Physical Activity for Anxiety

A Guided Review of the Literature and Evidence

Learning Objectives

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

More days than not for at least 6 months:

- **Excessive anxiety that is generalized to a number of different events/activities**
- **Difficulty Controlling Worry**

At least 3 of the following symptoms:

- Restlessness
- Easily fatigued
- Difficulty concentrating
- Irritability
- Muscle tension
- Sleep disturbance

DSM-V Anxiety Disorders

- **Generalized Anxiety Disorder**
- **Specific Phobia**
- **Social Anxiety Disorder**
- **Agoraphobia**
- **Panic Disorder**

Previous versions of the Diagnostic and Statistical Manual of Mental Disorders (DSM) included **obsessive-compulsive disorder** (OCD) and **post-traumatic stress disorder** (PTSD).

*As of the DSM-V, PTSD is no longer considered an “Anxiety Disorder” and has been moved to “Trauma- and Stressor- Related Disorder” section

Evaluating Intervention Efficacy

Prevention:

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

Therapeutic:

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

Treatment:

- Is there evidence to suggest that physical activity/exercise can **treat** anxiety disorders?

Physical Activity for Anxiety

Part 1: Prevention

Physical Activity for Non-Clinical Anxiety

2015 Meta-Meta-Analysis

- 4 Meta Analysis were combined including a total of 306 studies before the year 2014 (n = 10,755)
  - Previous analysis only looked at clinical populations; this study includes non-clinical/sub-clinical sample.

Key Findings:

- PA reduces anxiety in non-clinical populations.

Physical Activity for Non-Clinical Anxiety

Highlights

- “Evidence on the effect of physical activity on anxiety in clinical populations is mixed.”
- “It does not provide evidence for specific recommendations regarding the most beneficial duration, intensity, mode or frequency of physical activity for these mental benefits.”
- “Clinical anxiety can manifest in quite divergent disorders”

Physical Activity Protects From Incident Anxiety

2019 Meta-Analysis

- 13 Prospective Cohort Studies (n = 75,831)

Key Findings

- Higher levels of self-reported PA are associated with a decreased risk of both anxiety symptoms and anxiety disorders in people free from anxiety at baseline
- 27% lower risk for developing anxiety when compared to people with lower levels of self-reported PA.

Physical Activity Protects From Incident Anxiety

Highlight:

- Only included self-report data.
- Evidence supports the notion that self-reported PA can confer protection against the emergence of anxiety.
- Higher PA levels protects from agoraphobia and Posttraumatic disorder.

Physical Activity and Anxiety

2019 Systematic Review and Meta-Analysis

- 13 prospective cohort studies
  - Included generalized anxiety, panic, phobia
  - Excluded OCD and PTSD outcomes.
  - Excluded samples of individuals with clinically significant anxiety at baseline.

Key Findings:

- Inverse association between physical activity and subsequent anxiety.
- Physical activity may protect against anxiety symptoms and disorder.

Exercise and Reduced Anxiety Risk

2023 Systematic Review & Assessment of Causality

- 2 Systematic reviews (2000-2020) with meta-analysis
  - Only 2 reviews met criteria to infer causality (*Bradford Hill's Criteria*)

Key Findings:

- PA was associated with lower odds of self-reported anxiety symptoms.
- PA was associated with lower odds of diagnosis of **any** anxiety disorder and diagnosis of generalized anxiety disorder.

Exercise and Reduced Anxiety Risk

Highlights:

- Assessed the likelihood of these associations being causal.
- “When assessed against Bradford Hill's criteria for causality, we found a probable causal relationship, with higher levels of PA leading to a lower risk of depression and anxiety."
- “The consistent findings provide sufficient evidence to support an association between PA and incident cases of anxiety”

Physical Activity and Prevention

2024 Meta-analysis and umbrella review

- 11 prospective studies (n=69,037)
- Excluded Intervention Studies

Key Findings:

- Higher levels of PA are significantly associated with a reduced risk of incident depression and anxiety or stress-related disorders.
- Higher levels of PA significantly reduce the subsequent risk of indecent anxiety.

Physical Activity and Prevention

Highlights:

- Higher levels of PA significantly reduced the subsequent risk for **any anxiety disorder**, risk for **anxiety symptoms** and **GAD disorder.**
- Risk reduction from higher PA levels for **agoraphobia, and post traumatic stress disorder**”
- Positive effect for higher PA *did not reach statistical significant levels* for **panic, OCD, social phobia and specific phobia**.

Exercise Interventions to Reduce Anxiety in Mid-life and Late-life Anxiety disorders

2022 Systematic Review

- 4 randomized control trials (n = 132); All adults over the age of 40.

