordenacao de Aperfeicoamento de Pessoal de Nivel Superior.</td></tr>
</table>

<table>
<tr><th colspan="2">Anxiety</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Sciarrino NA, DeLucia C, O'Brien K, McAdams K. Assessing the effectiveness of yoga as a complementary and alternative treatment for post-traumatic stress disorder: a review and synthesis. J Altern Complement Med. July 2017. doi:10.1089/acm.2017.0036.</td></tr>
<tr><td>Purpose: To explore the effectiveness of a yoga intervention with an asana practice as an alternative or complementary intervention in reducing post traumatic stress disorder (PTSD) symptoms.</td><td rowspan="5">Abstract: OBJECTIVES: Posttraumatic stress disorder (PTSD) is a debilitating condition that affects many who have experienced trauma. In addition to skills-focused treatments, exposure-based treatments, cognitive therapy, combination treatments, and EMDR, a number of alternative treatments for PTSD have emerged in recent years. The search for alternative treatments is justified based on the empirical observation that a large percentage of individuals fail to benefit optimally from existing treatments (e.g., between 30 and 60). Moreover, current studies often utilize stringent inclusion criteria (e.g., absence of comorbid disorders), raising the likelihood that results will not generalize to many individuals currently experiencing PTSD. The primary objective of the current paper was to explore the effects of one type of alternative treatment: yoga. DESIGN: A comprehensive review of the literature was conducted targeting research examining yoga postures and PTSD. Seven randomized controlled trials (RCTs) were identified and reviewed, and effect sizes were computed for the post-test assessments. RESULTS: Cohen's d for each study ranged (in absolute value) from a low of -0.06 to a high of 1.42 (average weighted d across studies was 0.48; 95% CI: 0.26, 0.69). CONCLUSIONS: Putative mechanisms of action for the possible beneficial effects of yoga for PTSD-related symptomatology and clinical implications are discussed.</td></tr>
<tr><td>Timeframe: Inception–April 2017</td></tr>
<tr><td>Total # of Studies: 7</td></tr>
<tr><td>Exposure Definition: Yoga interventions ranged in length from 5 days to 16 weeks for 60–90 minutes/session, 1–2 times/week and utilized a variety of yoga forms that ranged in difficulty.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: PTSD symptoms: PTSD Checklist-Civilian (PCL-C), PTSD Checklist (PCL-17), Clinician-Administered PTSD Scale (CAPS), Primary Care PTSD Screen (PC-PTSD), Post-traumatic Stress Diagnostic Scale (PDS).
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Age ≥18; PTSD</td><td>Author-Stated Funding Source: No funding source used.</td></tr>
</table>

<table>
<tr><th colspan="2">Anxiety</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Stonerock GL, Hoffman BM, Smith PJ, Blumenthal JA. Exercise as treatment for anxiety: systematic review and analysis. Ann Behav Med. 2015;49(4):542-556. doi:10.1007/s12160-014-9685-9.</td></tr>
<tr><td>Purpose: To describe and critically evaluate published exercise interventions targeting individuals with elevated anxiety or with a diagnosis of an anxiety disorder.</td><td rowspan="4">Abstract: BACKGROUND: Exercise has been shown to reduce symptoms of anxiety, but few studies have studied exercise in individuals preselected because of their high anxiety. PURPOSE: The objective of this study is to review and critically evaluate studies of exercise training in adults with either high levels of anxiety or an anxiety disorder. METHODS: We conducted a systematic review of randomized clinical trials (RCTs) in which anxious adults were randomized to an exercise or nonexercise control condition. Data were extracted concerning anxiety outcomes and study design. Existing meta-analyses were also reviewed. RESULTS: Evidence from 12 RCTs suggested benefits of exercise, for select groups, similar to established treatments and greater than placebo. However, most studies had significant methodological limitations, including small sample sizes, concurrent therapies, and inadequate assessment of adherence and fitness levels. CONCLUSIONS: Exercise may be a useful treatment for anxiety, but lack of data from rigorous, methodologically sound RCTs precludes any definitive conclusions about its effectiveness.</td></tr>
<tr><td>Timeframe: Inception–July 2014</td></tr>
<tr><td>Total # of Studies: 12</td></tr>
<tr><td>Exposure Definition: Exercise interventions including walking, jogging, cycling, resistance training, cardiac rehab, or gym training. Duration ranged from 2 weeks to 6 months.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Anxiety- Hamilton Anxiety Rating Scale, Beck Anxiety Inventory, and others.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: ≥18 years old, Anxiety</td><td>Author-Stated Funding Source: National Institutes of Health.</td></tr>
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<table>
<tr><th colspan="2">Affect</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Stork MJ, Banfield LE, Gibala MJ, Martin Ginis KA. A scoping review of the psychological responses to interval exercise: Is interval exercise a viable alternative to traditional exercise?. Health Psychol Rev. 2017;1-47. doi:10.1080/17437199.2017.1326011.</td></tr>
<tr><td>Purpose: To catalog what psychological outcomes have been investigated in studies of interval exercise, the methods used, and the results.</td><td rowspan="4">Abstract: While considerable evidence suggests that interval exercise confers numerous physiological adaptations linked to improved health, its psychological consequences and behavioural implications are less clear and the subject of intense debate. The purpose of this scoping review was to catalogue studies investigating the psychological responses to interval exercise in order to identify what psychological outcomes have been assessed, the research methods used, and the results. A secondary objective was to identify research issues and gaps. Forty-two published articles met the review inclusion/exclusion criteria. These studies involved 1258 participants drawn from various active/inactive and healthy/unhealthy populations, and 55 interval exercise protocols (69% high-intensity interval training [HIIT], 27% sprint interval training [SIT], 4% body-weight interval training [BWIT]). Affect and enjoyment were the most frequently studied psychological outcomes. Post-exercise assessments indicate that overall, enjoyment of, and preferences for interval exercise are equal or greater than for continuous exercise, and participants can hold relatively positive social cognitions regarding interval exercise. Although several methodological issues (e.g., inconsistent use of terminology, measures and protocols) and gaps (e.g., data on adherence and real-world protocols) require attention, from a psychological perspective, the emerging data support the viability of interval exercise as an alternative to continuous exercise.</td></tr>
<tr><td>Timeframe: 1946–November 2016</td></tr>
<tr><td>Total # of Studies: 42</td></tr>
<tr><td>Exposure Definition: Interval exercise protocols of any type or modality (e.g., cycle ergometer, treadmill, resistance exercise), classified as either high-intensity interval training (relatively intense but submaximal efforts ≥80% of maximal heart rate [HRmax]), sprint interval training (“all-out” or “supramaximal” efforts at workload ≥100% of maximal oxygen uptake [VO2max]), or body-weight interval training (body-weight resistance exercise performed in circuit-type manner with short periods of recovery). Moderate-intensity continuous training performed at 46–63% of VO2max (64–76% HRmax) and vigorous-intensity continuous training performed at 64–90% VO2max (77–95% HRmax). Training studies lasted from 2 to 24 weeks in duration, with exercise session frequency ranging from 2 to 4 times per week.
Measures Steps: No
Measures Bouts: No
Examines HIIT: Yes</td></tr>
<tr><td>Outcomes Addressed: Affective responses, enjoyment, exercise-related social cognitions, cognition, executive function, and behavior. Feeling Scale and Physical Activity Enjoyment Scale most frequently administered measures.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Not reported</td><td>Author-Stated Funding Source: Social Sciences and Humanities Research Council of Canada.</td></tr>
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<table>
<tr><th colspan="2">Anxiety</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Stubbs B, Vancampfort D, Rosenbaum S, et al. An examination of the anxiolytic effects of exercise for people with anxiety and stress-related disorders: a meta-analysis. Psychiatry Res. 2017;49:102-108. doi:10.1016/j.psychres.2016.12.020.</td></tr>
<tr><td>Purpose: To evaluate the effects of exercise on anxiety symptoms in people with anxiety/stress disorders.</td><td rowspan="4">Abstract: The literature regarding exercise for people with established anxiety disorders is equivocal. To address this issue, we conducted a systematic review and meta-analysis investigating the benefits of exercise compared to usual treatment or control conditions in people with an anxiety and/or stress-related disorders. Major electronic databases were searched from inception until December/2015 and a random effect meta-analysis conducted. Altogether, six randomized control trials (RCTs) including 262 adults (exercise n=132, 34.74 [9.6] years; control n=130, 37.34 [10.0] years) were included. Exercise significantly decreased anxiety symptoms more than control conditions, with a moderate effect size (Standardized Mean Difference=-0.582, 95%CI -1.0 to -0.76, p=0.02). Our data suggest that exercise is effective in improving anxiety symptoms in people with a current diagnosis of anxiety and/ or stress-related disorders. Taken together with the wider benefits of exercise on wellbeing and cardiovascular health, these findings reinforce exercise as an important treatment option in people with anxiety/stress disorders.</td></tr>
<tr><td>Timeframe: Inception–December 2015</td></tr>
<tr><td>Total # of Studies: 6</td></tr>
<tr><td>Exposure Definition: Aerobic exercise sessions defined as planned, structured, repetitive, and purposive, in the sense that improvement or maintenance of 1 or more components of physical fitness is an objective. Frequency ranged from 1 to 7 days per week.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Changes in anxiety or stress: Hamilton Scale for Anxiety and other validated questionnaires.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Adults, Anxiety/stress disorders</td><td>Author-Stated Funding Source: No funding source used.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Wang F, Lee Ek, Wu T, et al. The effects of Tai Chi on depression, anxiety, and psychological well-being: a systematic review and meta-analysis. Int J Behav Med. 2014;21(4):605-617.</td></tr>
<tr><td>Purpose: To examine the effects of tai chi on psychological well-being.
Timeframe: Inception–May 2013
Total # of Studies: 42 (5 in meta-analysis)
Exposure Definition: Tai chi interventions ranging from 4 weeks to 5 years.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No
Outcomes Addressed: Depression, mood, or anxiety: validated questionnaires.
Examine Cardiorespiratory Fitness as Outcome: No</td><td>Abstract: BACKGROUND:
Tai chi, also called taiji or tai chi chuan, is a form of mind-body exercise that originated from China. It combines Chinese martial arts and meditative movements that promote balance and healing of the mind and body, involving a series of slowly performed, dance-like postures that flow into one another. As it comprises mental concentration, physical balance, muscle relaxation, and relaxed breathing, tai chi shows great potential for becoming widely integrated into the prevention and rehabilitation of a number of medical and psychological conditions.
PURPOSE:
A growing body of clinical research has begun to evaluate the efficacy of tai chi as a therapy for a variety of health issues. A systematic review and meta-analysis were carried out on randomized controlled trials (RCTs) and quasi-experimental (Q-E) trials that studied the effects of tai chi on psychological well-being.
METHOD:
Drawn from English and Chinese databases, 37 RCTs and 5 Q-E studies published up to May 31, 2013 were included in the systematic review. The methodological quality of the RCTs was evaluated based on the following criteria: adequate sequence generation, allocation concealment, blinding, completeness of outcome data, selective reporting, and other potential biases. Statistical analyses were performed using Review Manager version 5.0.
RESULTS:
The studies in this review demonstrated that tai chi interventions have beneficial effects for various populations on a range of psychological well-being measures, including depression, anxiety, general stress management, and exercise self-efficacy. Meta-analysis was performed on three RCTs that used depression as an outcome measure (ES=-5.97; 95% CI -7.06 to -4.87), with I2=0%.
CONCLUSION:
In spite of the positive outcomes, the studies to date generally had significant methodological limitations. More RCTs with rigorous research design are needed to establish the efficacy of tai chi in improving psychological well-being and its potential to be used in interventions for populations with various clinical conditions.</td></tr>
<tr><td>Populations Analyzed: Not reported</td><td>Author-Stated Funding Source: U.S. Centers for Disease Control and Prevention; Ministry of Science and Technology of the People's Republic of China.</td></tr>
</table>

