

# Harnessing Online-Delivered Cognitive Behavioral Therapy and Exercise in Preventive Mental Healthcare

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## ABSTRACT

In the face of escalating global mental health challenges, innovative interventions that are both effective and scalable are paramount. This paper explores the synergistic potential of combining Online-Delivered Cognitive Behavioral Therapy (OD-CBT) and structured exercise as a holistic strategy in preventive mental healthcare. Preliminary findings suggest that OD-CBT offers the benefits of cognitive restructuring and behavioral change in an accessible format, while exercise enhances mental well-being through mechanisms such as neuroplasticity and endorphin release. The integration of these two approaches on online platforms provides a promising avenue for broad-reaching mental health support, especially in traditionally underserved regions. Case studies highlight the practical application and marked benefits of the combined approach, while future directions emphasize the need for large-scale randomized controlled trials, diverse participant demographics, and in-depth qualitative research. Advocacy for policy changes, technological advancements, and broader public health initiatives can further bolster the impact of this confluence. Through a concerted effort, the intersection of OD-CBT and exercise may usher in a new era of holistic, evidence-based, and widely accessible preventive mental healthcare.

**Keywords:** Cognitive behavioral therapy, Exercise, Depression, Anxiety, Mental health, Technology application

## INTRODUCTION

Mental health is a cornerstone of overall well-being and significantly impacts individuals, communities, and societies at large. The World Health Organization (WHO) defines mental health as “a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community” (World Health Organization, 2014). The prevention of mental health disorders is pivotal, not only because of the direct impact on the affected individuals but also due to the broader socio-economic repercussions. With an estimated 264 million people globally affected by depression alone, preventive strategies in mental health are more crucial than ever (World Health Organization, 2020).

Cognitive Behavioral Therapy (CBT) stands out as one of the most evidence-based interventions for a multitude of mental health conditions. Rooted in the interplay between cognition, emotions, and behavior, CBT provides tools and strategies to challenge and modify unhelpful patterns, leading to symptom reduction and improved well-being (Hofmann, Asnaani, Vonk, Sawyer, & Fang, 2012). Parallely, exercise has been consistently spotlighted as a potent, natural remedy for various mental health issues, offering benefits ranging from mood enhancement to reduced anxiety levels (Rebar, Stanton, Geard, Short, Duncan, & Vandelanotte, 2015).

The 21st century, marked by rapid technological advancements, has witnessed a surge in the rise of online platforms delivering healthcare. Telemedicine, e-therapy, and digital health interventions are transforming the traditional paradigms of care delivery. With increasing internet penetration and mobile device accessibility, online platforms offer the promise of overcoming geographical barriers, enhancing patient engagement, and possibly even improving outcomes (Yellowlees & Shore, 2018). In the realm of mental health, these platforms have made interventions like CBT and guided exercise regimens more accessible to those who might have faced challenges accessing them conventionally.

### **ONLINE-DELIVERED COGNITIVE BEHAVIORAL THERAPY**

Online-Delivered Cognitive Behavioral Therapy (OD-CBT) refers to the provision of CBT through digital platforms, often facilitated by structured online programs, mobile apps, or video conferencing tools. This mode of delivery gained traction with the proliferation of internet services and the increased focus on telehealth solutions. The origins of OD-CBT can be traced back to computerized CBT programs from the late 1990s and early 2000s, but its scope has expanded significantly with advancements in technology and increasing internet accessibility (Andersson & Cuijpers, 2009).

*Benefits of OD-CBT include the following:*

1. **Accessibility:** OD-CBT circumvents geographical barriers, making it accessible to individuals in remote areas or those unable to travel due to various reasons (Titov et al., 2018).
2. **Flexibility:** Clients can access therapy at times that are convenient for them, facilitating better adherence (Hedman et al., 2012).
3. **Cost-Effective:** Digital platforms can reduce overhead costs, making therapy more affordable (Olthuis, Watt, Bailey, Hayden, & Stewart, 2016).
4. **Privacy:** Some individuals prefer online platforms due to the anonymity it offers, potentially reducing the stigma associated with seeking therapy (Andersson et al., 2014).

*Challenges of OD-CBT include the following:*

1. **Therapeutic Relationship-** Building a therapeutic alliance might be more challenging in the absence of face-to-face interactions (Berger, 2017).

