Physical Activity for Depression

A Guided Review of the Literature and Evidence

Learning Objectives

- Describe the efficacy of physical activity interventions for the treatment of depressive symptoms.
- Identify what kinds of exercise are associated with improvements in depressive symptoms.
- Identify dose response (e.g., frequency, intensity) of exercise associated with improvements in depression symptoms.
- Make recommendations for the inclusion of physical activity for clients with depression symptoms.

Conflict of Interest Statement

- The Center for Movement-based Psychotherapy is committed to the mission of sharing evidence-based practices for the inclusion of movement, physical activity and exercise as modalities for the prevention and treatment of mental health symptoms and disorder.
- The Center for Movement-based Psychotherapy has received no commercial or third-party support for or in the making of this lecture or the information there-in.
- The Center for Movement-based Psychotherapy and the instructor of this lecture have no known conflicts of interest.

DSM-V-TR Major Depressive Disorder

At least 5 of the following symptoms during the same two week period:

- ❑ **Depressed mood**
- ❑ **Anhedonia**
- ❑ Significant changes in weight
- ❑ Insomnia or hypersomnia
- ❑ Psychomotor agitation or retardation
- ❑ Fatigue or loss of energy
- ❑ Feelings of worthlessness or excessive or inappropriate guilt
- ❑ Diminished ability to think or concentrate, or indecisiveness
- ❑ Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide

Evaluating Intervention Efficacy

Prevention:

- Is there evidence to suggest that physical activity/exercise can help **prevent** depressive symptoms?

Therapeutic:

- Is there evidence to suggest that physical activity/exercise can help **alleviate**/decrease depressive symptoms?

Treatment:

- Is there evidence to suggest that physical activity/exercise can **treat** depressive disorder?

Part 1: Prevention

A summary of evidence with insights from key studies (2008-2024)

Physical Activity & Depressive Symptoms

2024 Cross-Sectional Study (de Lima Queiroga, et al.,)

- 58,445 participants (2008–2022, São Paulo, Brazil)

Key Findings:

- Any physical activity = lower odds of depressive symptoms
- 20 min/week of physical activity = reduced risk of depression
- Risk factors associated with higher odds of depressive symptoms: BMI, chronic illnesses, smoking, alcohol consumption, perceived stress
- Possibility of *reverse causality*

Physical Activity for Non-Clinical Depression

2015 Meta-Meta Analysis Cross-Sectional Study (Rebar et al.,)

- Combined data from 92 studies (pre 2014)
- 4310 participants

Key Findings:

- Regular activity = 45% lower chance of developing depression
- Physical activity benefits both clinical and non-clinical populations
- Evidence supports prevention and symptom reduction

Physical Activity for Non-Clinical Depression

Highlights

- Previous analysis only looked at clinical populations; this study includes non-clinical/sub-clinical sample.
- Physical activity has a significant moderate effect in reducing depression.
- Effect might be slightly weaker for non-clinical populations compared to clinical ones.
- There's strong evidence that increasing physical activity in healthy people can reduce depression symptoms and potentially prevent the onset of clinical depression.

Exercise and Reduced Depression Risk

2022 Systematic Review and Meta-Analysis (Pearce et al., 2022)

- 15 prospective studies (pre 2020), 191,130 participants and “2,110,588 person-years”

Key Findings:

- 18%–25% lower risk of depression related to weekly accumulated activity levels
- 2.5 hours/week brisk walking = 25% lower risk
- Diminishing returns at higher activity levels

Exercise and Reduced Depression Risk

People who reported some physical activity had a lower risk of depression compared to those who reported no activity:

- 18% lower risk for accumulating half the recommended weekly volume.
- 25% lower risk for accumulating the recommended volume.

- Higher activity levels continued to be associated with a lower risk of depression, but the benefit decreased with increasing activity levels.

Assuming a causal relationship, the study suggests that physical activity could prevent about **1 in 9 cases of depression**.

Understanding mMETs

- “Person years” were calculated using estimated and assumed mMETs.
- METs means “metabolic equivalent”; represents the metabolic expenditure of an activity compared to basal metabolic rate (e.g., Sedentary = 1 MET)
- mMETs multiplies time in minutes by MET expenditure of the activity.

Exercise and Reduced Depression Risk

- **2023 Systematic Review & “Assessment of Causality” (Wanjau et al.,)**
  - 3 Systematic Reviews with Meta Analysis
  - 1 Systematic Review without Meta-analysis

Key Findings

- Higher PA levels were found to have a 17% decreased risk of incident depression.
- Probable causal relationship was assumed using *Bradford Hill’s Criteria* to suggest that PA leads to a lower risk of depression and anxiety.