<table>
<tr><th colspan="2">Anxiety</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Wegner M, Helmich I, Machado S, Nardi AE, Arias-Carrion O, Budde H. Effects of exercise on anxiety and depression disorders: review of meta-analyses and neurobiological mechanisms. CNS Neurol Disord Drug Targets. 2014;13(6):1002-1014.</td></tr>
<tr><td>Purpose: To synthesize the meta-analyses and review articles on the effects of exercise on anxiety and depression, and to describe average effect sizes.</td><td rowspan="5">Abstract: Anxiety and depression are the most frequently diagnosed psychological diseases showing a high co-morbidity. They have a severe impact on the lives of the persons concerned. Many meta-analytical studies suggested a positive anxiolytic and depression-reducing effect of exercise programs. The aim of the present article is to synthesize metaanalyses on the effects of exercise on anxiety and depression and to describe average effect sizes. For this purpose 37 meta-analyses were included reporting 50 effect sizes for anxiety scores of 42,264 participants and depression scores of 48,207 persons. The average documented anxiolytic effect of exercise in these reviews was small, 0.34. In contrast, the effect of exercise on depression was significantly higher and at a moderate level, 0.56. Data of randomized controlled trials suggest higher sizes for the effect of exercise on anxiety and depression leading to increases up to moderate and large effects, respectively. Additionally, exercise seems to be more beneficial for patients compared to participants within a non-clinical, normal range of psychological disease. Especially for the effect of exercise on anxiety, more high quality meta-analyses of randomized controlled trials are needed. Finally, possible neurobiological explanations are suggested for the positive effect of exercise on psychological disorders like anxiety and depression.</td></tr>
<tr><td>Timeframe: 1990–2013</td></tr>
<tr><td>Total # of Studies: 50</td></tr>
<tr><td>Exposure Definition: PA or exercise. Analysis conducted for minutes of exercise session in 0–20, 21–30, 31–40, >40 minutes per session.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Anxiety: various measures, including State Trait Anxiety Inventory (STAI), the Profile of Mood States (POMS), the Multiple Affect Adjective Check List (MAACL), the Manifest Anxiety Scale (MAS), the Test Anxiety Scale (TAS), the SCL-90-R, or the Beck Anxiety Inventory (BAI). Depression: various measures, including the Beck Depression Inventory (BDI) and the Hamilton Depression Scale.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: All ages, Normal/non-clinical; patients with anxiety/depression disorder</td><td>Author-Stated Funding Source: German Research Foundation.</td></tr>
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<table>
<tr><th colspan="2">Anxiety</th></tr>
<tr><td colspan="2">Systematic Review
Citation: Whitworth JW, Ciccolo JT. Exercise and post-traumatic stress disorder in military veterans: a systematic review. Mil Med. 2016;181(9):953-960. doi:10.7205/MILMED-D-15-00488.</td></tr>
<tr><td>Purpose: To systematically review studies examining the relationship between exercise and post-traumatic stress disorder (PTSD) in veterans.</td><td rowspan="4">Abstract: Post-traumatic stress disorder (PTSD) is a prominent mental health issue for many military veterans. Recent evidence from nonveteran populations with PTSD suggests that exercise may be a potential treatment option. As such, the purpose of this review was to (1) provide the rationale for the use of exercise in the treatment of veterans with PTSD and (2) systematically review studies examining the relationship between exercise and PTSD in military veterans. A search of electronic databases (PubMed, PsycINFO, and Web of Science) for relevant studies published in print or online from January 1980 to September 2015 produced 204 unique articles and 13 relevant studies (9 observational studies, 2 experimental, and 2 qualitative). Results of these initial studies are promising and suggest that regular exercise is inversely correlated with PTSD and its symptoms in military veterans. However, the longitudinal effect of exercise on PTSD in military veterans remains unclear because the current research lacks a common focus and suffers from several methodological limitations. Recommendations for the development of future trials are included.</td></tr>
<tr><td>Timeframe: 1980–September 2015</td></tr>
<tr><td>Total # of Studies: 13</td></tr>
<tr><td>Exposure Definition: Varied exercise training, aerobic, and strength training.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depression. Sleep quality. Pain. Stress. Mental alertness. Social support. Motivation.
Examine Cardiorespiratory Fitness as Outcome: No</td><td></td></tr>
<tr><td>Populations Analyzed: PTSD</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Yan S, Jin Y, Oh Y, Choi Y. Effect of exercise on depression in university students: a meta-analysis of randomized controlled trials. J Sports Med Phys Fitness. 2016;56(6):811-816.</td></tr>
<tr><td>Purpose: To assess the effect of exercise on depression in university students.</td><td rowspan="4">Abstract: INTRODUCTION: The aim of this study was to assess the effect of exercise on depression in university students. EVIDENCE ACQUISITION: A systematic literature search was conducted in PubMed, EMBASE and the Cochrane library from their inception through December 10, 2014 to identify relevant articles. The heterogeneity across studies was examined by Cochran's Q statistic and the I2 statistic. Standardized mean difference (SMD) and 95% confidence interval (CI) were pooled to evaluate the effect of exercise on depression. Then, sensitivity and subgroup analyses were performed. In addition, publication bias was assessed by drawing a funnel plot. EVIDENCE SYNTHESIS: A total of 352 participants (154 cases and 182 controls) from eight included trials were included. Our pooled result showed a significant alleviative depression after exercise (SMD=-0.50, 95% CI: -0.97 to -0.03, P=0.04) with significant heterogeneity (P=0.003, I2=67%). Sensitivity analyses showed that the pooled result may be unstable. Subgroup analysis indicated that sample size may be a source of heterogeneity. Moreover, no publication bias was observed in this study. CONCLUSIONS: Exercise may be an effective therapy for treating depression in university students. However, further clinical studies with strict design and large samples focused on this specific population should be warranted in the future.</td></tr>
<tr><td>Timeframe: Inception–December 2014</td></tr>
<tr><td>Total # of Studies: 8</td></tr>
<tr><td>Exposure Definition: Exercise modalities included strength training or aerobic exercise (walking, running, or jogging). Programs varied in length, intensity, and frequency.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Depressive symptoms: various questionnaires, including Beck Depression Inventory (BDI), Center for Epidemiological Studies Depression Scale (CES-D), DSM-IV diagnostic, and Multiple Affect Adjective Checklist.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: University students</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Yin J, Dishman RK. The effect of Tai Chi and Qigong practice on depression and anxiety symptoms: a systematic review and meta-regression analysis of randomized controlled trials. Database of Abstracts of Reviews of Effects. 2014;(2):135-146.</td></tr>
<tr><td>Purpose: To examine the effects of tai chi and qigong exercises on symptoms of depression and anxiety in randomized controlled trials.</td><td rowspan="5">Abstract: Background: We extend findings from previous quantitative reviews of the effects of Tai Chi and Qigong exercises on symptoms of depression and anxiety in randomized controlled trials by examining whether effects varied according to participant characteristics, exposure, or features of research design. Methods: Thirty-five articles published before 1 April 2013 involving 2765 participants were selected according to PRISMA guidelines. Hedges d effect sizes were calculated and random effects models were used to estimate population variance of the observed effects and its moderators using meta-regression analysis. Results: Tai Chi training reduced depression by a heterogeneous standardized mean effect size 0.36 (95% CI, 0.19e0.53); reductions were larger in participants having elevated symptoms at baseline. Studies with blinded allocation of participants had smaller effects. The homogeneous mean effect of Qigong on depression was 0.38 (95% CI ¼ 0.25e0.51). The heterogeneous mean effect of Tai Chi on anxiety was 0.34 (95% CI ¼ 0.02e0.66); reductions were larger when participants were Asian and smaller when they were older. The heterogeneous mean effect of Qigong on anxiety was 0.72 (95% CI ¼ 0.4e1.03); reductions were inversely related to age and positively related to session duration and weekly frequency. Conclusion: Tai Chi and Qigong exercises have small-to-moderate efficacy for reducing symptoms of depression and anxiety. Higher-quality trials are needed that sample patients with elevated symptoms, use blinded allocation to conditions, and standardize Tai Chi and Qigong exposure in order to better determine clinical effectiveness and its modifiers.</td></tr>
<tr><td>Timeframe: Inception–April 2013</td></tr>
<tr><td>Total # of Studies: 35</td></tr>
<tr><td>Exposure Definition: Tai chi or qigong exercise interventions, which consisted of 1 to 5 sessions per week, 30–120 minutes per session, and 8–48 weeks duration.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Anxiety and depressive symptoms using validated questionnaires.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Asian, Ages 30; 30–60; >60; <50; >50</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