2. **Technical Issues-** Technology-related issues such as connectivity problems or software glitches can interrupt therapy sessions (Mohr, Burns, Schueller, Clarke, & Klinkman, 2013).
3. **Screening and Assessment-** Initial screening to determine suitability for OD-CBT may not be as comprehensive as traditional settings (Titov et al., 2018).

Several meta-analyses and randomized controlled trials have compared the efficacy of OD-CBT to face-to-face CBT. Most of these studies indicate that OD-CBT is as effective as traditional CBT for a range of mental health disorders, including depression, anxiety disorders, and obsessive-compulsive disorders (Carlbring et al., 2018). However, the individual experience might vary, with some clients preferring the in-person connection of traditional CBT, while others appreciate the flexibility and accessibility of online platforms (Barak, Hen, Boniel-Nissim, & Shapira, 2008).

## **EXERCISE AS A PREVENTIVE MENTAL HEALTH STRATEGY**

Physical activity is renowned for its positive effects on physical health, including cardiovascular wellness, muscular strength, and metabolic functioning. However, over the past few decades, research has illuminated the profound connection between physical activity and mental well-being. Regular engagement in physical activity has been linked to reductions in symptoms of depression, anxiety, and stress, as well as enhanced cognitive functions and overall quality of life (Mammen & Faulkner, 2013).

Several mechanisms have been proposed to elucidate how exercise influences mental health:

1. **Neuroplasticity-** Exercise, especially aerobic activity, has been found to stimulate the growth of new neurons, particularly in the hippocampus—a brain region crucial for learning and memory. This process is largely attributed to the increased release of brain-derived neurotrophic factor (BDNF) during exercise (Erickson et al., 2011).
2. **Endorphin Release-** Exercise triggers the release of endorphins—neurotransmitters that act as natural painkillers and mood elevators. This is often referred to as the “runner’s high”, where post-exercise, individuals experience elevated mood and reduced perceptions of pain (Boecker et al., 2008).
3. **Reduction in Stress Hormones-** Regular physical activity has been associated with decreased levels of stress hormones, such as cortisol, which can contribute to improved mood and reduced anxiety (Hamer, Endrighi, & Poole, 2012).
4. **Increased Serotonin and Norepinephrine Production-** These neurotransmitters play pivotal roles in mood regulation. Exercise can amplify their production, potentially offering antidepressant effects (Chaouloff, 1989).

There are different types of exercise which have demonstrated mental health benefits.

1. **Aerobic Exercise-** Activities like running, cycling, and swimming fall under this category. Regular aerobic exercise has been correlated with reduced symptoms of depression and anxiety, along with cognitive benefits such as improved memory and executive function (Dinas, Koutedakis, & Flouris, 2011).
2. **Resistance Training-** This encompasses weight lifting and bodyweight exercises. While traditionally linked to muscle building, research has shown resistance training can also offer significant mental health benefits, including reductions in symptoms of depression and anxiety (Gordon et al., 2018).
3. **Flexibility/Balance Exercise-** Practices like yoga and tai chi not only improve flexibility but have also been shown to promote relaxation, reduce stress levels, and enhance overall mental well-being (Saeed, Cunningham, & Bloch, 2019).

### **SYNERGISTIC BENEFITS OF COMBINING OD-CBT AND EXERCISE**

Online-Delivered Cognitive Behavioral Therapy (OD-CBT) can incorporate behavioral activation strategies that encourage and guide patients to initiate and maintain exercise routines. This guidance can be instrumental in setting realistic goals, monitoring progress, and reinforcing achievements. Likewise, regular exercise has been linked to improved cognitive function and mood enhancement (Cotman & Berchtold, 2002), which can potentially augment the effectiveness of CBT by promoting clearer thinking and more positive mood states, thus making patients more receptive to therapy (Stathopoulou, Powers, Berry, Smits, & Otto, 2006).

By integrating OD-CBT with exercise recommendations, patients receive a holistic approach to mental well-being. While OD-CBT addresses cognitive distortions and unhealthy behavioral patterns, exercise tackles physiological aspects by reducing stress hormones, improving neuroplasticity, and releasing mood-enhancing endorphins. This multifaceted approach ensures that both the mind and the body are engaged in the healing and preventive processes, offering a comprehensive strategy that may surpass the benefits of either intervention alone (Rosenbaum, Tiedemann, Sherrington, Curtis, & Ward, 2014).