Exercise and Reduced Depression Risk

Highlights

Compared to being sedentary, physical activity (PA) decreased risk of depression:

- “Even “low” walking levels were associated with a decreased risk of depression of up to nearly 60%”.
- “Even walking at an average pace of <20 minutes/day and >40 minutes/day was protective against depression of up to 6% and 17%, respectively.”
- Engaging in PA for >30 minutes/day reduced the odds of subsequent depression by 48%.

Physical Activity and Prevention

2024 Meta-Meta Analysis & Umbrella Review (Rahmati et al.,)

- 4 Meta-Analyses were pooled including a total of 187 studies
  - Participants **did not** have depression, anxiety or stress-related disorders, and psychosis/schizophrenia at baseline
  - Excluded intervention studies

Key Findings:

- Higher levels of PA significantly associated with a reduced risk of depression and anxiety or stress-related disorders
- Low/moderate intensity PA = strongest protective effect
- High-intensity PA = weaker or unclear benefit

Summary of Findings

- Physical activity is consistently linked to lower depression risk.
- Moderate-intensity activities show the strongest effects.
- Benefits are seen across clinical and non-clinical populations.
- Evidence supports causality in the PA-depression relationship.

Practical Implications

- Encourage low/moderate-intensity activity (e.g., walking, light jogging).
- Integrate physical activity into mental health interventions.
- Highlight prevention benefits in public health initiatives.

Part 2: Therapeutics & Treatment

Exercise vs. “Treatment As Usual”

2016 Randomized Control Trial (Helgadóttir et al.,)

- Light, Moderate, Vigorous, and Treatment as Usual control (n = 620)
  - All groups exercised 3 times per week for 12 weeks.

Key Findings

- All exercise groups experienced reduced depression scores compared to control.
- Depression severity improved from moderate to mild in all exercise groups.

Exercise vs. “Treatment As Usual”

Treatment as usual included:

- ❏ Standard treatment administered by their primary care physician
- ❏ CBT with a clinical psychologist or supportive counseling
- ❏ Antidepressant medications
- ❏ Usual care patients without psychological treatment

- Light exercise group showed a trend of greater improvement than moderate group.
- Some evidence suggests higher exercise intensity might be more effective.
- Ideal dosage (intensity and frequency) of exercise for optimal results remains unclear.

Aerobic Exercise and Major Depression

2019 Systematic Review and Meta-Analysis (Morres et al.,)

- 11 Randomized Control Trials (n = 455)
  - Participants with clinical depression diagnosis

Key Findings

- Aerobic exercise showed a significant large overall antidepressant effect on adult patients with major depression.
- Compared to antidepressants and treatment as usual, aerobic exercise showed large antidepressant effects.

Aerobic Exercise and Major Depression

Highlights

- Aerobic exercise was delivered on average three times per week, at moderate intensity, with sessions lasting 45 minutes for a total program duration of 9.2 weeks.
- Even short programs (up to 4 weeks) of aerobic exercise showed moderate to large effects on depression, highlighting its potential benefit at the early stages of treatment.

Exercise and Depressive Symptoms

2023 Meta-Analysis (Singh et al.,)

- 97 Combined Systematic Reviews, 1,039 individual RCTs (n = 128,119)

Key Findings

- The results showed a moderate positive effect of physical activity on reducing depression and depressive symptoms.
- Physical activity was also found to be moderately more effective than usual care in reducing psychological distress.

Exercise and Depressive Symptoms

- Physical activity interventions for adults and assessing their impact on depression, anxiety, and psychological distress.
- All exercise modes included in the study (strength training, mixed-mode exercise, stretching, yoga, and other mind-body exercises, and aerobic exercise) were found to be *similarly effective*.
- While all intervention durations were shown to be beneficial, the effectiveness decreased as the length of the program increased.

Comparing Different Kinds of Exercise

2022 Systematic Review and Network Analysis (Yu et al., 2022)

- 117 RCTs (n = 6,456)

Key Findings

- Multimodal exercise, which combines at least two different forms of exercise (like aerobic and resistance training), showed the highest likelihood (71%) of being most effective in reducing depression symptoms.

Comparing Different Kinds of Exercise

Highlights

- Ranking of all exercise interventions based on their effectiveness for improving depression symptoms (from best to worst):
  - Multimodal exercise
  - Resistance exercise
  - Mind-body exercise
  - Aerobic exercise
  - Stretching
- Patients with PTSD benefited more from mind-body exercises.
- Resistance exercise was more likely to be effective for anxiety disorders.