<table>
<tr><th colspan="2">Depression</th></tr>
<tr><td colspan="2">Meta-Analysis
Citation: Zhai L, Zhang Y, Zhang D. Sedentary behaviour and the risk of depression: a meta-analysis. Br J Sports Med. 2015;49(11):705-709. doi:10.1136/bjsports-2014-093613.</td></tr>
<tr><td>Purpose: To derive an estimation of the association between sedentary behavior and depression.</td><td rowspan="4">Abstract: BACKGROUND: Sedentary behaviour is associated with risk of depression. We review and quantitatively summarise the evidence from observational studies in a meta-analysis. METHODS: We searched the PubMed, Web of Knowledge, Chinese National Knowledge Infrastructure and Wanfang databases for observational studies related to the association of sedentary behaviour and depression risk up to 15 January 2014. Summary relative risks (RRs) were estimated by the use of a random effects model. RESULTS: Thirteen cross-sectional studies with 110,152 participants and 11 longitudinal studies with 83,014 participants were included in this meta-analysis. The summary RR of depression for the highest versus non-occasional/occasional sedentary behaviour was 1.25 (95% CI 1.16 to 1.35, I(2)=50.7%) for all included studies. The pooled RRs of depression for sedentary behaviour were 1.31 (95% CI 1.16 to 1.48) in cross-sectional studies and 1.14 (95% CI 1.06 to 1.21) in longitudinal studies. In subgroup analysis by different types of sedentary behaviour, the pooled RRs of depression were 1.13 (95% CI 1.06 to 1.21) for long-time TV viewing and 1.22 (95% CI 1.10 to 1.34) for prolonged computer or internet use. CONCLUSIONS: This meta-analysis of observational studies indicates that sedentary behaviour is associated with increased risk of depression.</td></tr>
<tr><td>Timeframe: Inception–January 2014</td></tr>
<tr><td>Total # of Studies: 24</td></tr>
<tr><td>Exposure Definition: Sedentary behavior, including TV viewing, computer or internet use, and other sedentary states.
Measures Steps: No
Measures Bouts: No
Examines HIIT: No</td></tr>
<tr><td>Outcomes Addressed: Relative Risk of Depression. Depression: doctor’s diagnosis of depression, beginning regular use of antidepressant medication, or identified by interview or depression rating scales.
Examine Cardiorespiratory Fitness as Outcome: No</td></tr>
<tr><td>Populations Analyzed: Region: Europe, America, Asia, Australia</td><td>Author-Stated Funding Source: Not reported.</td></tr>
</table>

Table 3. Existing Systematic Reviews and Meta-Analyses Quality Assessment Chart

AMSTARExBP: SR/MA	Abraha, 2017	Adamson, 2015	Barreto, 2015	Bartley, 2013	Bridges, 2017	Brown, 2013	Carter, 2016
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population variables defined and considered in methods.	No	Yes	No	No	No	No	No
Comprehensive literature search performed.	Yes	Yes	Partially Yes	Yes	Partially Yes	Yes	Yes
Duplicate study selection and data extraction performed.	Yes	Yes	Yes	No	No	No	Yes
Search strategy clearly described.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Relevant grey literature included in review.	No	Yes	Yes	No	No	Yes	Yes
List of studies (included and excluded) provided.	No	Yes	No	No	No	No	No
Characteristics of included studies provided.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FITT defined and examined in relation to outcome effect sizes.	N/A	No	No	No	N/A	No	No
Scientific quality (risk of bias) of included studies assessed and documented.	Yes	Yes	Partially Yes	Partially Yes	Yes	Yes	Yes
Results depended on study quality, either overall, or in interaction with moderators.	Yes	Yes	No	No	No	Yes	Yes
Scientific quality used appropriately in formulating conclusions.	Yes	Yes	Yes	Yes	No	Yes	Yes
Data appropriately synthesized and if applicable, heterogeneity assessed.	N/A	Yes	Yes	Yes	N/A	Yes	Yes
Effect size index chosen justified, statistically.	N/A	Yes	Yes	Yes	N/A	Yes	Yes
Individual-level meta-analysis used.	N/A	No	No	No	N/A	No	No
Practical recommendations clearly addressed.	Yes	Yes	No	Yes	Yes	Yes	Yes
Likelihood of publication bias assessed.	No	No	Yes	Yes	No	Yes	Yes
Conflict of interest disclosed.	Yes	No	Yes	No	Yes	Yes	No

AMSTARExBP: SR/MA	Cooney, 2013	Cramer, 2013	Cramer, 2017	Das, 2016	de Souza Moura, 2015	Eng, 2014	Ensari, 2015
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population variables defined and considered in methods.	No	No	Yes	No	No	No	Yes
Comprehensive literature search performed.	Yes	Yes	Yes	Partially Yes	Yes	Yes	Yes
Duplicate study selection and data extraction performed.	Yes	Yes	Yes	Yes	Yes	No	No
Search strategy clearly described.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Relevant grey literature included in review.	Yes	Yes	Yes	No	No	Yes	No
List of studies (included and excluded) provided.	Yes	Yes	Yes	No	Yes	No	No
Characteristics of included studies provided.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FITT defined and examined in relation to outcome effect sizes.	Yes	No	N/A	N/A	N/A	No	Yes
Scientific quality (risk of bias) of included studies assessed and documented.	Yes	Yes	Yes	Yes	Partially Yes	Yes	Yes
Results depended on study quality, either overall, or in interaction with moderators.	Yes	No	No	Yes	No	Yes	Yes
Scientific quality used appropriately in formulating conclusions.	Yes	Yes	Yes	Yes	No	Yes	Yes
Data appropriately synthesized and if applicable, heterogeneity assessed.	Yes	Yes	N/A	N/A	N/A	Yes	Yes
Effect size index chosen justified, statistically.	Yes	Yes	N/A	N/A	N/A	Yes	Yes
Individual-level meta-analysis used.	No	No	N/A	N/A	N/A	No	No
Practical recommendations clearly addressed.	Yes	Yes	Yes	Yes	No	Yes	Yes
Likelihood of publication bias assessed.	Yes	No	No	No	No	Yes	Yes
Conflict of interest disclosed.	Yes	No	Yes	Yes	No	No	No

AMSTARExBP: SR/MA	Farah, 2016	Gordon, 2017	Hall, 2015	Hoare, 2016	Hoare, 2014	Jayakody, 2014	Josefsson, 2014
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population variables defined and considered in methods.	No	Yes	No	No	No	No	No
Comprehensive literature search performed.	Yes	Yes	Yes	Yes	Partially Yes	Yes	Yes
Duplicate study selection and data extraction performed.	Yes	No	No	No	No	No	No
Search strategy clearly described.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Relevant grey literature included in review.	No	No	No	No	No	No	Yes
List of studies (included and excluded) provided.	No	No	No	No	Yes	No	No
Characteristics of included studies provided.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FITT defined and examined in relation to outcome effect sizes.	No	Yes	N/A	N/A	N/A	N/A	No
Scientific quality (risk of bias) of included studies assessed and documented.	Partially Yes	Yes	Partially Yes	Yes	No	Yes	Yes
Results depended on study quality, either overall, or in interaction with moderators.	Yes	No	No	Yes	N/A	No	Yes
Scientific quality used appropriately in formulating conclusions.	Yes	Yes	Yes	Yes	N/A	Yes	Yes
Data appropriately synthesized and if applicable, heterogeneity assessed.	Yes	Yes	N/A	N/A	N/A	N/A	Yes
Effect size index chosen justified, statistically.	Yes	Yes	N/A	N/A	N/A	N/A	Yes
Individual-level meta-analysis used.	No	No	N/A	N/A	N/A	N/A	No
Practical recommendations clearly addressed.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Likelihood of publication bias assessed.	No	Yes	No	No	No	No	No
Conflict of interest disclosed.	No	Yes	Yes	Yes	No	Yes	No

