

**Exercise in Anorexia Nervosa Treatment: From Problematic to Therapeutic**

by

Maeve Gale

A Capstone Research Project submitted in partial fulfillment of the requirements for the degree of

Master of Counselling (MC)

City University in Canada

Vancouver BC, Canada site

March 14<sup>th</sup>, 2023

APPROVED BY

Ron Manley, PhD, RCC, Capstone Advisor, Master of Counselling Faculty

Bruce Hardy, PhD, RCC, Faculty Reader, Master of Counselling Faculty

School of Health and Social Sciences

### **Abstract**

There is a common link between anorexia nervosa (AN) and compulsive exercise. Despite this, current AN treatment models generally do not incorporate exercise, which can negatively affect recovery and enhance health risks. This paper provides a literature review exploring issues in defining and measuring compulsive exercise, and examining the prevalence, etiology, and effects of compulsive exercise in AN. It also reviews the risks and benefits of incorporating exercise into AN treatment and explores the focuses of research and treatment that has attempted to incorporate exercise thus far. With this synthesis of the research, it is clear that there is much more work to be done to see how treatment programs may support participants of different environments, ages, genders, and stages of illness; this paper explores possible future directions for research and practice to enhance treatment and mitigate risk. In an outline of 12 best practices, this paper concludes with recommendations for incorporating exercise into treatment in safe and sustainable ways.

*Keywords:* anorexia nervosa, compulsive exercise, treatment, best practices

### **Acknowledgements**

There are several people I would like to thank - not only for supporting me in completing this paper, but for their presence throughout my Master of Counselling journey.

I first want to thank my family for their encouragement and guidance. I cannot count the ways they have shown up for me, not just in these last three years, but for my whole life. In every way imaginable, I would not be here without them.

I'd like to thank Dr. Ron Manley for his time, expertise, kindness, and incredible efficiency, all of which allowed me to complete this paper with the least amount of stress possible. Thank you also to Dr. Laura Farres for her tireless work in facilitating the capstone program.

Thank you to Kaela Scott and the Looking Glass Foundation team for their essential work in the eating disorders field, and for how much they have taught me personally. Thank you to every volunteer participant and counselling client I have had within the foundation so far. Their strength and perseverance inspire me every day.

Last, and by no means least, I want to express my immense gratitude and love for my cohort, the 'happy accident', the supportive ship in a storm of pandemic, postgraduate, personal and professional challenges. Thank you for all the warm fuzzies.

## Table Of Contents

Chapter One: Introduction .....	6
Overview Of The Topic .....	<b>Error! Bookmark not defined.</b>
Purpose Statements .....	8
Theoretical/Conceptual Framework .....	8
Contribution To The Field.....	12
Reflectivity And Positionality Statement.....	13
Definition Of Terms .....	14
Outline Of Project Chapters .....	18
Chapter Two: Literature Review .....	19
Theme A: Measuring Exercise .....	19
Problems Of Defining Excessive/Compulsive Exercise .....	19
Difficulties Of Measuring Exercise.....	211
Proposals For Measuring/Defining Compulsive Exercise .....	244
Theme B: Exercise In Anorexia Nervosa .....	255
Prevalence .....	255
Motives And Correlations .....	266
Physical Effects .....	29
Theme C: Risks And Benefits Of Incorporating Exercise Into An Treatment .....	300
Negative Consequences Of Bed Rest .....	300
Potential Risks Of Incorporating Exercise.....	300
Case Study: Maximal Strength Training .....	322
Potential Benefits Of Incorporating Exercise .....	344
Thoughts From The Population.....	366
Autonomy & Harm Reduction.....	377
Theme D: Incorporating Exercise Into Treatment: Focuses Of Previous & Current Models .....	3388

Physical Health And Safety.....	388
Body Image And Body Appreciation .....	338
Openness .....	400
Social Inclusion.....	411
Connection Of Mind And Body .....	411
Theme E: Gaps In The Field.....	433
Issues Of Methodology .....	433
Underrepresented Populations.....	433
Chapter Three: Discussion And Applied Practices .....	455
Discussion Of Purpose Statements .....	<b>Error! Bookmark not defined.</b>
Best Practice Guidelines.....	48
Safety And Preparation .....	48
Psychological Support .....	500
Maintenance And Sustainability .....	524
Practical Considerations.....	555
Research Limitations And Recommendations.....	566
Conclusions And Synthesis.....	56
References .....	59