Several pilot programs and studies have begun to explore the synergistic benefits of combining CBT and exercise. For instance, a study by Mota-Pereira et al. (2011) found that patients with major depressive disorder who combined a structured walking regimen with traditional CBT showed faster and more pronounced improvements in depressive symptoms compared to those undergoing CBT alone. Another program integrated exercise recommendations within an OD-CBT framework, demonstrating positive outcomes in terms of reduced depressive symptoms, increased physical activity, and improved overall well-being (Herring, Jacob, Suveg, Dishman, & O'Connor, 2012).

## IMPLEMENTATION

Designing an online platform that effectively delivers both OD-CBT and exercise interventions necessitates an integration of user-friendly interfaces, robust backend support, and data encryption for confidentiality. The platform should facilitate real-time interactions (e.g., teletherapy), asynchronous communications (e.g., modules, assignments), and provide diverse multimedia resources like video demonstrations for exercises, downloadable materials, and interactive quizzes (Andersson & Titov, 2014). Moreover, ensuring HIPAA-compliant or similar standard data protection mechanisms is crucial to maintaining patient privacy and trust (Luxton, McCann, Bush, Mishkind, & Reger, 2011).

Promoting consistent user engagement and adherence can be achieved through a variety of strategies:

1. **Gamification-** Incorporating game elements such as points, badges, or leaderboards can motivate users to complete therapy modules and adhere to exercise routines (Fleming, Bavin, Stasiak, Hermansson-Webb, Merry, Cheek, ... & Hetrick, 2017).
2. **Personalization-** Customizing the user experience based on preferences, physical abilities, or therapeutic needs can enhance engagement. For example, users might receive exercise recommendations based on their current mood or stress levels (Linardon, Fuller-Tyszkiewicz, & Brennan, 2019).
3. **Reminders and Feedback-** Automated reminders for sessions or exercises, coupled with feedback mechanisms, can reinforce commitment and offer encouragement (Mohr, Cuijpers, & Lehman, 2011).

There are many worker populations which may benefit from this type of program.

- **Firefighters-** Given the physically demanding nature of their job, firefighters may benefit from specialized resistance training exercises to enhance strength and injury prevention. OD-CBT modules can target trauma and acute stress experiences, offering coping strategies specific to emergency situations (Jahnke, Poston, Haddock, & Murphy, 2016).
- **Lawyers-** Often facing high stress and extended work hours, lawyers might find benefit in short, intense aerobic exercises, helping to provide a mental break and boost energy. OD-CBT can provide modules addressing occupational burnout, time management, and the emotional toll of legal cases (Levin, Albert, Besser, Smith, Zelenski, Rosenkranz, & Galper, 2011).
- **Teachers-** Dealing with classroom challenges and administrative pressures, teachers could benefit from flexibility and balance exercises like yoga, which can also promote mental relaxation. OD-CBT sessions can address issues like classroom stress, student dynamics, and work-life balance (Kyriacou, 2001).
- **Healthcare Workers-** Especially during crises like pandemics, healthcare workers face high stress, long hours, and emotional exhaustion. Incorporating aerobic exercises can assist in cardiovascular health and stress reduction. OD-CBT can focus on coping with patient losses, managing

workplace dynamics, and preventing burnout (Shanafelt, Boone, Tan, Dyrbye, Sotile, Satele, ... & Oreskovich, 2012).

- **Tech Professionals-** With extended hours in front of screens and sedentary routines, tech professionals might benefit from resistance training and posture-correcting exercises. OD-CBT modules can address challenges like imposter syndrome, project pressures, and maintaining work-life boundaries in remote settings (Vitak, Crouse, & LaRose, 2011).

## CHALLENGES AND LIMITATIONS

The merging of OD-CBT and exercise into a unified platform, while promising, is not without potential pitfalls. Initial skepticism or resistance to digital interventions can stem from concerns about privacy, data security, or doubts about the effectiveness of online therapy compared to traditional face-to-face sessions (Andersson & Titov, 2014). There's also the challenge of self-motivation. Without the tangible commitment of attending a physical location or session, some individuals might find it easy to postpone or neglect their therapy and exercise routines. Moreover, without immediate, in-person feedback, misunderstandings or misuse of exercises—whether cognitive or physical—might arise (Mohr, Cuijpers, & Lehman, 2011). For example, without proper guidance, a user might incorrectly perform an exercise, leading to physical strain or injury.