Key Findings:

- “Exercise interventions have the potential to be an effective non-pharmacological intervention for anxiety and subthreshold anxiety disorders in mid-life and late-life, despite the limited extent of the evidence base.”

Exercise Interventions to Reduce Anxiety in Mid-life and Late-life Anxiety disorders

Highlights:

- Flexibility, toning and balance versus healthy aging DVD
- Aerobic training versus non-physical activities
- Tai Chi with paroxetine versus paroxetine only
- Aerobic and strength training versus inactive control

¾ studies demonstrated interventions were more effective at reducing anxiety than control interventions.

Physical Activity for Reducing Anxiety Symptoms in Older Adults

2024 Systematic Review and Meta–Analysis

- 11 randomized control trials (n = 770); 60 years and over.

Key Findings:

- Physical activity can significantly reduce anxiety symptoms in older adults.
- All types of exercises reduced anxiety symptoms compared to the control group.

Physical Activity for Reducing Anxiety Symptoms in Older Adults

Highlights:

- Exercise modalities included pilates, walking, resistance training and aerobic exercises
- Control including “usual care”, stretching, waitlist and exercise advice.
- Longer duration of exercise showed larger effect on reducing anxiety.

Practical Implications

- Inverse relationship between physical activity levels and anxiety symptoms.
- Physical activity can help prevent or reduce anxiety symptoms, but evidence is noticeably mixed.
- Efficacy appears to be variable for different anxiety disorders.

Physical Activity for Anxiety

Part 2: Therapeutics & Treatment

Effectiveness of Physical Activity in Primary Prevention of Anxiety

2022 Systematic Review and Meta-analysis

- 3 randomized control trials (n= 350)
- No prospective studies included

Key Findings:

- There is no evidence that anxiety can be prevented through physical activity, although the quality of evidence was low.

Effectiveness of Physical Activity in Primary Prevention of Anxiety

The three interventions observed included:

- Home-based walking exercise (in individuals with lung cancer)
- Individually-tailored exercise (combination of aerobic and strength-based exercise) with goal of reaching 180 minutes of exercise per week over the course of 16 weeks post cancer-related surgery
- Walking program with sedentary individuals

Interventions included two studies with cancer patients and two studies with walking-based interventions.

Exercise in the Treatment of Clinical Anxiety

2018 Systematic Review and Meta-Analysis

- 15 randomized control trials with wait-list controls (n = 675)
    - Participants either (a) had an anxiety disorder or (b) had elevated anxiety on a validated scale/screener.

Key Findings:

- Results showed that exercise is more effective than waiting list control group with a moderate effect size.
- Findings suggest high intensity exercise is more effective than low intensity exercise.

Exercise in the Treatment of Clinical Anxiety

Highlights:

- Exercise interventions included walking, running, treadmill training and supervised aerobic training sessions (note: all aerobic exercises).
- Both low and high intensity groups maintained improvements in anxiety after a “long term follow-up”.
- High intensity exercise found large effect sizes compared to untreated waiting list control group.
- Unclear if exercise intervention is comparable to an active control group (e.g., mindfulness based stress reduction; Bartley et al., 2013)

Resistance Training (RET) and Anxiety

2017 Meta-Analysis and Meta-regression analysis

- 16 Randomized control trials (n = 922)

Key Findings:

- RET has a small-to-moderate statistically significant positive effect on anxiety symptoms.
- Effects are similar to aerobic exercise on primarily healthy adults.

Resistance Training and Anxiety

Highlights:

- *Resistance Exercise Training* (RET) has demonstrated additional positive effects on other outcomes such as pain intensity, metabolic syndrome, depressive symptoms, feelings of fatigue, self-esteem, and sleep.
- Larger positive effects were found in studies of healthy participants in comparison to participants with a physical or mental illness.
- Consistent with previous meta-analytic findings of exercise effects on anxiety in non-clinical participants and patients.

Exercise and Anxiety Symptoms

2023 Meta-Analysis

- 97 Systematic Reviews, 1,039 individual RCTs (n = 128,119).
  - 28 meta-analyses were included for anxiety (n = 10,952)

Key findings:

- Results show a medium effect of PA for reducing anxiety
- PA was generally effective for reducing anxiety across disease conditions.
- All modes were effective (strength-based interventions, mixed modes, stretching, yoga and other mind-body modalities, and aerobic exercise)

Is Exercise a Viable Therapy for Anxiety?

2023 Systematic Review and Meta-Analysis

- 25 Randomized Control Trials (n = 1,831)
  - Follow up from 2015 study by the same authors including data between 2014 to 2021
  - Anxiety as a “primary outcome”; includes PTSD and OCD

Key Findings:

- 18 of 25 RCTS either had equivocal findings or found that exercise did not improve anxiety.
- Evidence does not provide strong support for efficacious use of exercise to treat anxiety.