AMSTARExBP: SR/MA	Korczak, 2017	Liao, 2015	Lindheimer, 2015	Liu, 2015	Loi, 2014	Mammen, 2013	Meekums, 2015
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population variables defined and considered in methods.	Yes	No	No	Yes	No	No	Yes
Comprehensive literature search performed.	Partially Yes	Partially Yes	Yes	Partially Yes	Yes	Yes	Yes
Duplicate study selection and data extraction performed.	No	Yes	No	No	No	No	Yes
Search strategy clearly described.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Relevant grey literature included in review.	No	No	Yes	No	No	No	Yes
List of studies (included and excluded) provided.	No	No	No	Yes	Yes	No	Yes
Characteristics of included studies provided.	Yes	Yes	Yes	Yes	Yes	No	Yes
FITT defined and examined in relation to outcome effect sizes.	No	N/A	No	No	N/A	N/A	Yes
Scientific quality (risk of bias) of included studies assessed and documented.	Yes	Yes	No	Yes	Yes	Yes	Yes
Results depended on study quality, either overall, or in interaction with moderators.	No	Yes	N/A	Yes	No	Yes	Yes
Scientific quality used appropriately in formulating conclusions.	Yes	Yes	N/A	Yes	Yes	Yes	Yes
Data appropriately synthesized and if applicable, heterogeneity assessed.	Yes	N/A	Yes	Yes	N/A	N/A	Yes
Effect size index chosen justified, statistically.	Yes	N/A	Yes	Yes	N/A	N/A	Yes
Individual-level meta-analysis used.	No	N/A	No	No	N/A	N/A	No
Practical recommendations clearly addressed.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Likelihood of publication bias assessed.	Yes	No	Yes	Yes	No	No	No
Conflict of interest disclosed.	Yes	Yes	Yes	Yes	No	Yes	Yes

AMSTARExBP: SR/MA	Mochcovitch, 2016	Mura, 2013	Nystrom, 2015	Oliveira, 2015	Park, 2014	Potter, 2011	Radovic, 2017
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population variables defined and considered in methods.	No	No	No	No	No	No	No
Comprehensive literature search performed.	Yes	Yes	Yes	Yes	Partially Yes	Yes	Partially Yes
Duplicate study selection and data extraction performed.	No	No	Yes	No	Yes	Yes	No
Search strategy clearly described.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Relevant grey literature included in review.	No	No	No	Yes	No	No	No
List of studies (included and excluded) provided.	No	Yes	No	No	No	No	No
Characteristics of included studies provided.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FITT defined and examined in relation to outcome effect sizes.	N/A	N/A	N/A	Yes	No	No	Yes
Scientific quality (risk of bias) of included studies assessed and documented.	Partially Yes	Partially Yes	Yes	Yes	Yes	Yes	Yes
Results depended on study quality, either overall, or in interaction with moderators.	No	Yes	Yes	No	No	No	No
Scientific quality used appropriately in formulating conclusions.	No	Yes	Yes	Yes	Yes	Yes	Yes
Data appropriately synthesized and if applicable, heterogeneity assessed.	N/A	N/A	N/A	Yes	Yes	Yes	Yes
Effect size index chosen justified, statistically.	N/A	N/A	N/A	Yes	Yes	Yes	Yes
Individual-level meta-analysis used.	N/A	N/A	N/A	No	No	No	No
Practical recommendations clearly addressed.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Likelihood of publication bias assessed.	No	No	No	Yes	Yes	No	No
Conflict of interest disclosed.	Yes	No	No	Yes	No	Yes	No

AMSTARExBP: SR/MA	Rebar, 2015	Rhyner, 2016	Robertson, 2012	Rosenbaum, 2015	Sarris, 2012	Schuch, 2016a	Schuch, 2016b
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes	No	Yes	Yes
Population variables defined and considered in methods.	No	Yes	No	No	No	No	Yes
Comprehensive literature search performed.	Yes	Yes	Yes	Yes	Partially Yes	Yes	Yes
Duplicate study selection and data extraction performed.	Yes	No	Yes	No	No	Yes	Yes
Search strategy clearly described.	Yes	Yes	Yes	Yes	No	Yes	Yes
Relevant grey literature included in review.	No	Yes	Yes	No	Yes	No	Yes
List of studies (included and excluded) provided.	No	No	No	No	No	Yes	Yes
Characteristics of included studies provided.	Yes	Yes	Yes	Yes	No	Yes	Yes
FITT defined and examined in relation to outcome effect sizes.	No	No	No	No	N/A	No	Yes
Scientific quality (risk of bias) of included studies assessed and documented.	Yes	No	Yes	Yes	No	No	Yes
Results depended on study quality, either overall, or in interaction with moderators.	Yes	N/A	Yes	No	N/A	N/A	Yes
Scientific quality used appropriately in formulating conclusions.	Yes	N/A	Yes	Yes	N/A	N/A	Yes
Data appropriately synthesized and if applicable, heterogeneity assessed.	Yes	Yes	Yes	Yes	N/A	No	Yes
Effect size index chosen justified, statistically.	Yes	Yes	Yes	Yes	N/A	Yes	Yes
Individual-level meta-analysis used.	No	No	No	No	N/A	No	No
Practical recommendations clearly addressed.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Likelihood of publication bias assessed.	Yes	Yes	No	Yes	No	No	Yes
Conflict of interest disclosed.	Yes	No	No	No	No	No	Yes

AMSTARExBP: SR/MA	Schuch, 2016c	Sciarrino, 2017	Stoneroc k, 2015	Stork, 2017	Stubbs, 2017	Wang, 2014	Wegner, 2014
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population variables defined and considered in methods.	Yes	No	Yes	No	No	No	No
Comprehensive literature search performed.	Yes	Partially Yes	Partially Yes	Yes	Yes	Partially Yes	Yes
Duplicate study selection and data extraction performed.	Yes	No	Yes	Yes	Yes	Yes	No
Search strategy clearly described.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Relevant grey literature included in review.	Yes	No	Yes	No	No	No	No
List of studies (included and excluded) provided.	No	No	Yes	Yes	No	No	No
Characteristics of included studies provided.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FITT defined and examined in relation to outcome effect sizes.	Yes	N/A	N/A	N/A	No	No	N/A
Scientific quality (risk of bias) of included studies assessed and documented.	Yes	No	Yes	No	Yes	Yes	No
Results depended on study quality, either overall, or in interaction with moderators.	Yes	N/A	No	N/A	Yes	No	N/A
Scientific quality used appropriately in formulating conclusions.	Yes	N/A	Yes	N/A	Yes	Yes	N/A
Data appropriately synthesized and if applicable, heterogeneity assessed.	Yes	N/A	N/A	N/A	Yes	Yes	N/A
Effect size index chosen justified, statistically.	Yes	N/A	N/A	N/A	Yes	Yes	N/A
Individual-level meta-analysis used.	No	N/A	N/A	N/A	No	No	N/A
Practical recommendations clearly addressed.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Likelihood of publication bias assessed.	Yes	No	No	No	Yes	Yes	No
Conflict of interest disclosed.	Yes	Yes	Yes	Yes	Yes	Yes	Yes

AMSTARExBP: SR/MA	Whitworth, 2016	Yan, 2016	Yin, 2014	Zhai, 2015
Review questions and inclusion/exclusion criteria delineated prior to executing search strategy.	Yes	Yes	Yes	Yes
Population variables defined and considered in methods.	No	No	Yes	No
Comprehensive literature search performed.	Yes	Yes	Yes	Yes
Duplicate study selection and data extraction performed.	No	Yes	No	Yes
Search strategy clearly described.	Yes	Yes	Yes	Yes
Relevant grey literature included in review.	No	No	Yes	No
List of studies (included and excluded) provided.	No	No	No	No
Characteristics of included studies provided.	Yes	Yes	No	Yes
FITT defined and examined in relation to outcome effect sizes.	N/A	No	Yes	N/A
Scientific quality (risk of bias) of included studies assessed and documented.	No	Yes	Partially Yes	Yes
Results depended on study quality, either overall, or in interaction with moderators.	N/A	No	Yes	Yes
Scientific quality used appropriately in formulating conclusions.	N/A	Yes	Yes	Yes
Data appropriately synthesized and if applicable, heterogeneity assessed.	N/A	Yes	Yes	Yes
Effect size index chosen justified, statistically.	N/A	Yes	Yes	Yes
Individual-level meta-analysis used.	N/A	No	No	No
Practical recommendations clearly addressed.	Yes	Yes	Yes	Yes
Likelihood of publication bias assessed.	No	Yes	Yes	Yes
Conflict of interest disclosed.	No	No	No	No

Appendices

Appendix A: Analytical Framework

Topic Area
Brain Health

Systematic Review Questions

What is the relationship between physical activity and (1) affect, (2) anxiety, and (3) depressed mood and depression?

a. Is there a dose-response relationship? If yes, what is the shape of the relationship?
b. Does the relationship vary by age, sex, race/ethnicity, socio-economic status, or weight status?
c. Does the relationship exist across a continuum of mood and affective disorders (i.e., depression)?
d. What is the relationship between physical activity and brain structure and function?