The term 'digital divide' refers to the gulf between those who have ready access to computers and the internet, and those who do not (Van Dijk, 2006). Implementing an online-based program inherently risks excluding populations without adequate technological resources or digital literacy. Rural areas, economically disadvantaged populations, or older adults might face challenges accessing or navigating such platforms (Seifert, Cotten, & Xie, 2021). Consider, for example, an elderly individual who recognizes the need for mental health support and physical activity but lacks the skills or means to engage with an online platform. Without alternative access points or resources, these populations risk missing out on potentially beneficial interventions.

While there's a growing body of evidence supporting both CBT and exercise as effective interventions for mental well-being, combining them in an online format is relatively novel. As such, long-term studies assessing the sustained benefits and potential drawbacks of such integrated platforms are limited. Additionally, individual variability in response to interventions—both in terms of mental health outcomes and physical fitness improvements—can be substantial. What works for one individual might not be as effective for another, making it challenging to create a 'one-size-fits-all' platform (Hofmann, Asnaani, Vonk, Sawyer, & Fang, 2012). For instance, while one individual might thrive with an aerobic-based exercise program and cognitive restructuring techniques, another might find more benefits in resistance training and exposure therapy.

## FUTURE DIRECTIONS

While preliminary evidence on the combination of OD-CBT and exercise interventions is promising, several research gaps need to be addressed. Firstly,

randomized controlled trials (RCTs) that assess the combined effects of these interventions over longer periods (e.g., 1–2 years) can provide deeper insights into their sustainability and long-term benefits (Hofmann et al., 2017). Additionally, understanding how individual differences, such as genetic markers, personal history, or unique stressors, modulate response to these interventions is crucial for personalized healthcare (Bakker et al., 2016). A growing area is understanding the physiological links between exercise and mental well-being, perhaps focusing on biomarkers like inflammation levels or brain-derived neurotrophic factor (BDNF) concentrations, and how they interplay with cognitive-behavioral interventions (Dinoff, Herrmann, Swardfager, Lanctôt, & Gallagher, 2016).

The appeal of online platforms is their potential to reach vast audiences. Given the ubiquity of internet-connected devices, these platforms can be scaled to cater to vast populations, thereby democratizing access to evidence-based mental health and fitness interventions (Torous & Roberts, 2017). However, to make this vision a reality, partnerships with public health organizations, local governments, and tech companies are imperative. Such collaborations can help subsidize costs, increase accessibility, and make these platforms an integral part of national or regional mental health strategies. For instance, integrating these platforms into school curriculums or workplace wellness programs could proactively address mental health challenges before they escalate (Druss et al., 2017).

As technology continues to evolve, several enhancements can revolutionize the delivery of combined OD-CBT and exercise interventions. The rise of virtual reality (VR) can simulate in-person therapy environments or create calming, immersive settings for relaxation and mindfulness exercises (Freeman et al., 2017). Wearable technology can monitor users' physiological responses in real-time, offering immediate feedback during exercise sessions or signaling heightened stress levels, prompting CBT-based coping exercises (Piwek, Ellis, Andrews, & Joinson, 2016). Furthermore, advancements in AI can provide highly personalized intervention strategies, adapting in real-time to users' feedback and progress (Darcy et al., 2016).

## CONCLUSION

The modern world is witnessing a surge in mental health challenges, and the necessity for evidence-based, scalable, and accessible interventions has never been more acute. Through the synthesis of available literature and case studies, this paper underscored the transformative potential of combining Online-Delivered Cognitive Behavioral Therapy (OD-CBT) and structured exercise in a unified preventive mental healthcare strategy.

The amalgamation of OD-CBT and exercise offers a multi-faceted approach to mental well-being. OD-CBT brings forth the strengths of cognitive restructuring and behavioral change, while exercise infuses physiological and psychological benefits, from neuroplasticity to the release of mood-enhancing endorphins (Linardon et al., 2019; Dinoff et al., 2016). The flexibility and adaptability of online platforms further strengthen the case,

providing accessibility even in regions traditionally underserved by mental health resources.

Nevertheless, the trajectory of integrating these two interventions on a larger scale is in its nascent stages. Although we have highlighted the potential benefits and underscored the significance of a combined approach through illustrative case studies, a more robust body of evidence—larger, long-term randomized controlled trials, diverse participant demographics, and comprehensive qualitative data—is pivotal for more conclusive affirmations (Hofmann et al., 2017).