## Chapter One: Introduction

Of all psychiatric illnesses, anorexia nervosa (AN) has the highest mortality rate (Edakubo & Fushimi, 2020), with reported mortality rates varying widely from 5-20% (Arcelus et al., 2011; Fichter & Quadflieg, 2016; Neumärker, 1998). Even these alarming statistics are conservative, as cause of death may be recorded as the specific resulting medical complication or suicide, hiding the disorder's true lethality. Furthermore, statistics on the prevalence of AN often represent only those who have sought medical help. Given the fear and shame that surrounds AN and other eating disorders (EDs), many individuals do not reach out, meaning that the actual occurrence is likely significantly higher than we assume.

Compulsive exercising is a common behaviour in individuals with AN, and a potent maintaining mechanism of ED psychopathology (Bratland-Sanda et al., 2010; Keyes et al., 2015; Mond & Calogero, 2009; Mond & Gorrell, 2021). There are also reports that over-exercise is a major risk factor for suicidal behaviour in patients with EDs (Hausenblas et al., 2017). Compulsive exercise also increases the risk of injuries and cardiac complications and appears to be a predictor of poor treatment outcome (Dalle Grave, 2009). However, compulsive exercise within AN is often left untreated in current treatment models, and this can negatively affect recovery (Calogero & Pedrotty, 2004). By reviewing the research to date, I hope to develop a set of best practice guidelines which enhance the benefits and mitigate the risks of incorporating exercise into treatment for AN.

### Purposeful Exceptions

There are certain areas I chose not to include for the purposes of this paper. I chose to focus on adults with AN, rather than children or youth. There is plenty of excellent research for this population (Chubbs-Payne et al., 2021; Jankauskiene et al., 2020; Manley & Standish, 2005), and this research may help to inform best practices for adults. However, my interest is in adults as there tends to be a drastic reduction in available treatment and services for those with EDs once they pass the age of majority. Additionally, there may be other health and safety factors to consider when treating minds and bodies in earlier development stages.

Unfortunately, the research included in this paper also almost exclusively involves individuals with low body mass index (BMI). There are many issues using the BMI as a measurement tool. Designed in the mid-1800s to measure the average weight of a population, it was not designed for use in individuals; it was also based solely on data gathered from (primarily White) men's heights and weights to determine the 'average man' (Humphreys, 2010). It therefore does not account for many factors including sex and racial differences, level of exercise, individuals' special clinical circumstances, and it is not valid for individuals under 20 years of age (Prentice & Jebb, 2001). In the context of EDs, a low BMI has consistently been a threshold for gaining access to treatment. It is used as an assessment of immediate risk due to malnutrition but does not account for the fact that many people with EDs do not present with a low BMI and are still at significant risk of physical and mental health complications. While this is beginning to be addressed and shifted, BMI remains a faulty diagnostic factor for many health professionals and treatment programs.

Treatment programs that incorporate exercise often rely on BMI values to determine appropriate activity levels, although the parameters vary widely (Davies et al., 2008). This approach reinforces the idea that problematic exercise is directly and exclusively related to weight. From the perspective of individuals in treatment (or seeking treatment), such practices may reinforce the idea that compulsive exercise is acceptable if one is any size but underweight. It is essential to question why exercise is often considered dangerous or dysfunctional only in the context of low weight; these considerations have real and important implications for how we utilize exercise in the treatment of AN (Calogero & Pedrotty-Stump, 2010).

Women and girls receive the vast majority of AN diagnoses (Hoek, 2006; Striegel-Moore & Bulik, 2007). As such, the research included in this paper (and therefore the focus of this paper overall) is almost exclusively on cisgender women. There are various factors influencing the lack of diagnoses for, and literature on, men and non-binary individuals with AN. These are explored further in Chapter 2: Underrepresented Populations. In addition to the social and ethical implications of representation in the literature, this gendered focus may also have empirical effects. Certain

quantitative and qualitative results, such as differences in strength and body composition, engagement in educational programs, and compliance to treatment, may differ for men and non-binary individuals due to socialization, biology, or other factors. As such, it is important to note that recommendations for treatment based on findings with cisgender women may not serve the wider population.

I have also excluded treatment for athletes with AN. This was not due to a lack of available research, but rather to avoid complicating an already multifaceted topic. Another area that I did not include, but believe would benefit from more research in the future, is the management of more severe comorbidities in exercise programs for AN treatment. For example, how might we help to manage obsessive compulsive disorder (OCD) while striving to make exercise less rigid and more social for participants? How can we utilize exercise as part of behavioural activation for AN patients who are severely depressed?