Population
People of all ages, including healthy people and people with psychiatric disorders or cognitive impairment

Exposure
All types and intensities of physical activity, including free-living activities, sedentary behavior, play, and single, acute bouts of physical activity

Comparison
People who participate in varying levels of physical activity

Endpoint Health Outcomes

- Activation
- Affect
- Affect/Mood Disorders
- Anger
- Anxiety
- Anxiety Disorders
- Arousal
- Bipolar disorder
- Dejection
- Depression
- Dysthymia
- Emotion
- Feeling
- Hostility
- Hypervigilance
- Mood
- Nervousness
- Pleasant
- Pleasure
- Post-traumatic stress disorder (PTSD)
- Symptoms of Anxiety or Mood Disorders
- Tension
- Valence
- Vigor
- Worry

Appendix A: Analytical Framework

Key Definitions

- Anxiety is a noticeable, psychophysiological emotional state which is most often characterized by feelings of apprehension, fear or expectations of fear, worry, nervousness, and physical sensations arising from activation of the autonomic nervous system (e.g., increased muscle tension, elevated heart rate, sweating). In the Surgeon General's Report on Mental Health (U.S. DHHS, 1999), anxiety is defined as the "pathological counterpart of normal fear, manifest by disturbances of mood, as well as of thinking, behavior, and physiological activity" (p. 233). This normal human emotion becomes pathological (i.e., clinical anxiety or an anxiety disorder) when it results in changes in thoughts and actions, occurs even in the absence of an eliciting event, and when the response is disproportionate and unmanageable (American Psychiatric Association, 2000, p. 299A–C). Sources:
  US Department of Health and Human Services. Mental Health: A Report of the Surgeon General. Rockville, MD: US Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Center for Mental Health Services, National Institutes of Health, National Institutes of Mental Health; 1999. https://profiles.nlm.nih.gov/ps/access/NNBBHS.pdf. Accessed December 20, 2017.; American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders.* 4th ed. Text revision. Washington, DC: American Psychiatric Association; 2000.
- *Affect* refers to the experiential component of all valenced (i.e., 'good' or 'bad') responses, including emotions and moods (Ekkekakis & Petruzzello, 2000). A common approach to examining affective responses is to utilize a dimensional space defined by the dimensions of affective valence (i.e., pleasantness-unpleasantness, positive-negative, good-bad) and perceived activation/arousal (ranging from low to high). These dimensions are orthogonal to one another, thus resulting in characterizing affective states that can be: low activation-pleasant (e.g., calm, relaxed), low activation-unpleasant (e.g., sad, tired), high activation-unpleasant (e.g., tense, nervous) or high activation-pleasant (e.g., excited, energetic). Source: Ekkekakis P, Petruzzello SJ. Analysis of the affect measurement conundrum in exercise psychology: I. Fundamental issues. *Psychol Sport Exerc.* 2000;1(2):71-88. doi:10.1016/S1469-0292(00)00010-8

Appendix B: Final Search Strategy

Search Strategy: PubMed (Systematic Reviews, Meta-Analyses, Pooled Analyses, and High-Quality Reports)

Database: PubMed; Date of Search: 8-28-17; 1,590 results

Set	Search Terms
Limit: Language	(English[lang])
Limit: Exclude animal only	NOT ("Animals"[Mesh] NOT ("Animals"[Mesh] AND "Humans"[Mesh]))
Limit: Publication Date (SR/MA)	AND ("2006/01/01"[PDAT] : "3000/12/31"[PDAT])
Limit: Publication Type Include (SR/MA)	AND (systematic[sb] OR meta-analysis[pt] OR "systematic review"[tiab] OR "systematic literature review"[tiab] OR metaanalysis[tiab] OR "meta analysis"[tiab] OR metanalyses[tiab] OR "meta analyses"[tiab] OR "pooled analysis"[tiab] OR "pooled analyses"[tiab] OR "pooled data"[tiab])
Limit: Publication Type Exclude (SR/MA)	NOT ("comment"[Publication Type] OR "editorial"[Publication Type])
Physical Activity	AND (("Exercise"[mh] OR "Exercise"[tiab] OR "Physical activity"[tiab] OR "Sedentary lifestyle"[mh] OR "Lifestyle activities"[tiab] OR "Lifestyle activity"[tiab] OR "Recreational activities"[tiab] OR "Recreational activity"[tiab] OR "Tai ji"[mh] OR "Yoga"[mh] OR "Balance training"[tiab] OR "Qigong"[mh] OR "Functional training"[tiab] OR ("Recess" AND ("Child" OR "Youth")) OR "Physical education and Training"[mh] OR "Free living activities"[tiab] OR "Free living activity"[tiab] OR "motor skills"[mh] OR "motor performance"[tiab] OR "Computer time"[tiab] OR "Computer use"[tiab] OR "Screen time"[tiab] OR "Sitting"[tiab] OR "Television"[tiab] OR "TV viewing"[tiab] OR "TV watching"[tiab] OR "Video game"[tiab] OR "Video gaming"[tiab]) OR (("Aerobic activities"[tiab] OR "Aerobic activity"[tiab] OR "Cardiovascular activities"[tiab] OR "Cardiovascular activity"[tiab] OR "Endurance activities"[tiab] OR "Endurance activity"[tiab] OR "Physical activities"[tiab] OR "Physical conditioning"[tiab] OR "Resistance training"[tiab] OR "strength training"[tiab] OR "Sedentary"[tiab] OR "Tai chi"[tiab] OR "Tai ji"[tiab] OR "Yoga"[tiab] OR "Walk"[tiab] OR "Walking"[tiab] OR "Chi kung"[tiab] OR "Qigong"[tiab] OR "stretching"[tiab] OR "Physical education"[tiab] OR "motor skills"[tiab] OR "motor skill"[tiab] OR "Inactivity"[tiab] OR "Physically inactive"[tiab] OR "Sedentarism"[tiab]) NOT medline[sb]))

Set	Search Terms
Affect & Anxiety	AND (("Affect"[mh] OR "Affect"[tiab] OR "Anxiety"[mh] OR "Anxiety"[tiab] OR "Mood"[tiab] OR "Mood disorders"[mh] OR "Bipolar disorder"[mh] OR "Trauma and Stressor Related Disorders"[mh] OR "Anxiety disorders"[mh] OR "Panic"[tiab] OR "Affect disorder"[tiab] OR "Affect disorders"[tiab] OR "Depression"[mh] OR "Antidepressant"[tiab] OR "Hypervigilance"[tiab] OR "Nervousness"[tiab] OR "Nervous"[tiab] OR "Worry"[tiab] OR "Worries"[tiab] OR "Worried"[tiab] OR "Arousal"[mh] OR "Pleasant"[tiab] OR "Pleasureable"[tiab] OR "Pleasure"[tiab] OR "Valence"[tiab] OR "Activate"[tiab] OR "Activated"[tiab] OR "Activation"[tiab] OR "Activates"[tiab] OR "Feelings"[tiab] OR "Emotion"[tiab] OR "Emotions"[tiab] OR "Emotional"[tiab] OR "Emotions"[mh] OR "Tension"[tiab] OR "Anger"[tiab] OR "Hostility"[tiab] OR "Dejection"[tiab] OR "Vigor"[tiab]) OR (("Affective"[tiab] OR "Mood disorder"[tiab] OR "Mood disorders"[tiab] OR "Bipolar disorders"[tiab] OR "Bipolar disorder"[tiab] OR "Adjustment disorder"[tiab] OR "Adjustment disorders"[tiab] OR "Traumatic stress disorder"[tiab] OR "Traumatic stress disorders"[tiab] OR "PTSD"[tiab] OR "Anxiety disorder"[tiab] OR "Anxiety disorders"[tiab] OR "Depression"[tiab] OR "Depressive"[tiab] OR "Depressed"[tiab] OR "Anxiolytic"[tiab] OR "Phobia"[tiab] OR "Phobic"[tiab] OR "Arousal"[tiab] OR "Aroused"[tiab] OR "Dysthymic Disorder"[tiab] OR "Dysthymia"[tiab]) NOT medline[sb]))

Search Strategy: CINAHL (Systematic Reviews, Meta-Analyses, Pooled Analyses, and High-Quality Reports)

Database: CINAHL; Date of Search: 8-28-17; 98 results
All terms searched in title or abstract

Set	Search Terms
Physical Activity	("Aerobic activities" OR "Aerobic activity" OR "Cardiovascular activities" OR "Cardiovascular activity" OR "Endurance activities" OR "Endurance activity" OR "Exercise" OR "Physical activity" OR "Physical activities" OR "Physical conditioning" OR "Resistance training" OR "strength training" OR "Sedentary" OR "Lifestyle activities" OR "Lifestyle activity" OR "Recreational activities" OR "Recreational activity" OR "Tai chi" OR "Tai ji" OR "Yoga" OR "Walk" OR "Walking" OR "Balance training" OR "Chi kung" OR "Qigong" OR "Functional training" OR "stretching" OR (Recess AND (Child OR Youth)) OR "Physical education" OR "Free living activities" OR "Free living activity" OR "motor skills" OR "motor skills" OR "motor skill" OR "motor performance" OR "Inactivity" OR "Physically inactive" OR "Sedentarism" OR "Computer time" OR "Computer use" OR "Screen time" OR "Sitting" OR "Television" OR "TV viewing" OR "TV watching" OR "Video game" OR "Video gaming")
Affect & Anxiety	("Affect" OR "Affective" OR "Anxiety" OR "Mood" OR "Mood disorder" OR "Mood disorders" OR "Bipolar disorders" OR "Bipolar disorder" OR "Trauma and Stressor Related Disorders" OR "Adjustment disorder" OR "Adjustment disorders" OR "Traumatic stress disorder" OR "Traumatic stress disorders" OR "PTSD" OR "Anxiety disorder" OR "Anxiety disorders" OR "Panic" OR "Affect disorder" OR "Affect disorders" OR "Depression" OR "Depressive" OR "Depressed" OR "Antidepressant" OR "Anxiolytic" OR "Phobia" OR "Phobic" OR "Hypervigilance" OR "Nervousness" OR "Nervous" OR "Worry" OR "Worries" OR "Worried" OR "Arousal" OR "Aroused" OR "Pleasant" OR "Pleasureable" OR "Pleasure" OR "Valence" OR "Activate" OR "Activated" OR "Activation" OR "Activates" OR "Feelings" OR "Dysthymic Disorder" OR "Dysthymia" OR "Emotion" OR "Emotions" OR "Emotional" OR "Tension" OR "Anger" OR "Hostility" OR "Dejection" OR "Vigor")
Limit: Publication Type Include (SR/MA)	("systematic review" OR "systematic literature review" OR "metaanalysis" OR "meta analysis" OR metanalyses OR "meta analyses" OR "pooled analysis" OR "pooled analyses" OR "pooled data")
Limits	2006-present English language Peer reviewed Exclude Medline records Human