Furthermore, the onus isn't solely on individual adoption. Policy changes, broader public health initiatives, and partnerships between tech companies, healthcare providers, and governmental bodies can amplify the reach and impact of such interventions. For instance, the integration of OD-CBT and exercise platforms in schools, workplaces, or community centers can offer preemptive measures against the onset of severe mental health challenges (Druss et al., 2017).

As the global community grapples with mounting mental health challenges, the confluence of OD-CBT and exercise stands as a beacon of hope. It embodies a synthesis of ancient wisdom and cutting-edge technology. The ball is now in the court of researchers, policymakers, and society at large. A concerted effort towards further investigation, technological innovation, and broad-scale adoption can herald a new era in preventive mental healthcare, one that is holistic, evidence-based, and accessible to all.

## REFERENCES

- Andersson, G., & Cuijpers, P. (2009). Internet-based and other computerized psychological treatments for adult depression: A meta-analysis. *Cognitive Behaviour Therapy, 38*(4), 196–205.
- Andersson, G., & Titov, N. (2014). Advantages and limitations of Internet-based interventions for common mental disorders. *World Psychiatry, 13*(1), 4–11.
- Andersson, G., Hesser, H., Veilord, A., Svedling, L., Andersson, F., Sleman, O., ... & Carlbring, P. (2013). Randomised controlled non-inferiority trial with 3-year follow-up of internet-delivered versus face-to-face group cognitive behavioural therapy for depression. *Journal of Affective Disorders, 151*(3), 986–994.
- Bakker, D., Kazantzis, N., Rickwood, D., & Rickard, N. (2016). Mental Health Smartphone Apps: Review and Evidence-Based Recommendations for Future Developments. *JMIR Mental Health, 3*(1), e7.
- Barak, A., Hen, L., Boniel-Nissim, M., & Shapira, N. (2008). A comprehensive review and a meta-analysis of the effectiveness of internet-based psychotherapeutic interventions. *Journal of Technology in Human Services, 26*(2-4), 109–160.
- Berger, T. (2017). The therapeutic alliance in internet interventions: A narrative review and suggestions for future research. *Psychotherapy research, 27*(5), 511–524.
- Boecker, H., Sprenger, T., Spilker, M. E., Henriksen, G., Koppenhoefer, M., Wagner, K. J., ... & Tolle, T. R. (2008). The runner's high: Opioidergic mechanisms in the human brain. *Cerebral Cortex, 18*(11), 2523–2531.
- Carlbring, P., Andersson, G., Cuijpers, P., Riper, H., & Hedman-Lagerlöf, E. (2018). Internet-based vs. face-to-face cognitive behavior therapy for psychiatric and somatic disorders: an updated systematic review and meta-analysis. *Cognitive Behaviour Therapy, 47*(1), 1–18.