Is Exercise a Viable Therapy for Anxiety?

- “There have been a number of meta-analyses of the effects of regular exercise on anxiety with disparate conclusions, in part because participants without elevated anxiety or with no anxiety were included in these studies”
- It may be that physical activity is more effective with “healthy” or “non-anxious” individuals than individuals with anxiety disorders.

Combined Psychotherapy and Exercise

2018 Systematic Review and Meta-Analysis

- 11 randomized control trials looked at anxiety-specific outcomes
- Compares CBT and Exercise (CBTEx) with CBT alone.

Key Findings:

- Comparison of CBTEx with either CBT or exercise alone showed no significant difference in outcome in anxiety-specific outcomes.
- 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

- 18 studies (n = 1686 participants)
- “Behavioral therapy” (BT) included all modalities of psychotherapy (e.g., CBT, interpersonal therapy, counseling)

Key Findings:

- The effect of BT+Ex on depression and anxiety was significant.
- BT+Ex does not appear to be significantly more effective than BT for a reduction in anxiety.

Practical Implications

- BT+Ex is a more effective treatment for depression than BT alone, but not anxiety.
- Results from both Bernard et al., and Bourbeau suggest that psychotherapy alone is comparable to intentions that include both exercise and therapy for clinical anxiety.
- Exercise may still have health benefits that psychotherapy alone does not.

Single Bout Physical Exercise for Anxiety

2022 Randomized Control Trial

- n = 88 participants (30 min of acute aerobic exercise on a stationary bike vs nature documentary)
  - Can one acute bout of exercise be sufficient to reduce state anxiety in a subclinical sample?

Key Findings:

- Both groups showed significant decreases in state anxiety and the extent of the change did not differ between the two groups.
- One bout of exercise is not sufficient to reduce anxiety in a subclinical sample.

Single Bout Physical Exercise for Anxiety

- Previous studies could reliably show that one bout of exercise is sufficient to significantly reduce state anxiety in healthy samples compared to a control condition.
- For example, meta-analysis including 36 randomized control trials by Ensari et al., found that “acute bouts of exercise can yield a small reduction in state anxiety” (2015).
- Potential that “floor effects” with healthy populations may have impacted results.

The Anxiolytic Effects of Exercise

2017 Meta-Analysis

- 6 randomized control trials (n = 262)
  - Adults with primary diagnosis of anxiety OR stress disorder (including GAD, PD, OCD, PTSD);
  - Included a non-active control. Excluded articles that compared exercise to other active treatments.

Key Findings:

- Findings suggest that exercise significantly decreased anxiety and/or stress-related symptoms more than control conditions.

The Anxiolytic Effects of Exercise

2021 Systematic Review and Meta-Analysis

- 13 Randomized Control Trials (n = 731)
  - Used same inclusion criteria as Stubbs et al., (includes OCD and PTSD)
  - Excluded active controls.

Key Findings:

- Exercise reduced symptoms of anxiety across the 13 studies.
- Exercise has a small effect on reducing anxiety symptoms in anxiety and related disorders.

The Anxiolytic Effects of Exercise

Highlights:

- “Importantly, we have found a moderate effect (SMD = -0.58) on anxiety symptoms reductions”:
    - Compared to paroxetine (SMD = -0.56), fluoxetine (SMD = 0.56), quetiapine (SMD = -0.56), fluvoxamine (SMD = 0.60) and venlafaxine (SMD = 0.50)

- The optimal duration, intensity and frequency for clinical exercise interventions in people with anxiety and related disorders remain unclear.

Practical Implications

- Exercise and physical activity are seemingly effective in anxiety prevention and have both an acute and chronic anxiolytic effect.
- Effects are most robust in non-clinical populations.
- Exercise and physical activity alone may not treat clinical anxiety symptoms.

Physical Activity for Anxiety

Part 3: Summary and Clinical Recommendations

Summary

- Greater physical activity is protective against incidents of anxiety (especially compared to low- or no- activity).
- Physical activity has acute and chronic anxiolytic effects; can reduce symptoms of anxiety.
- Evidence does not suggest that physical activity is a stand-alone treatment for anxiety disorders.
- Physical activity may be an effective adjunct treatment option alongside psychotherapy and/or medication.

Prevention vs. Treatment

- Resilience Model? (Speculation)
- Unique Causes of Anxiety Disorders (e.g., Social Phobia)

Therapeutic vs. Treatment

- Anxiolytic effect may provide acute anxiety relief but not treat anxiety disorder
- While exercise may confer unique health benefits, psychotherapy remains a “gold standard”.