### **Purpose Statements**

1. To explore the issues of defining and measuring excessive/compulsive/problematic exercise.
2. To examine the prevalence, etiology, and effects of problematic exercise in AN.
3. To review risks and benefits of incorporating exercise into the treatment of AN, utilizing the research to date.
4. To outline best practices for incorporating exercise into AN treatment.

### **Theoretical/Conceptual Framework**

#### ***Collaborative and Person-Centred Approaches***

I believe that all mental health treatment should be person-centred, from both an ethical and a practical standpoint. Positive regard, empathy and genuineness are broadly effective in therapeutic practice (Prochaska & Norcross, 2018), with empathy being particularly facilitative in fostering change. For example, client perception of therapist's empathy has been found to be the strongest therapist determinant of successful psychotherapy (Bohart et al., 2002).

Centering the voices of individuals with AN is also relevant to research. A common issue in AN literature is defining recovery; for example, when achieving 'healthy weight' was the marker, 60% of cases reportedly reached full recovery, whereas when it was defined as recovery from all essential AN symptoms, only 46.9% of cases were reported as recovered (Steinhausen, 2002). A more useful approach would be to ask recovered individuals themselves. A meta-synthesis research study investigating recovery from AN found that recovered individuals identified reclaiming power and self-acceptance, increased agency, and connecting with emotions as essential aspects of the recovery process (Duncan et al., 2014). A broader range of treatment choices and a person-centred focus could help therapists, physicians, and other members of care teams to individualise treatment approaches, thereby increasing successful outcomes (Kashubeck-West & Tagger, 2012).

I also believe that a person-centred approach connects closely to a collaborative approach. Collaborating with individuals in their recovery whenever possible, rather than taking a more distant or authoritative approach, allows these individuals to reclaim their own sense of self and power, and feel more agency. Since agency and power are important elements of recovery (Duncan et al., 2014), it follows that a collaborative relationship between healthcare providers and AN patients is ideal.

### ***Cognitive Behavioural Therapy***

In developing best practices for incorporating exercise into AN treatment, elements of cognitive behavioural therapy (CBT) can be useful for promoting both insight and change. CBT is goal-oriented and aims to solve problems and reduce symptoms through a structured, collaborative, empirical approach. The goal is to teach the client to be their own therapist, and therefore promote agency and problem-solving far past the course of therapy (Beck & Hindman, 2017).

By helping healthcare providers and patients to understand relationships between thoughts, feelings and behaviours, CBT principles can help in adjusting maladaptive exercise behaviours such as over-exercising, exercising past exhaustion, or exercising with an injury. CBT can help individuals to identify their emotions, which may be particularly useful for those who exercise to avoid negative affect. CBT can also help individuals to notice their thoughts, which can be helpful for clarifying and

shifting negative body image and distancing from internalized messages that foster low self-esteem. Lastly, CBT can shed light on behaviours, including antecedents and consequences of behaviours. This can help with the change process all the way from building motivation to change (by highlighting the negative consequences of current behaviours) to maintaining change (by noticing and managing antecedents that lead to the behaviours). By helping individuals to understand the reasons for and effects of their problematic exercising, sustainable self-monitoring and self-care skills can be developed, allowing change to be maintained past the course of treatment.

### ***Feminist Theory***

While approaches have been shifting in recent years, traditional ED treatment has generally followed a model of psychopathology: treating the illness as a dysfunction to be fixed, without fully considering the context in which it flourishes. I believe that a feminist lens is crucial to understanding and addressing the context of cultural gender ideologies, and how these are communicated and performed in the domains of family, media, culture, workplace, and much more. According to the feminist perspective, the patriarchy suppresses women in part by attacking and generating anxiety about women's appearances (Gilbert & Thompson, 1996). Women are expected to control their eating and their bodies, representing control of women's behaviour in general (Seid, 1994).

While the bulk of feminist literature about EDs focuses on those who identify as women, these cultural gender ideologies also deeply affect men, particularly when we consider the effect of toxic masculinity on expectations of men's bodies. Feminist theory emphasizes the loss of voice and suppression of feelings that are involved in being in a position of diminished power in relationships (Geller et al., 2000). This can therefore extend to any gender in the context of being a patient. The theory is also relevant to power differentials in the etiology and maintenance of AN, suggesting that recovery from AN "requires regaining or developing one's voice and sense of personal power through appropriate expression of feelings" (Geller et al., 2000, p. 18). As such, societal expectations and scripts around power and voice must be addressed and challenged in treatment programs.