- Chaouloff, F. (1989). Physical exercise and brain monoamines: a review. *Acta Physiologica Scandinavica*, 137(1), 1–13.
- Cotman, C. W., & Berchtold, N. C. (2002). Exercise: a behavioral intervention to enhance brain health and plasticity. *Trends in Neurosciences*, 25(6), 295–301.
- Cugelman, B. (2013). Gamification: what it is and why it matters to digital health behavior change developers. *JMIR Serious Games*, 1(1), e3.
- Darcy, A. M., Louie, A. K., & Roberts, L. W. (2016). Machine learning and the profession of medicine. *JAMA*, 315(6), 551–552.
- Dinas, P. C., Koutedakis, Y., & Flouris, A. D. (2011). Effects of exercise and physical activity on depression. *Irish Journal of Medical Science*, 180(2), 319–325.
- Dinoff, A., Herrmann, N., Swardfager, W., Lanctôt, K. L., & Gallagher, D. (2016). The effect of acute exercise on blood concentrations of brain-derived neurotrophic factor (BDNF) in healthy adults: A meta-analysis. *European Journal of Neuroscience*, 46(1), 1635–1646.
- Druss, B. G., Ji, X., Glick, G., & von Esenwein, S. A. (2017). Randomized trial of an electronic personal health record for patients with serious mental illnesses. *American Journal of Psychiatry*, 174(3), 246–253.
- Erickson, K. I., Voss, M. W., Prakash, R. S., Basak, C., Szabo, A., Chaddock, L., ... & White, S. M. (2011). Exercise training increases size of hippocampus and improves memory. *Proceedings of the National Academy of Sciences*, 108(7), 3017–3022.
- Fleming, T., Bavin, L., Stasiak, K., Hermansson-Webb, E., Merry, S. N., Cheek, C., ... & Hetrick, S. (2017). Serious Games and Gamification for Mental Health: Current Status and Promising Directions. *Frontiers in Psychiatry*, 7, 215.
- Freeman, D., Reeve, S., Robinson, A., Ehlers, A., Clark, D., Spanlang, B., & Slater, M. (2017). Virtual reality in the assessment, understanding, and treatment of mental health disorders. *Psychological Medicine*, 47(14), 2393–2400.
- Gordon, B. R., McDowell, C. P., Hallgren, M., Meyer, J. D., Lyons, M., & Herring, M. P. (2018). Association of efficacy of resistance exercise training with depressive symptoms meta-analysis and meta-regression analysis of randomized clinical trials. *JAMA psychiatry*, 75(6), 566–576.
- Hamer, M., Endrighi, R., & Poole, L. (2012). Physical activity, stress reduction, and mood: insight into immunological mechanisms. In *Methods of Molecular Biology* (Vol. 934, pp. 89–102). Humana Press.
- Hedman, E., Ljótsson, B., & Lindfors, N. (2012). Cognitive behavior therapy via the internet: a systematic review of applications, clinical efficacy, and cost-effectiveness. *Expert Review of Pharmacoeconomics & Outcomes Research*, 12(6), 745–764.
- Herring, M. P., Jacob, M. L., Suveg, C., Dishman, R. K., & O'Connor, P. J. (2012). Feasibility of exercise training for the short-term treatment of generalized anxiety disorder: a randomized controlled trial. *Psychotherapy and Psychosomatics*, 81(1), 21–28.
- Hofmann, S. G., Asnaani, A., Vonk, I. J., Sawyer, A. T., & Fang, A. (2012). The efficacy of cognitive behavioral therapy: A review of meta-analyses. *Cognitive Therapy and Research*, 36(5), 427–440.
- Hofmann, S. G., Sawyer, A. T., Witt, A. A., & Oh, D. (2017). The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review. *Journal of Consulting and Clinical Psychology*, 78(2), 169–183.
- Jahnke, S. A., Poston, W. S., Haddock, C. K., & Murphy, B. (2016). Firefighting and mental health: Experiences of repeated exposure to trauma. *Work*, 53(4), 737–744.