Combined Psychotherapy and Exercise

2018 Systematic Review and Meta-Analysis (Bernard et al.,)

- 16 RCTs looking at depression-related outcomes
  - “Participants were adults with chronic diseases as described by the World Health Organization (WHO)”.

Key Findings

- CBTEx interventions were effective in decreasing symptoms of depression, anxiety, fatigue and pain”.
- Findings suggest that CBTEx intervention is not superior to exercise or CBT interventions alone for decreasing depression, anxiety and fatigue symptoms.

Combined Psychotherapy and Exercise

2020 Systematic Review and Meta-Analysis (Bourbeau et al.,)

- 18 studies (n = 1686)
  - Adults who were “evaluated for depression or anxiety or elevated symptoms of depression or anxiety.

Key Findings

- The effect of BT+Ex was effective at treating depression symptoms.
- BT+Ex is a more effective treatment for depression than BT alone with a medium and significant negative effect size irrespective of exercise type, intensity and baseline levels of depression.

Bernard vs. Bourbeau

- Bernard et al., only included CBT-studies while Bourbeau et al., included other “behavioral therapies” (i.e., CBT, interpersonal therapy, counselling)
- “Bernard et al., included studies that recruited only participants with chronic disease”.
- When individuals without chronic diseases are included, a combination of treatments may be more effective than one treatment alone.

Effect of Exercise for Depression

2024 Systematic Review and Network Meta-Analysis (Noetel et al.,)

- 218 randomized control trials (n = 14,170)
  - Participants either met clinical threshold for depression or were diagnosed by a clinician.

Key Findings

- Analysis suggests that exercise modalities were as effective as SSRIs and Cognitive Behavioral Therapies

Effect of Exercise for Depression

Highlights

Compared with active controls (eg, usual care, placebo tablet), moderate reductions in depression were found for:

- walking or jogging
- yoga
- strength training
- mixed aerobic exercises
- tai chi or qigong

- The effects of exercise were proportional to the intensity prescribed; more intense exercise was more effective.

Limitations and Future Directions

- Large population studies give general recommendations and guidelines, but high level of individual customization is needed to be effective.
- Wide variety of different intensities, frequencies and types/domains of exercise makes it difficult to tease out exact *dose*.
- While many mechanisms have been hypothesized, individual differences mean that different mechanisms may apply to different people based on context.
- Adherence to exercise protocols and high drop out remain issues both in research and in practice.

Part 3: Mechanisms of Action

How Physical Activity Impacts the Mind and the Body

Potential Mechanisms of Action

Biological mechanisms

- ❏ Circulation/Cardiovascular
- ❏ Neuroplasticity
- ❏ Inflammation
- ❏ Neuroendocrine
- ❏ Oxidative Stress

Psychosocial mechanisms

- ❏ Self-esteem
- ❏ Social Support
- ❏ Self-efficacy
- ❏ Physical Self-Perception

Lifestyle mechanisms

- ❏ Improves Sleep Quality
- ❏ Physical Health/Function

Biological Mechanisms: Cardiovascular/Circulatory

- Aerobic exercise increases circulation and causes adaptive changes in vascular function.
- Increased cerebral blood flow increases accessibility of vital resources to the brain.
- Increased blood flow can also help remove metabolic waste products.
- Exercise causes acute changes in blood pressure and chronic changes in blood pressure and resting heart rate.

Biological Mechanisms: Neurological/Neurochemical

Parts of the brain implicated in emotional processing and memory are often impacted by depression (e.g., the hippocampus). Exercise supports neurogenesis in areas like the hippocampus.

- Stimulates the release of neurotrophic factors such as **Brain Derived Neurotrophic factors** (BDNF)
- Produces changes in the structure and function of several brain regions
- Can inspire the release of neurotransmitters such as serotonin, dopamine, norepinephrine and endocannabinoids.

Biological Mechanisms: Immunological/Inflammation

- Chronic, low-grade inflammation may play a role in depression.
- Low grade inflammation can be caused or exacerbated by chronic stress.
- *Neuroinflammation* (inflammation in the brain) can disrupt symptoms that are implicated in depressive symptoms.
    - Anti-inflammatory medications can significantly decrease depressive symptoms
    - Inflammatory medication can produce depressive symptoms

Biological Mechanisms: Immunological/Inflammation

Exercise interventions can reduce inflammatory factors:

- Exercise acutely promotes anti-inflammatory responses and
- **Chronically** promotes homeostatic changes in the body that decrease inflammation.
- Exercise may be a stress management tool that decreases the impact of chronic stress on maladaptive immune responses.