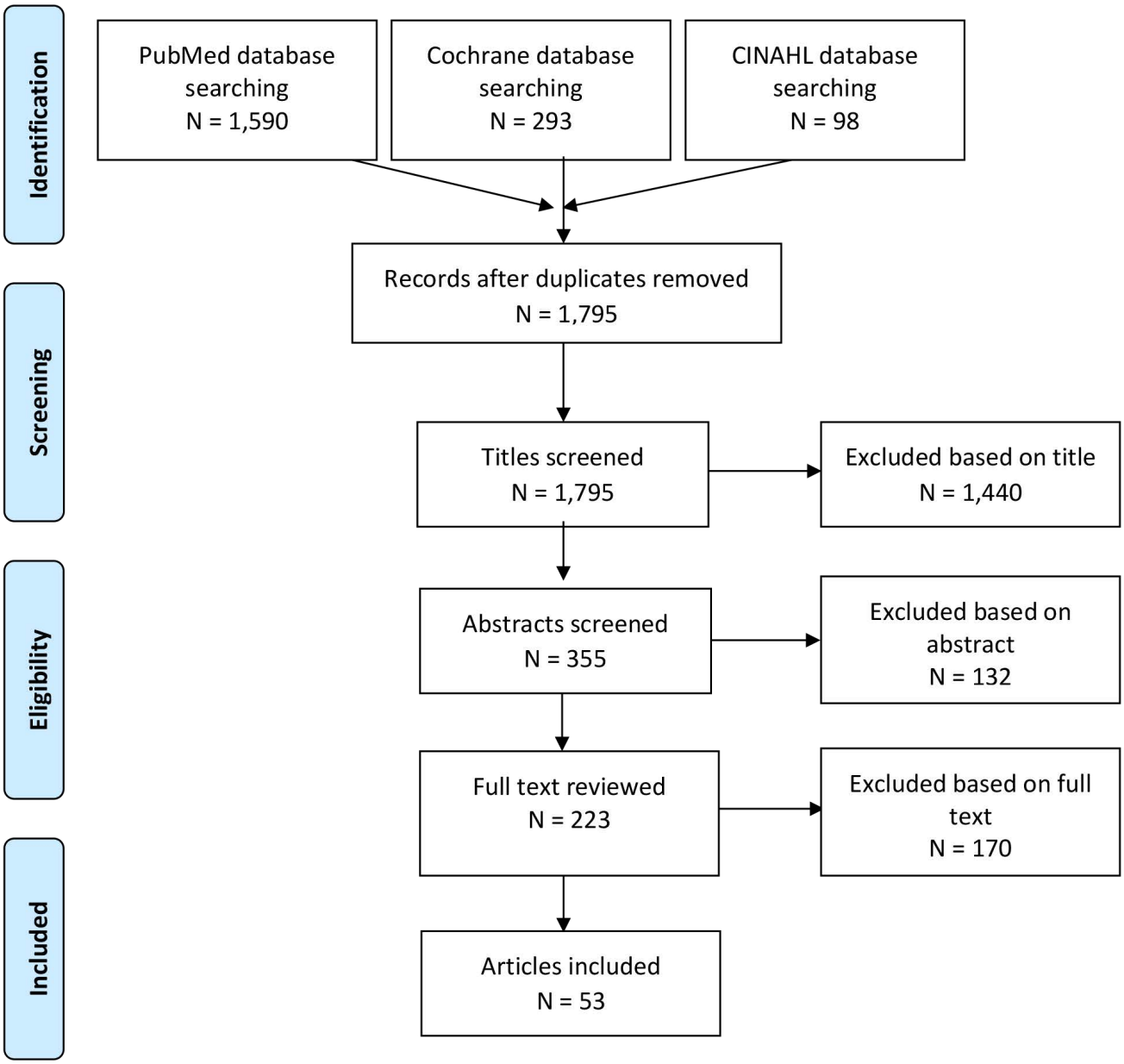
Search Strategy: Cochrane (Systematic Reviews, Meta-Analyses, Pooled Analyses, and High-Quality Reports)

Database: Cochrane; Date of Search: 8-28-17, 293 results
All terms searched in title, abstract, or keywords

Set	Search Terms
Physical Activity	("Aerobic activities" OR "Aerobic activity" OR "Cardiovascular activities" OR "Cardiovascular activity" OR "Endurance activities" OR "Endurance activity" OR "Exercise" OR "Physical activity" OR "Physical activities" OR "Physical conditioning" OR "Resistance training" OR "strength training" OR "Sedentary" OR "Lifestyle activities" OR "Lifestyle activity" OR "Recreational activities" OR "Recreational activity" OR "Tai chi" OR "Tai ji" OR "Yoga" OR "Walk" OR "Walking" OR "Balance training" OR "Chi kung" OR "Qigong" OR "Functional training" OR "stretching" OR (Recess AND (Child OR Youth)) OR “Physical education” OR "Free living activities" OR "Free living activity" OR "motor skills" OR "motor skills" OR "motor skill" OR "motor performance" OR "Inactivity" OR "Physically inactive" OR “Sedentarism” OR "Computer time" OR "Computer use" OR "Screen time" OR "Sitting" OR "Television" OR "TV viewing" OR "TV watching" OR "Video game" OR "Video gaming")
Affect & Anxiety	("Affect" OR "Affective" OR "Anxiety" OR "Mood" OR "Mood disorder" OR "Mood disorders" OR "Bipolar disorders" OR "Bipolar disorder" OR "Trauma and Stressor Related Disorders" OR "Adjustment disorder" OR "Adjustment disorders" OR "Traumatic stress disorder" OR "Traumatic stress disorders" OR "PTSD" OR "Anxiety disorder" OR "Anxiety disorders" OR "Panic" OR "Affect disorder" OR "Affect disorders" OR "Depression" OR "Depressive" OR "Depressed" OR "Antidepressant" OR "Anxiolytic" OR "Phobia" OR "Phobic" OR "Hypervigilance" OR "Nervousness" OR "Nervous" OR "Worry" OR "Worries" OR "Worried" OR "Arousal" OR "Aroused" OR "Pleasant" OR "Pleasureable" OR "Pleasure" OR "Valence" OR "Activate" OR "Activated" OR "Activation" OR "Activates" OR "Feelings" OR "Dysthymic Disorder" OR "Dysthymia" OR "Emotion" OR "Emotions" OR "Emotional" OR "Tension" OR "Anger" OR "Hostility" OR "Dejection" OR "Vigor")
Limits	2006-present Word variations not searched Cochrane Reviews (Reviews) and Other Reviews

Appendix C: Literature Tree

Existing Systematic Reviews, Meta-Analyses, Pooled Analyses, and Reports Literature Tree



Appendix D: Inclusion/Exclusion Criteria

Brain Health

Q3: What is the relationship between physical activity and (1) affect, (2) anxiety, and (3) depressed mood and depression?

a. Is there a dose-response relationship? If yes, what is the shape of the relationship?
b. Does the relationship vary by age, sex, race/ethnicity, socio-economic status, or weight status?
c. Does the relationship exist across a continuum of mood and affective disorders (i.e., depression)?
d. What is the relationship between physical activity and brain structure and function?

Category	Inclusion/Exclusion Criteria	Notes/Rationale
Publication Language	**Include:** • Studies published with full text in English	
Publication Status	**Include:** • Studies published in peer-reviewed journals • Reports determined to have appropriate suitability and quality by PAGAC **Exclude:** • Grey literature, including unpublished data, manuscripts, abstracts, conference proceedings	
Research Type	**Include:** • Original research • Meta-analyses • Systematic reviews • Pooled analysis • Reports determined to have appropriate suitability and quality by PAGAC	
Study Subjects	**Include:** • Human subjects	
Age of Study Subjects	**Include:** • People of all ages	
Health Status of Study Subjects	**Include:** • Healthy people • People with psychiatric disorders or cognitive impairment **Exclude:** • People with chronic conditions only (other than psychiatric conditions) • People living in long-term care only • Hospitalized patients only • Athletes only	Sample disorders include: anxiety, mood, depression, schizophrenia, ADHD, dementia, mild cognitive impairment, PTSD, autism spectrum disorders. Frailty is a chronic condition.
Comparison	**Exclude:**	