Accordingly, a feminist approach is relevant to the promotion of agency in exercise-based interventions during treatment. Paternalistic interventions have historically been recommended, particularly in serious cases, following the belief that the biological effects of starvation prevent any ability to heal psychologically, including hindering any rational treatment-based decisions (Brumberg, 2000). While this has validity (Bargiacchi et al., 2018), weight restoration without other support works against embodied, holistic, and long-term recovery. Firstly, it often reinforces key symptoms of AN, such as preoccupation with calories and bodily appearance (Kwee & Launeanu, 2019). Additionally, this limited and authoritative model of treatment works to perpetuate the lack of agency often felt by those suffering from AN, echoing the oppression of women and “the patriarchal values in which the patient must ‘behave well’ in order to ‘get better’” (Kwee & Launeanu, 2019, p. 344). Encouraging individuals to participate in exercise interventions while simultaneously providing education, encouraging feedback and dialogue, and fostering collaboration in the process may all be important to challenging traditional, more patriarchal treatment practices.

### ***Third Wave Therapies***

Third-wave behaviour therapies feature a strong emphasis on mindfulness, both as theoretical foundation and the basis of interventions (Hayes & Hofmann, 2017). Mindfulness-based practices promote well-being and self-care, as well as decreasing reactivity to stress and other triggers (Siegel, 2007). They have also been found to help with addressing self-stigma and shame (Stynes et al., 2022), which are commonly found in AN.

Mindfulness in exercise is an antithesis to mindless (i.e., problematic) exercise, and is therefore an important approach to using exercise in AN treatment. Mindful exercise encompasses any movement that is done with attention, purpose, self-compassion, acceptance, awareness, and joy. It is focused on the process of becoming more connected, healthier, and stronger, whereas mindless exercise is often appearance-based and focused on outcomes (Calogero & Pedrotty-Stump, 2010). Utilizing a Mindful Exercise Mindset Scale, recent research has demonstrated a link between a

mindful exercise mindset and improved ED pathology and psychological functioning (Calogero & Pedrotty-Stump, 2010).

### **Contribution to the Field**

Mainstream definitions of recovery from AN tend to focus on attaining specific physical outcomes such as weight restoration or normalisation of menstruation. Given the prevalence of over-exercising behaviours in AN, and the high rate of relapse, more treatment models incorporating safe, sustainable exercise habits are needed.

Older models of AN treatment, especially inpatient programs, restricted exercise for participants. This has been questioned in the literature in recent years, but current models of treatment often still leave problematic exercise habits largely untreated (Nahman & Holland, 2022). There may be many reasons for this, including fear of adverse consequences such as further weight loss and cardiac complications for patients. It may also be tied to a lack of resources for developing and maintaining an exercise program that can be appropriately staffed to ensure safety and consistency, as well as a lack of consensus and guidelines on what such a program entails.

However, this lack of attention on exercise habits in AN can have many negative effects on recovery. Failing to address such a significant area of the disorder maintains the disconnect between mind and body. Consequences may include many individuals experiencing 'quasi-recovery', continuing to use exercise to control weight/shape or emotions, and experiencing a higher rate of relapse (Nahman & Holland, 2022). Even if a 'full' relapse into AN is not experienced (or recognised), an ongoing problematic relationship with exercise likely signifies a negative sense of body image, as well as the ongoing potential for unhealthy and unsafe habits (e.g., exercising to or past the point of injury). This potential for harm includes the loss of potential for full recovery, which may not always be recognized in the medical community or the literature. This is not always a failure on the part of medical practitioners or researchers, but rather a difficulty in quantifying what full recovery may look like to a general population. However, I believe it is reasonable to say that harnessing the benefits of moderate exercise on mental and physical health, including the opportunity to develop a healthier

relationship with one's body and with exercise, is an important part of holistic and sustainable recovery for this population.