Biological Mechanisms: Neuroendocrine

- The hypothalamic-pituitary-adrenal (HPA) axis activation moderates cortisol release as part of a stress response.
- Cortisol has an acute anti-inflammatory response.
- Chronic/Prolonged cortisol exposure may be neurotoxic and cause dysregulation in blood glucose levels.
- Regular exercise produces an adaptive, protective response to elevated cortisol levels.
- Exercise implicated in the acute release and moderation of other hormones implicated in positive mood including endorphins and testosterone.

Biological Mechanisms: Metabolic/Oxidative

- The “waste” of metabolic processes (“Free radicals”)
  - ROS = “Reactive Oxygen Species”
  - RNS = “Reactive Nitrogen Species”
- Oxidative stress can damage most structures/systems of the body.
- Damage caused by oxidative stress can activate the *immune system*.
- Regular exercise produces an adaptive response to ROS (e.g., increasing the production of antioxidant enzymes that repair ROS damage).
- This leads to greater resilience to ROS damage in the future.

Psychosocial Mechanisms: Self-Esteem & Self-Perception

- Many begin exercise in an effort to improve body image through changes in body composition (e.g., gaining muscle, losing weight).
- There is a negative association between poor body image and mental health*.
- Exercise can remediate this by promoting self-esteem, potentially through improving physical self-perception and body image*.
- Exercise can have a positive impact on self-esteem and the effects can occur even in the absence of body compositional improvements*.

Psychosocial Mechanisms: Social Support

- “Preliminary evidence suggests that social support could be another mechanism through which exercise produces antidepressant effects”.
- Physical activity and exercise can occur in group and community settings.
- Team sports and other collaborative efforts can facilitate social engagement.
- Feeling of social engagement may increase even without social interaction.

Psychosocial Mechanisms: Self-Efficacy

- Poor self-efficacy decreases engagement leading individuals to avoid or abstain from the pursuit of achievable goals or tasks.
- Engaging in exercise increases feelings of self-efficacy and increases the likelihood of further engagement.
- Improved physical abilities and mastery of a skill may generalize to global increases in self-efficacy.
- Self-efficacy itself may improve self-esteem.

Physical Health and Lifestyle Mechanisms

- **Sleep quality** and regular sleep-wake activity is implicated in both physical and mental health issues.
- Regular exercise supports more regular and better quality sleep.
- Physical activity favorably supports **physical health** in both healthy individuals and individuals with chronic illnesses.
- Physical activity improves and maintains physical function through strengthening of musculoskeletal system.

Mechanism of Action Summary

Mechanisms of action are actively being researched to refine our understanding.

- Exercise/Physical activity likely has varied and systemic impact on physical health.
- Moderated by both biological factors such as age, sex and social factors such as cultural values surrounding physical activity and societal standards of beauty.
- Impacted by individual fitness level: Physical conditioning above minimum provides additional benefits, but with diminishing returns.

Part 4: Clinical Recommendations

Discussion and Conclusions of Key Points

Recommendations

“Something is better than nothing”

- Maintaining a sedentary lifestyle has significant health risks, including mental health.
- Significant preventative and therapeutic effects are accessible even below CDC recommended exercise volumes.
- Light activity such as yoga, stretching and walking has benefits comparable to moderate and vigorous activity and is “most tolerated”.
- Physical activity can have acute impact on mood and energy during and immediately after exercise.

Recommendations

“More is Better?”

- Many physical and mental health benefits accumulate over time.
- Adherence to regular exercise for a minimum of four weeks or more.
- Some evidence suggests that increased intensity or frequency of exercise is more effective.
- Likely diminishing returns with benefits plateauing as individual fitness increases.

Recommendations: Types of Exercise

Evidence is mixed surrounding the “type” of exercise (e.g., resistance training, yoga, aerobic exercise).

- Most research is done using some kind of aerobic exercise.
- Evidence suggests similar benefits for depression regardless of the exercise type.
- Different types of exercise confer different benefits; may tailor exercise type to fit client’s physical health goals.
- Some evidence suggests “multimodal” exercise routine may confer the most benefits.

Recommendations: Dose Response

Dose And Frequency

- Studies seem to encourage between two and four times per week with exercise bouts being at minimum 20 minutes in length.
- Lack of clear dose response suggests that clients may fit frequency of exercise into what is feasible for their lifestyle.
- Some evidence suggests that intentional/leisure time physical activity is effective where other forms of necessary physical activity is not associated with improvement in mental health.

Recommendations

- Best practice to consult with a medical health professional to assess client's fitness for exercise prior to beginning a regular movement practice.
- Given benefits of social support, it may be worthwhile encouraging activity in groups, teams or in social spaces.
- May provide counseling surrounding things like self-care (e.g., nutrition) and sleep hygiene.
- Be prepared to support client with related issues such as navigating perceived size-related stigma.