	• Studies comparing athlete types (e.g., comparing runners to soccer players)	
Date of Publication	**Include:** • Original research published since 2006 • Systematic reviews, meta-analyses, pooled analyses, and reports published since 2006	
Study Design	**Include:** • Randomized controlled trials • Non-randomized controlled trials • Prospective cohort studies • Retrospective cohort studies • Case-control studies • Before-and-after studies • Time series studies • Systematic reviews • Meta-analyses • Pooled analysis • Report **Exclude:** • Cross-sectional studies • Narrative reviews • Commentaries • Editorials	
Intervention/ Exposure	**Include studies in which the exposure or intervention is:** • All types and intensities of physical activity, including: o free-living activities o play o sedentary behavior • Studies with single, acute bouts of exercise as the exposure **Exclude:** • Studies that do not include physical activity • Studies with physical fitness as the exposure • Studies of a specific therapeutic exercise delivered by a medical professional (e.g., physical therapist) • Studies of multimodal interventions that do not present data on physical activity alone • Studies where physical activity is only used as a confounding variable	Note: Studies with single, acute bouts of exercise as the exposure are included.
Outcome	**Include studies in which the outcome is:** • Activation • Affect	Symptoms of Anxiety and Mood Disorders Include: fatigue,

	• Affect/Mood Disorders • Anger • Anxiety • Anxiety Disorders • Arousal • Bipolar disorder • Dejection • Depression • Dysthymia • Emotion • Feeling • Hostility • Hypervigilance • Mood • Nervousness • Pleasant • Pleasure • Post-traumatic stress disorder (PTSD) • Symptoms of Anxiety or Mood Disorders • Tension • Valence • Vigor • Worry **Exclude studies in which the outcome is:** • Quality-of-life only • Well-being only	restlessness, hypervigilance, irritability, racing thoughts, unwanted thoughts, anxiety, excessive worry, fear, feelings of impending doom, guilt, or worthlessness, nausea, poor concentration, sensation of an abnormal heartbeat, trembling, prolonged sadness, unexplained crying spells, significant changes in appetite or sleep patterns (e.g., insomnia, hypersomnia, sleep disturbance), anger, agitation, pessimism, indifference, loss of energy, persistent lethargy, inability to concentrate, indecisiveness, inability to take pleasure in former interests, social withdrawal, unexplained aches and pains, recurring thoughts of death or suicide

Appendix E: Rationale for Exclusion at Abstract or Full-Text Triage for Existing Systematic Reviews, Meta-Analyses, Pooled Analyses, and Reports

The table below lists the excluded articles with at least one reason for exclusion, but may not reflect all possible reasons.

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
Ahern E, Semkovska M. Cognitive functioning in the first-episode of major depressive disorder: a systematic review and meta-analysis. *Neuropsychology*. 2017;31(1):52-72. doi:10.1037/neu0000319.				X		
Allen MS, Walter EE, McDermott MS. Personality and sedentary behavior: a systematic review and meta-analysis. *Health Psychol.* 2017;36(3):255-263. doi:10.1037/hea0000429.	X					
Amaral JM, Spadaro PT, Pereira VM, et al. The carbon dioxide challenge test in panic disorder: a systematic review of preclinical and clinical research. *Rev Bras Psiquiatr.* 2013;35(3):318-331				X		
Antoniades J, Mazza D, Brijnath B. Efficacy of depression treatments for immigrant patients: results from a systematic review. *BMC Psychiatry.* 2014;14:176. doi:10.1186/1471-244X-14-176.				X		
Arbesman M, Bazyk S, Nochajski SM. Systematic review of occupational therapy and mental health promotion, prevention, and intervention for children and youth. *Am J Occup Ther.* 2013;67(6):e120-e130. doi:10.5014/ajot.2013.008359.				X		
Archer T, Josefsson T, Lindwall M. Effects of physical exercise on depressive symptoms and biomarkers in depression. *CNS Neurol Disord Drug Targets.* 2014;13(10):1640-1653.			X			
Arroll B, Wallace HB, Mount V, Humm SP, Kingsford DW. A systematic review and meta-analysis of treatments for acrophobia. *Med J Aust.* 2017;206(6):263-267.				X		
Asher GN, Gartlehner G, Gaynes BN, et al. Comparative benefits and harms of complementary and alternative medicine therapies for initial treatment of major depressive disorder: systematic review and meta-analysis. *J Altern Complement Med.* July 2017. doi:10.1089/acm.2016.0261.						X
Azar D, Ball K, Salmon J, et al. The association between physical activity and depressive symptoms in young women: a review. *Mental Health and Physical Activity*. 2008;1(2):82-88. doi:10.1186/1471-2458-13-535.						X
Baker G, Gray SR, Wright A, et al. The effect of a pedometer-based community walking intervention "Walking for Wellbeing in the			X			

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
West" on physical activity levels and health outcomes: a 12-week randomized controlled trial. *Int J Behav Nutr Phys Act*. 2008;5:44. doi:10.1186/1479-5868-5-44.						
Balasubramaniam M, Telles S, Doraiswamy PM. Yoga on our minds: a systematic review of yoga for neuropsychiatric disorders. *Front Psychiatry.* 2012;3:117. doi:10.3389/fpsyt.2012.00117.						X
Bandelow B, Reitt M, Rover C, Michaelis S, Görlich Y, Wedekind D. Efficacy of treatments for anxiety disorders: a meta-analysis. *Int Clin Psychopharmacol*. 2015;30(4):183-192. doi:10.1097/YIC.0000000000000078.			X			
Barbui C, Butler R, Cipriani A, Geddes J, Hatcher S. Depression in adults: drug and physical treatments. *BMJ Clin Evid*. 2007. 2007:1003.		X				
Barton J, Pretty J. What is the best dose of nature and green exercise for improving mental health? A multi-study analysis. *Environ Sci Technol.* 2010;44(10):3947-3955.						X
Bauer IE, Galvez JF, Hamilton JE, et al. Lifestyle interventions targeting dietary habits and exercise in bipolar disorder: a systematic review. *J Psychiatr Res.* 2016;74:1-7. doi:10.1016/j.jpsychires.2015.12.006.				X		
Bennett K, Manassis K, Duda S, et al. Preventing child and adolescent anxiety disorders: overview of systematic reviews. *Depress Anxiety.* 2015;32(12):909-918. doi:10.1002/da.22400.			X			
Bhui KS, Dinos S, Stansfeld SA, White PD. A synthesis of the evidence for managing stress at work: a review of the reviews reporting on anxiety, depression, and absenteeism. *J Environ Public Health*. 2012. 2012:515874. doi:10.1155/2012/515874.				X		
Biddle SJ, Asare M. Physical activity and mental health in children and adolescents: a review of reviews. *Br J Sports Med*. 2011;45(11):886-895. doi:10.1136/bjsports-2011-090185.			X			
Blake H, Mo P, Malik S, Thomas S. How effective are physical activity interventions for alleviating depressive symptoms in older people? A systematic review. *Clin Rehabil*. 2009;23(10):873-887. doi:10.1177/0269215509337449.						X
Bonura KB. The psychological benefits of yoga practice for older adults: evidence and guidelines. *Int J Yoga Therap*. 2011;(21):129-142.			X			
Borde R, Hortobagyi T, Granacher U. Dose-response relationships of resistance training in	X					

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
healthy old adults: a systematic review and meta-analysis. *Sports Med.* 2015;45(12):1693-1720. doi:10.1007/s40279-015-0385-9.						
Brazzelli M, Saunders DH, Greig CA, Mead GE. Physical fitness training for stroke patients. *Cochrane Database Syst Rev.* 2011;(11):Cd003316. doi:10.1002/14651858.CD003316.pub4.	X					
Bremer E, Crozier M, Lloyd M. A systematic review of the behavioural outcomes following exercise interventions for children and youth with autism spectrum disorder. *Autism*. 2016;20(8):899-915. doi:10.1177/1362361315616002.	X					
Brett L, Traynor V, Stapley P. Effects of physical exercise on health and well-being of individuals living with a dementia in nursing homes: a systematic review. *J Am Med Dir Assoc*. 2016;17(2):104-116.		X				
Bridle C, Spanjers K, Patel S, Atherton NM, Lamb SE. Effect of exercise on depression severity in older people: systematic review and meta-analysis of randomised controlled trials. *Br J Psychiatry*. 2012;201(3):180-185. doi:10.1192/bjp.bp.111.095174.						X
Brodaty H, Burns K. Nonpharmacological management of apathy in dementia: a systematic review. *Am J Geriatr Psychiatry*. 2012;20(7):549-564. doi:10.1097/JGP.0b013e31822be242.						X
Broderick J, Knowles A, Chadwick J, Vancampfort D. Yoga versus standard care for schizophrenia. *Cochrane Database Syst Rev*. 2015;(10). doi:10.1002/14651858.CD010554.pub2.	X					
Brown J, Ceysens G, Boulvain M. Exercise for pregnant women with gestational diabetes for improving maternal and fetal outcomes. *Cochrane Database Syst Rev*. 2017;6:Cd012202. doi:10.1002/14651858.CD012202.pub2.	X					
Brown HE, Gilson ND, Burton NW, et al. Does physical activity impact on presenteeism and other indicators of workplace well-being?. *Sports Med*. 2011;41(3):249-262. doi:10.2165/11539180-000000000-00000.	X					
Bruins J, Jorg F, Bruggeman R, Slooff C, Corpeleijn E, Pijnenborg M. The effects of lifestyle interventions on (long-term) weight management, cardiometabolic risk and depressive symptoms in people with psychotic disorders: a meta-analysis. *PLoS One*. 2014;9(12):e112276. doi:10.1371/journal.pone.0112276.				X		