### **Reflectivity and Positionality Statement**

#### ***Ethics and Autonomy***

Given the high mortality rate of AN, a paternalistic approach is often cited as necessary for survival, particularly once the illness reaches a certain level of severity (Bargiacchi et al., 2019). There is a clear ethical tension between keeping the patient alive and respecting their autonomy (Kwee & Launeanu, 2019). In an illness where embodied freedom and agency is so essential for recovery - where loss of control can paradoxically be the symptom and also the cure - vulnerability and need must be carefully weighed in the context of each patient. Regardless of the final decision, I believe that dialogue and psychoeducation between professional(s) and patient must be maintained throughout the process. Even if the patient is unable to fully comprehend the gravity of the situation or the information presented (for example, due to cognitive distortions or malnourishment), the respect and empathy inherent in maintaining communication is essential and will be remembered by the patient.

Additionally, we must consider the medical system in which EDs are treated. 'Efficient' referring allows more patients to cycle through much-needed beds, allowing as many patients as possible to reach a weight at which they can physically function, but rarely providing effective long-term healing treatment (Galsworthy-Francis & Allan, 2014; Kass et al., 2013). This can often lead to multiple hospitalizations, where individuals repeatedly have their weight restored but become further disembodied, dehumanized, and powerless in the process (Beyer & Launeanu, 2016). These issues clearly show the need to measure health and recovery by more markers than body mass index (BMI) and organ function, and to offer treatment that is sustainably effective.

#### ***Personal Experience***

My own struggle with AN, including my experiences of inpatient and outpatient programs, have led me to a deep interest in bettering ED treatment. Although problematic exercise is such a

common feature of AN, I, myself, did not struggle with it. Therefore, I feel I have a balance of empathy and objective distance that serves me well in researching and considering this aspect of the disorder.

I also recognize that my road to recovery, despite being long and difficult, was a very privileged one. As a White, cisgender, able-bodied woman, I had a great many advantages both in my life in general and in my treatment. Secrecy and denial in AN can be extremely powerful, and I hid it well for many years. I believe the main reasons that my illness was eventually detected was because I was visibly underweight, and because I have close family that do not stigmatize mental illness. When recognition for and treatment of my disorder was not available, my parents had the resources – and the willingness – to move us to a place where help was accessible. With my Canadian citizenship, I was able to access healthcare including an extended hospital stay, which otherwise would have been prohibitively expensive (if available at all).

### **Definition of Terms**

#### ***Anorexia Nervosa (AN)***

An eating disorder characterized by difficulties maintaining an appropriate body weight, and often distorted body image. People with AN generally restrict the number of calories and the types of food that they eat; other common behaviours in AN include compulsive exercise, purging, and/or binge eating (National Eating Disorders Association, 2022). There are two subtypes of AN: Restricting (AN-R), or binge-eating/purging type (AN-BP). To be diagnosed with AN according to the DSM-5, the following criteria must be met:

1. Restriction of energy intake relative to requirements leading to a significantly low body weight in the context of age, sex, developmental trajectory, and physical health.
2. Intense fear of gaining weight or becoming fat, despite being underweight.
3. Disturbance in the way in which one's body weight or shape is experienced, undue influence of body weight or shape on self-evaluation, or denial of the seriousness of the current low body weight (American Psychiatric Association, 2013).

*Restricting type (AN-R):* during the last three months, the individual has not engaged in recurrent binge eating or purging behaviours (e.g., self-induced vomiting, misuse of laxatives, etc.). Weight loss is accomplished mainly through dieting, fasting, or excessive exercise.

*Binge-eating/purging type (AN-BP):* during the last three months, the individual has engaged in recurrent binge eating or purging behaviours (American Psychiatric Association, 2013).

### **Body Mass Index (BMI)**

A numerical measurement, calculated by a person's weight divided by the square of their height (Centers for Disease Control and Prevention, 2022). BMI screens for weight categories (underweight, healthy weight, overweight, and obese), but it does not diagnose the health of an individual. It does not distinguish between fat, muscle, or bone mass, and therefore is not an accurate indicator of health or distribution of fat among individuals (Centers for Disease Control and Prevention (CDC), n.d.).

*Bone Mineral Density (BMD):* also called bone density or bone mass, BMD is a measure of the amount of minerals contained in a certain volume of bone. BMD measurements are used as a diagnostic tool for osteoporosis, as this condition is marked by decreased bone mass. BMD is also used to measure the effectiveness of osteoporosis treatments, and how likely bones are to break (National Cancer Institute, n.d.).