Anxiety vs. Depression

- High heterogeneity in category of “anxiety disorders”.
- Physical activity as a “psychostimulant” can be physiologically arousing which may be beneficial for depression but activating for anxiety. (Speculation)

PA Outcomes: Anxiety vs. Depression

- High comorbidity between anxiety and depression symptoms suggest that exercise may still be a helpful treatment option but research is admittedly limited.
- While there is some evidence that higher intensity exercise is more effective, dose response remains inconclusive.
- Future studies may benefit from more specific inclusion/exclusion criteria due to heterogeneity (e.g., only GAD)

In Conclusion

- Physical Activity is a preventative lifestyle factor for anxiety.
- Exercise can have an acute anxiolytic effect on state anxiety.
- Evidence for aerobic and resistance training at moderate and vigorous intensity levels.
- Exercise may not be a viable stand-alone treatment for anxiety.

References

References

[1] 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.

[2] 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.

[3] 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.

[4] Moreno-Peral, P., Pino-Postigo, A., Conejo-Cerón, S., Bellón, D., Rodríguez-Martín, B., Martínez-Vizcaíno, V., & Bellón, J. Á. (2022). Effectiveness of physical activity in primary prevention of anxiety: systematic review and meta-analysis of randomized controlled trials. *International Journal of Environmental Research and Public Health*, *19*(3), 1813.

References

[5] Chong, T. W., Kootar, S., Wilding, H., Berriman, S., Curran, E., Cox, K. L., ... & Lautenschlager, N. T. (2022). Exercise interventions to reduce anxiety in mid-life and late-life anxiety disorders and subthreshold anxiety disorder: a systematic review. *Therapeutic Advances in Psychopharmacology*, *12*, 20451253221104958.

[6] Goodarzi, S., Teymouri Athar, M. M., Beiky, M., Fathi, H., Nakhaee, Z., Omran, S. P., & Shafiee, A. (2024). Effect of physical activity for reducing anxiety symptoms in older adults: a meta-analysis of randomized controlled trials. *BMC Sports Science, Medicine and Rehabilitation*, *16*(1), 153.

[7] 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.

[8] 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.

[9] Aylett, E., Small, N., & Bower, P. (2018). Exercise in the treatment of clinical anxiety in general practice–a systematic review and meta-analysis. *BMC health services research*, *18*, 1-18.

References

[10] Herzog, E., Voß, M., Keller, V., Koch, S., Takano, K., & Cludius, B. (2022). The benefits of physical exercise on state anxiety: Exploring possible mechanisms. Mental Health and Physical Activity, 23, 100478.

[11] McDowell, C. P., Dishman, R. K., Gordon, B. R., & Herring, M. P. (2019). Physical activity and anxiety: a systematic review and meta-analysis of prospective cohort studies. *American journal of preventive medicine*, *57*(4), 545-556.

[12] Stubbs, B., Vancampfort, D., Rosenbaum, S., Firth, J., Cosco, T., Veronese, N., ... & Schuch, F. B. (2017). An examination of the anxiolytic effects of exercise for people with anxiety and stress-related disorders: a meta-analysis. *Psychiatry research*, *249*, 102-108.

[13] Ramos-Sanchez, C. P., Schuch, F. B., Seedat, S., Louw, Q. A., Stubbs, B., Rosenbaum, S., ... & Vancampfort, D. (2021). The anxiolytic effects of exercise for people with anxiety and related disorders: an update of the available meta-analytic evidence. *Psychiatry Research*, *302*, 114046.

[14] Stonerock, G. L., Gupta, R. P., & Blumenthal, J. A. (2024). Is exercise a viable therapy for anxiety? Systematic review of recent literature and critical analysis. *Progress in Cardiovascular Diseases*, *83*, 97-115.

References

[15] 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.

[16] Schuch, F. B., Stubbs, B., Meyer, J., Heissel, A., Zech, P., Vancampfort, D., ... & Hiles, S. A. (2019). Physical activity protects from incident anxiety: A meta‐analysis of prospective cohort studies. *Depression and anxiety*, *36*(9), 846-858.

[17] Gordon, B. R., McDowell, C. P., Lyons, M., & Herring, M. P. (2017). The effects of resistance exercise training on anxiety: a meta-analysis and meta-regression analysis of randomized controlled trials. *Sports Medicine*, *47*, 2521-2532.

[18] Wegner, M., Helmich, I., Machado, S., E Nardi, A., Arias-Carrion, O., & Budde, H. (2014). Effects of exercise on anxiety and depression disorders: review of meta-analyses and neurobiological mechanisms. *CNS & Neurological Disorders-Drug Targets (Formerly Current Drug Targets-CNS & Neurological Disorders)*, *13*(6), 1002-1014.