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
Buchan DS, Ollis S, Thomas NE, Baker JS. The influence of a high intensity physical activity intervention on a selection of health related outcomes: an ecological approach. *BMC Public Health*. 2010;10:8. doi:10.1186/1471-2458-10-8.			X			
Budde H, Velasques B, Ribeiro P. Does intensity or youth affect the neurobiological effect of exercise on major depressive disorder?. *Neurosci Biobehav Rev*. 2016. doi:10.1016/j.neubiorev.2016.09.026.	X					
Bursnall P. The relationship between physical activity and depressive symptoms in adolescents: a systematic review. *Worldviews Evid Based Nurs*. 2014;11(6):376-382.						X
Burton C, McKinstry B, Szentagotai Tatar A, Serrano-Blanco A, Pagliari C, Wolters M. Activity monitoring in patients with depression: a systematic review. *J Affect Disord.* 2013;145(1):21-28. doi:10.1016/j.jad.2012.07.001.	X					
Cabral P, Meyer HB, Ames D. Effectiveness of yoga therapy as a complementary treatment for major psychiatric disorders: a meta-analysis. *Prim Care Companion CNS Disord.* 2011;13(4). doi:10.4088/PCC.10r01068.	X					
Caddick, Nick, Smith, Brett. The impact of sport and physical activity on the well-being of combat veterans: A systematic review. *Psychology of Sport & Exercise*. 2014;15(1):9-18.			X			
Canbeyli R. Sensorimotor modulation of mood and depression: an integrative review. *Behav Brain Res*. 2010;207(2):249-264.						X
Catalan-Matamoros D, Gomez-Conesa A, Stubbs B, et al. Exercise improves depressive symptoms in older adults: An umbrella review of systematic reviews and meta-analyses. Psychiatry Res. 2016. 244:202-209.						X
Cerimele JM, Katon WJ. Associations between health risk behaviors and symptoms of schizophrenia and bipolar disorder: a systematic review. *Gen Hosp Psychiatry*. 2013;35(1):16-22.	X					
Cerrillo-Urbina AJ, García-Hermoso A, Sánchez-López M, Pardo-Guijarro MJ, Santos Gómez JL, Martínez-Vizcaíno V. The effects of physical exercise in children with attention deficit hyperactivity disorder: a systematic review and meta-analysis of randomized control trials. *Child Care Health Dev.* 2015;41(6):779-788. doi:10.1111/cch.12255.	X					
Chalder M, Wiles NJ, Campbell J, et al. A pragmatic randomised controlled trial to			X			

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
evaluate the cost-effectiveness of a physical activity intervention as a treatment for depression: the treating depression with physical activity (TREAD) trial. *Health Technol Assess*. 2012;16(10):1-164, iii-iv.						
Chi I, Jordan-Marsh M, Guo M, et al. Tai chi and reduction of depressive symptoms for older adults: a meta-analysis of randomized trials. *Geriatr Gerontol Int*. 2013;13(1):3-12.						X
Chu AH, Koh D, Moy FM, Müller-Riemenschneider F. Do workplace physical activity interventions improve mental health outcomes?. *Occup Med (Lond).* 2014;64(4):235-245. doi:10.1093/occmed/kqu045.						X
Chugh-Gupta N, Baldassarre FG, Vrkljan BH. A systematic review of yoga for state anxiety: considerations for occupational therapy. *Can J Occup Ther.* 2013;80(3):150-170.	X					
Cipriani A, Barbui C, Butler R, et al. Depression in adults: drug and physical treatments. *BMJ Clin Evid*. 2011;2011.	X					
Clancy F, Prestwich A, Caperon L, et al. Perseverative Cognition and Health Behaviors: A Systematic Review and Meta-Analysis. *Front Hum Neurosci*. 2016;10:534.	X					
Clark A, Mach N. Exercise-induced stress behavior, gut-microbiota-brain axis and diet: a systematic review for athletes. *J Int Soc Sports Nutr*. 2016;13:43.	X					
Colle F, Bonan I, Gellez Leman MC, et al. Fatigue after stroke. *Ann Readapt Med Phys*. 2006;49(6):272-276, 361-364.						X
Conn VS. Anxiety outcomes after physical activity interventions: meta-analysis findings. *Nurs Res*. 2010;59(3):224-231.						X
Conn VS. Depressive symptom outcomes of physical activity interventions: meta-analysis findings. *Ann Behav Med*. 2010;39(2):128-138.						X
Cooper C, Balamurali, TB, Selwood A, et al. A systematic review of intervention studies about anxiety in caregivers of people with dementia. *Int J Geriatr Psychiatry*. 2007;22(3):181-188.						X
Copeland JL, Ashe MC, Biddle SJ, et al. Sedentary time in older adults: a critical review of measurement, associations with health, and interventions. *Br J Sports Med*. July 2017. doi:10.1136/bjsports-2016-097210.	X					
Coyle C, Denault V, Miller R, et al. Understanding systematic reviews and their implications for evidence-based practice by examining aerobic exercise as a recreational therapy intervention for individuals with major			X			

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
depressive disorders. *American Journal of Recreation Therapy*. 2008;7(3):13-22.						
Craig M, Howard L. Postnatal depression. *BMJ Clin Evid*. 2009. 2009.	X					
Cusso ME, Donald KJ, Khoo TK. The impact of physical activity on non-motor symptoms in Parkinson's disease: a systematic review. *Front Med (Lausanne).* 2016;3:35. doi:10.3389/fmed.2016.00035.		X				
Daley A, Foster L, Long G, et al. The effectiveness of exercise for the prevention and treatment of antenatal depression: systematic review with meta-analysis. *Database of Abstracts of Reviews of Effects*. 2014;(2):epub.		X				
Daley A, Jolly K, MacArthur C. The effectiveness of exercise in the management of post-natal depression: systematic review and meta-analysis. *Fam Pract*. 2009;26(2):154-162.						X
Daley A. Exercise and depression: a review of reviews. *J Clin Psychol Med Settings.* 2008;15(2):140-147.						X
Daley AJ, Foster L, Long G, et al. The effectiveness of exercise for the prevention and treatment of antenatal depression: systematic review with meta-analysis. *BJOG*. 2015;122(1):57-62.		X				
Daley AJ, Jolly K, Sharp DJ, et al. The effectiveness of exercise as a treatment for postnatal depression: study protocol. *BMC Pregnancy Childbirth*. 2012;12:45.			X			
Danielsson L, Noras AM, Waern M, et al. Exercise in the treatment of major depression: a systematic review grading the quality of evidence. *Physiother Theory Pract*. 2013;29(8):573-585.						X
Dauwan M, Begemann MJ, Heringa SM, Sommer IE. Exercise improves clinical symptoms, quality of life, global functioning, and depression in schizophrenia: a systematic review and meta-analysis. *Schizophr Bull.* 2016;42(3):588-599. doi:10.1093/schbul/sbv164.	X					
Davidson JR. Major depressive disorder treatment guidelines in America and Europe. *J Clin Psychiatry.* 2010;71 Suppl E1(#issue#):e04.			X			
de Man-van Ginkel JM, Gooskens F, Schuurmans MJ, et al. A systematic review of therapeutic interventions for poststroke depression and the role of nurses. *J Clin Nurs*. 2010;19(23-24):3274-3290.						X
De Rosa C, Sampogna G, Luciano M, et al. Improving physical health of patients with severe mental disorders: a critical review of			X			

Citation	Outcome	Population	Study Design	Exposure	Not ideal fit for replacement of de novo search	Other
lifestyle psychosocial interventions. *Expert Rev Neurother.* 2017;1-15.						
de Souza Moura AM, Lamego MK, Paes F, et al. Comparison Among Aerobic Exercise and Other Types of Interventions to Treat Depression: A Systematic Review. *CNS Neurol Disord Drug Targets*. 2015;14(9):1171-1183.						X
DeBoer LB, Powers MB, Utschig AC, et al. Exploring exercise as an avenue for the treatment of anxiety disorders. *Expert Rev Neurother*. 2012;12(8):1011-1022.			X			
Den Heijer AE, Groen Y, Tucha L, et al. Sweat it out? The effects of physical exercise on cognition and behavior in children and adults with ADHD: a systematic literature review. *J Neural Transm (Vienna).* 2017;124(Suppl 1):3-26.	X					
Desai R, Tailor A, Bhatt T. Effects of yoga on brain waves and structural activation: A review. *Complement Ther Clin Pract*. 2015;21(2):112-118.	X					
Dinas PC, Lahart IM, Timmons JA, et al. Effects of physical activity on the link between PGC-1a and FNDC5 in muscle, circulating Iotarisin and UCP1 of white adipocytes in humans: a systematic review. *F1000Res*. 2017;6:286. doi:10.12688/f1000research.11107.2.	X					
Dinoff A, Herrmann N, Swardfager W, et al. The effect of acute exercise on blood concentrations of brain-derived neurotrophic factor (BDNF) in healthy adults: A meta-analysis. *Eur J Neurosci*. 2017.	X					
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Panebianco M, Sridharan K, Ramaratnam S. Yoga for epilepsy. *Cochrane Database Syst Rev.* 2015;(5):Cd001524.	X					
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Poquet N, Maher CG. Exercise for the management of depression (PEDro synthesis). *Br J Sports Med*. 2015. 49(24):1595			X			
Puetz TW, Beasman KM, O'Connor PJ. The effect of cardiac rehabilitation exercise programs on feelings of energy and fatigue: a meta-analysis of research from 1945 to 2005. *Eur J Cardiovasc Prev Rehabil*. 2006;13(6):886-893.		X				
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Qaseem A, Barry MJ, Kansagara D. Nonpharmacologic versus pharmacologic treatment of adult patients with major depressive disorder: a clinical practice guideline from the American College of Physicians. *Ann Intern Med*. 2016;164(5):350-359.			X			
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Rhodes RE, Lubans DR, Karunamuni N, et al. Factors associated with participation in resistance training: a systematic review. *Br J Sports Med*. 2017.	X					
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