### **Bone Turnover**

The process of resorption followed by replacement with new bone with little change in shape, which occurs throughout a person's life. Bone turnover is balanced with coupling of bone formation and resorption at various rates leading to continuous remodeling of bone. An increase in bone turnover (seen in aging and illnesses such as osteoporosis) leads to deterioration of bone microarchitecture and thus contributes to an increase in the risk of fracture (Shetty et al., 2016).

*Bulimia Nervosa (BN):* an eating disorder marked by a cycle of bingeing and compensatory behaviours (National Eating Disorders Association, 2022). According to the DSM-5, the official diagnostic criteria for bulimia nervosa are:

1. Recurrent episodes of binge eating, characterized by both of the following:
  - Eating, in a discrete period of time (e.g. within any 2-hour period), an amount of food that is larger than most people would eat during similar circumstances.
  - A sense of lack of control over eating during the episodes.
2. Recurrent inappropriate compensatory behaviour in order to prevent weight gain (e.g., self-induced vomiting, misuse of laxatives or diuretics, fasting, or excessive exercise).
3. Binge eating and inappropriate compensatory behaviours both occur, on average, at least once a week for three months.
4. Self-evaluation is unduly influenced by body shape and weight.
5. The disturbance does not occur exclusively during episodes of AN (American Psychiatric Association, 2013).

### ***Chronotropic Incompetence (CI)***

Generally defined as the inability to increase heart rate adequately during exercise, in order to match cardiac output to metabolic demands (Brubaker & Kitzman, 2011).

*Cognitive Behavioural Therapy (CBT)*: a structured, goal oriented, generally short-term type of psychotherapy. CBT focuses on the here-and-now and helps people to develop skills and strategies to improve and manage their mental health. The CBT model is based on how thoughts, feelings and behaviours influence each other; clients learn to identify, question and change the thoughts related to emotional and behavioural reactions that cause them distress (Centre for Addiction and Mental Health, 2022).

### ***Compulsive Exercise***

An inappropriately inflexible exercise pattern, characterized by a drive to exercise according to strict personal rules and an aim to manage negative emotions or prevent feared consequences (Dittmer, Jacobi, et al., 2018), such as weight gain.

*Eating Disorder (ED)*: psychological disorders characterized by severe and persistent disturbances in eating behaviours and associated distressing thoughts and emotions. EDs can affect physical,

psychological and social functioning. Types of EDs include anorexia nervosa, bulimia nervosa, binge eating disorder, avoidant restrictive food intake disorder, other specified feeding and eating disorder, and pica and rumination disorder. EDs often co-occur with other psychiatric conditions, most commonly mood and anxiety disorders, obsessive compulsive disorder and alcohol and drug abuse problems (American Psychiatric Association, 2021).

### ***Excessive Exercise***

The DSM-V defines excessive exercise as a behavioural addiction, wherein the behaviour becomes compulsive, excessive, and/or causes dysfunction in a person's life (American Psychiatric Association, 2013). However, in other literature, excessive exercise is often defined as exercise of inappropriately high duration, frequency or intensity (Adkins & Keel, 2005).

### ***Exercise***

Bodily exertion undertaken for the sake of developing and/or maintaining physical fitness (Merriam-Webster, 2022).

### ***Obsessive Compulsive Disorder (OCD)***

A psychological disorder in which people experience persistent, recurring, unwanted thoughts, ideas or sensations (obsessions). To get rid of these thoughts, they feel driven to do something repetitively (compulsions). These repetitive behaviours (e.g., hand washing or mental acts like counting) can significantly interfere with a person's daily activities and social interactions. Not performing the behaviours commonly causes great distress, often attached to a specific fear of dire consequences. A diagnosis of OCD requires the presence of obsessional thoughts and/or compulsions that are time-consuming (more than one hour a day), cause significant distress, and impair work or social functioning (American Psychiatric Association, 2022).

### ***Problematic Exercise***

Exercise that reflects a need to use physical activity as a coping mechanism, resulting in negative consequences. These consequences may include exercising to the exclusion of other obligations such as work or education, exercise that leads to conflict with loved ones, and obsession

with exercise on a daily basis. Problematic exercise continues despite physical, psychological, social and emotional distress that arises as a result (Chamberlain & Grant, 2020; Lichtenstein et al., 2018).

### ***Third Wave Therapies***

Third wave methods centralize topics such as mindfulness, acceptance, meta-cognition, values, and goals. Theoretical models and intervention approaches include acceptance and commitment therapy (ACT), dialectical behaviour therapy (DBT), mindfulness-based cognitive therapy (MBCT), and several others. (Hayes & Hofmann, 2017).