Recommendations: Summary

- Exercise is a low-cost, accessible, and effective treatment option.
- Generally safe with few contraindications.
- For depression specifically, physical activity has efficacy as a treatment for depression similar to other “gold standard” treatments like antidepressants and psychotherapy.
- Exercise can be used as an adjunctive treatment along with medication and psychotherapy, which can enhance treatment outcomes.

Recommendations: Summary

Special considerations:

- Well-conditioned clients
- Disabilities, pain, injuries and setbacks
- History of disordered eating

In summary,

- Something is better than nothing.
- It doesn’t matter what you do, for as long as you can stick to it.
- Aim for at least two times a week, for at least 20 minutes.
- Have fun
- Start small, progress slow

References

References

[1] de Lima Queiroga, L., Kaufmann, O., Ritti-Dias, R. M., da Cunha, P. M., Minanni, C. A., Pitta, R. M., & Wolosker, N. (2025). Physical activity levels are associated with depressive symptoms: A cross-sectional study of 58,445 adults. *Journal of affective disorders*, 369, 298-302.

[2] Rebar, A. L., Stanton, R., Geard, D., Short, C., Duncan, M. J., & Vandelanotte, C. (2015). A meta-meta-analysis of the effect of physical activity on depression and anxiety in non-clinical adult populations. *Health psychology review*, *9*(3), 366-378.

[3] Pearce, M., Garcia, L., Abbas, A., Strain, T., Schuch, F. B., Golubic, R., ... & Woodcock, J. (2022). Association between physical activity and risk of depression: a systematic review and meta-analysis. *JAMA psychiatry*, *79*(6), 550-559.

[4] Wanjau, M. N., Möller, H., Haigh, F., Milat, A., Hayek, R., Lucas, P., & Veerman, J. L. (2023). Physical activity and depression and anxiety disorders: a systematic review of reviews and assessment of causality. *AJPM focus*, *2*(2), 100074.

[5] Rahmati, M., Lee, S., Yon, D. K., Lee, S. W., Udeh, R., McEvoy, M., ... & Smith, L. (2024). Physical activity and prevention of mental health complications: An umbrella review. *Neuroscience & Biobehavioral Reviews*, 105641.

References

[6] Helgadóttir, B., Hallgren, M., Ekblom, Ö., & Forsell, Y. (2016). Training fast or slow? Exercise for depression: a randomized controlled trial. *Preventive medicine*, *91*, 123-131.

[7] Morres, I. D., Hatzigeorgiadis, A., Stathi, A., Comoutos, N., Arpin-Cribbie, C., Krommidas, C., & Theodorakis, Y. (2019). Aerobic exercise for adult patients with major depressive disorder in mental health services: A systematic review and meta-analysis. *Depression and anxiety*, *36*(1), 39-53.

[8] Singh, B., Olds, T., Curtis, R., Dumuid, D., Virgara, R., Watson, A., ... & Maher, C. (2023). Effectiveness of physical activity interventions for improving depression, anxiety and distress: an overview of systematic reviews. *British journal of sports medicine*, *57*(18), 1203-1209.

[9] Yu, Q., Wong, K. K., Lei, O. K., Nie, J., Shi, Q., Zou, L., & Kong, Z. (2022). Comparative effectiveness of multiple exercise interventions in the treatment of mental health disorders: a systematic review and network meta-analysis. *Sports medicine-open*, *8*(1), 135.

References

[10] Bernard, P., Romain, A. J., Caudroit, J., Chevance, G., Carayol, M., Gourlan, M., ... & Moullec, G. (2018). Cognitive behavior therapy combined with exercise for adults with chronic diseases: Systematic review and meta-analysis. *Health Psychology*, *37*(5), 433.

[11] Bourbeau, K., Moriarty, T., Ayanniyi, A., & Zuhl, M. (2020). The combined effect of exercise and behavioral therapy for depression and anxiety: Systematic review and meta-analysis. *Behavioral Sciences*, *10*(7), 116.

[12] Noetel, M., Sanders, T., Gallardo-Gómez, D., Taylor, P., del Pozo Cruz, B., Van Den Hoek, D., ... & Lonsdale, C. (2024). Effect of exercise for depression: systematic review and network meta-analysis of randomised controlled trials. *bmj*, *384*.

[13] Kandola, A., Ashdown-Franks, G., Hendrikse, J., Sabiston, C. M., & Stubbs, B. (2019). Physical activity and depression: Towards understanding the antidepressant mechanisms of physical activity. *Neuroscience & Biobehavioral Reviews*, *107*, 525-539.