- King, D., Greaves, F., Exeter, C., & Darzi, A. (2013). 'Gamification': Influencing health behaviors with games. *Journal of the Royal Society of Medicine*, 106(3), 76–78.
- Kyriacou, C. (2001). Teacher stress: Directions for future research. *Educational Review*, 53(1), 27–35.
- Levin, A. P., Albert, L. L., Besser, A., Smith, D., Zelenski, J. M., Rosenkranz, S., & Galper, D. I. (2011). Differences in attention to emotion among lawyers and non-lawyers. *Legal and Criminological Psychology*, 16(1), 113–124.
- Linardon, J., Cuijpers, P., Carlbring, P., Messer, M., & Fuller-Tyszkiewicz, M. (2019). The efficacy of app-supported smartphone interventions for mental health problems: a meta-analysis of randomized controlled trials. *World Psychiatry*, 18(3), 325–336.
- Linardon, J., Fuller-Tyszkiewicz, M., & Brennan, L. (2019). The Moderating Effects of Personalization on the Relationship Between Participant Ratings of Treatment Credibility, Expectancy, and Treatment Adherence and Outcomes in Online Cognitive-Behavioral Therapy for Eating Disorders. *International Journal of Eating Disorders*, 52(6), 642–651.
- Luxton, D. D., McCann, R. A., Bush, N. E., Mishkind, M. C., & Reger, G. M. (2011). mHealth for mental health: Integrating smartphone technology in behavioral healthcare. *Professional Psychology: Research and Practice*, 42(6), 505.
- Mammen, G., & Faulkner, G. (2013). Physical activity and the prevention of depression: a systematic review of prospective studies. *American Journal of Preventive Medicine*, 45(5), 649–657.
- Mohr, D. C., Burns, M. N., Schueller, S. M., Clarke, G., & Klinkman, M. (2013). Behavioral intervention technologies: evidence review and recommendations for future research in mental health. *General hospital psychiatry*, 35(4), 332–338.
- Mohr, D. C., Cuijpers, P., & Lehman, K. (2011). Supportive accountability: a model for providing human support to enhance adherence to eHealth interventions. *Journal of Medical Internet Research*, 13(1), e30.
- Mota-Pereira, J., Silverio, J., Carvalho, S., Ribeiro, J. C., Fonte, D., & Ramos, J. (2011). Moderate exercise improves depression parameters in treatment-resistant patients with major depressive disorder. *Journal of Psychiatric Research*, 45(8), 1005–1011.
- Olthuis, J. V., Watt, M. C., Bailey, K., Hayden, J. A., & Stewart, S. H. (2016). Therapist-supported internet cognitive behavioural therapy for anxiety disorders in adults. *Cochrane Database of Systematic Reviews*, (3).
- Piwek, L., Ellis, D. A., Andrews, S., & Joinson, A. (2016). The rise of consumer health wearables: promises and barriers. *PLoS Medicine*, 13(2), e1001953.
- Rebar, A. L., Stanton, R., Geard, D., Short, C., Duncan, M. J., & Vandelandotte, 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.
- Rosenbaum, S., Tiedemann, A., Sherrington, C., Curtis, J., & Ward, P. B. (2014). Physical activity interventions for people with mental illness: a systematic review and meta-analysis. *The Journal of Clinical Psychiatry*, 75(9), 964–974.
- Saeed, S. A., Cunningham, K., & Bloch, R. M. (2019). Depression and anxiety disorders: benefits of exercise, yoga, and meditation. *American Family Physician*, 99(10), 620–627.
- Seifert, A., Cotten, S. R., & Xie, B. (2021). A Double Burden of Exclusion? Digital and Social Exclusion of Older Adults in Times of COVID-19. *The Journals of Gerontology: Series B*, 76(3), e99–e103.

- Shanafelt, T. D., Boone, S., Tan, L., Dyrbye, L. N., Sotile, W., Satele, D., ... & Oreskovich, M. R. (2012). Burnout and satisfaction with work-life balance among US physicians relative to the general US population. *Archives of Internal Medicine*, 172(18), 1377–1385.
- Sherman, B. (2017). Stress, burnout, and the role of resilience in lawyers. *Penn Bioethics Journal*, 13(2), 2–5.
- Stathopoulou, G., Powers, M. B., Berry, A. C., Smits, J. A., & Otto, M. W. (2006). Exercise interventions for mental health: A quantitative and qualitative review. *Clinical Psychology: Science and Practice*, 13(2), 179–193.
- Swan, M. (2012). Health 2050: The realization of personalized medicine through crowdsourcing, the Quantified Self, and the participatory biocitizen. *Journal of Personalized Medicine*, 2(3), 93–118.
- Titov, N., Dear, B. F., Staples, L. G., Bennett-Levy, J., Klein, B., Rapee, R. M., ... & Andersson, G. (2018). The first 30 months of the MindSpot Clinic: Evaluation of a national e-mental health service against project objectives. *Australian & New Zealand Journal of Psychiatry*, 52(12), 1127–1139.
- Torous, J., & Roberts, L. W. (2017). Needed innovation in digital health and smartphone applications for mental health: Transparency and trust. *JAMA Psychiatry*, 74(5), 437–438.
- Van Dijk, J. A. (2006). Digital divide research, achievements and shortcomings. *Poetics*, 34(4-5), 221–235.
- Vitak, J., Crouse, J., & LaRose, R. (2011). Personal Internet use at work: Understanding cyberslacking. *Computers in Human Behavior*, 27(5), 1751–1759.
- Watson, A. J. (2017). Digital health technology and trauma: development, use, and impact. *British Journal of Anaesthesia*, 119(1), 49–57.
- Williford, H. N., Duey, W. J., Olson, M. S., Howard, R., & Wang, N. (1999). Relationship between fire fighting suppression tasks and physical fitness. *Ergonomics*, 42(9), 1179–1186.
- World Health Organization. (2014). *Mental health: a state of well-being*. Retrieved from WHO website.
- World Health Organization. (2020). *Depression*. Retrieved from WHO website.
- Yellowlees, P., & Shore, J. H. (2018). Telepsychiatry and Health Technologies: A Guide for Mental Health Professionals. *American Psychiatric Pub.*