### **Outline of Project Chapters**

In the following chapter (chapter two), I will review the literature to date, organized by five themes. Theme A will explore the difficulties of defining and measuring compulsive/excessive exercise, and proposals for useful consensus. Theme B will examine the prevalence, motives, correlations, and effects of problematic exercise in AN specifically. Theme C will consider the risks and benefits of incorporating exercise into AN treatment, including thoughts from the population and considerations of autonomy and harm reduction. Theme D will look at the focuses of previous and current models for incorporating exercise into AN treatment, including physical health and safety, body image and body appreciation, openness, social inclusion, and mind-body connection. Theme E will address gaps in the field, describing issues of methodology and underrepresented populations in the literature.

In the final chapter (chapter three), I will use the information gathered to contribute to recommendations for best practices. This will include ways to identify and mitigate risk, assess for improvement, and individualize interventions.

## Chapter Two: Literature Review

### Theme A: Measuring Exercise

#### *Problems of Defining Excessive/Compulsive Exercise*

A consistent operational definition of “problematic exercising” within the context of eating disorders (EDs) is distinctly absent from the literature. The term problematic exercise is helpful in generally and concisely labelling exercise that results in problematic (i.e., negative) consequences. However, clarifying key elements of defining criteria is essential to useful research and clinical practice. Meyer and Taranis (2011) noted the interchanging of the terms *compulsive exercise* and *excessive exercise* in research papers, both of which are further explored below.

**Excessive Exercise.** The term *excessive exercise* typically refers to quantity of exercise (Adkins & Keel, 2005) and so is defined in terms of frequency, duration and/or intensity. But what constitutes “excessive”? This can depend on variables such as age, fitness, values, and health status. For a “healthy adult”, recommended amounts are in the range of at least 150-300 minutes of moderate exercise or 75 minutes of strenuous exercise per week (Yang, 2019), whereas for AN patients who are medically unstable, it is arguable that any strenuous exercise at all would be excessive. Healthy marathon runners would not generally conceptualize their exercise as excessive, and yet it goes far beyond the health guidelines. Clearly, the concept of excessive is broad and vague.

The DSM-V defines excessive exercise as a behavioural addiction, wherein the behaviour becomes compulsive, excessive, and/or causes dysfunction in a person’s life (American Psychiatric Association, 2013a). Notably, this definition does not refer to quantity in any way.

Meyer and Taranis (2011) noted that there are two further problems with defining excessive exercise at a quantitative level. The first is that some studies classify excessive exercise based on participants’ level of activity at the time of diagnosis (e.g., Brewerton et al., 1995), while others consider the participants’ history of excessive exercise throughout their disorder (e.g., Davis et al., 1994). Secondly, the validity of focusing on quantity of exercise has been consistently undermined by studies finding that frequency and duration of exercise is unrelated to eating pathology in both

clinical and non-clinical samples (Adkins & Keel, 2005; Boyd et al., 2007; Mond et al., 2008; Mond et al., 2006). It has been found that while quantitative and qualitative dimensions of exercise are correlated (Adkins & Keel, 2005; Dalle Grave et al., 2008), the quantitative criterion is not relevant to the definition of the problematic exercise evident within EDs (Meyer & Taranis, 2011).

Together, this literature strongly suggests that the term excessive exercise, with its definition referring to purely quantitative dimensions, should be discarded within the context of exercise in EDs.

**Compulsive Exercise.** The most consistent support in the literature is for the term *compulsive exercise*. This can be described as an inappropriately inflexible exercise pattern, characterized by a drive to exercise according to strict personal rules and an aim to manage negative emotions or prevent feared consequences (Dittmer, Jacobi, et al., 2018). The compulsive dimension of exercise has been shown to clearly differentiate between eating disordered and non-eating disordered samples (Mond & Calogero, 2009).

However, a consensus on the definition and use of *compulsive exercise* is lacking. A recent Delphi study (Noetel et al., 2017) involving international experts in ED treatment indicated that consensus was only achieved for 59% of items regarding defining, assessing, and treating unhealthy exercise. Additionally, only 60% the experts preferred the term compulsive exercise over other terms, which was significantly less than their threshold for consensus (greater than or equal to 85% agreement) or near consensus (greater than or equal to 75% agreement) (Noetel et al., 2017).

**The Importance of Language.** Exercise behaviours in anorexia nervosa (AN) are complex and multifaceted. As Adkins and Keel (2005) pointed out, not all quantitatively defined (i.e. excessive) exercise is necessarily compulsive and not all compulsively defined exercise is quantitatively excessive, and therefore quantitatively defined exercise may or may not be pathological. Contrastingly, compulsive exercise in EDs is, by definition, always pathological since it is associated with increased levels of disordered eating attitudes and behaviours (Meyer & Taranis, 2011). Taking this and the research above into account, it is clear that compulsive exercise is more relevant to EDs.

### ***Difficulties of Measuring Exercise***

**Reliability, Validity and Accuracy of Common Measures.** Existing research on problematic/compulsive exercise has been mainly approached using self-report instruments (Marques et al., 2019; A. Szabo et al., 2015). Young et al. (2017) examined certain self-report exercise measures in adults with AN: the Eating Disorder Examination (EDE), Eating Disorder Examination Questionnaire (EDE-Q), Compulsive Exercise Test (CET), Reasons for Exercise Inventory (REI), Commitment to Exercise Scale (CES) and Exercise Beliefs Questionnaire (EBQ). Correlational and regression analyses were performed to test the validity of these exercise measures. It was found that of these self-reports, the CET demonstrated strong clinical utility in adult patients with AN. The CET is a test which assesses the primary factors operating in the maintenance of excessive exercise within the domain of EDs (Taranis et al., 2011). It was also suggested that the CET can be used in conjunction with the EDE to comprehensively assess both qualitative and quantitative dimensions of compulsive exercise. The EDE is a diagnostic interview that measures severity of ED psychopathology with four subscales (eating concern; weight concern; shape concern; dietary restraint), one global score, and ED behaviours (University of Sydney, 2022). As noted previously, quantity of exercise does not necessarily suggest pathology; however, awareness of patients' frequency and duration of exercise in treatment can be important, due to the potentially detrimental physical effects of exercise for patients who are severely underweight or are otherwise physically compromised. It is important to note that this study only featured medically stable outpatients and so may not generalise to people with medical instability.

To examine the reliability of exercise self-report instruments, Alcaraz-Ibáñez et al. (2022) used data retrieved from 255 studies (741 individual samples) with participants of various ages to report a reliability generalization meta-analysis of six well-known self-report measures of PE (Problematic Exercise). These were: the Commitment to Exercise Scale (CES), Compulsive Exercise Test (CET), Exercise Addiction Inventory (EAI), Exercise Dependence Questionnaire (EDQ), Exercise Dependence Scale (EDS-21), and Obligatory Exercise Questionnaire (OEQ). The meta-analysis

highlighted the need to improve reliability reporting of the scores of self-report instruments of PE, including “providing both prior justification for the appropriateness of the index employed and reliability data for all the subpopulation of interest” (Alcaraz-Ibáñez et al., 2022, p. 326).

Further to the reliability and validity of the self-report measures, there are mixed findings on the accuracy of self-reported physical activity in patients with AN. Three studies found that patients with AN under-reported their self-reported physical activity in comparison to objective accelerometer data (Alberti et al., 2013; Bratland-Sanda et al., 2010; van Elburg et al., 2007). For example, Alberti et al. (2013) demonstrated that 52 inpatients with AN significantly under-estimated PA on a self-administered format of the International Physical Activity Questionnaire (IPAQ) compared to an accelerometer device (Actiheart) over a seven-day period.

Contrastingly, Keyes et al. (2015) found that patients with AN were more likely than controls to report higher PA on self-report measures, as compared to data collected by an accelerometer. However, the study did not include comparisons between the self-report and accelerometer data for each individual, which would have been helpful data to examine.

A more recent study by Bezzina et al. (2019) examined the accuracy of self-reported physical activity compared to accelerometer data in adult patients with AN. It also investigated whether levels of accuracy (or inaccuracy) were associated with compulsive exercise, motivation to change, and psychological distress. The study involved 34 adult outpatients with AN, 32 of whom were female. It was found that patients accurately reported their moderate and vigorous intensity physical activity, but significantly under-reported light physical activity. Notably, higher levels of compulsive exercise were significantly associated with more accurate reporting. With the relatively small sample size of the study, further investigation is indicated.

The results of Bezzina et al. confirmed the research that patients with AN underestimate their PA on self-report measures to some extent. However, while patients with AN are often inaccurate in their self-reported activity compared to accelerometer data, evidence is still conflicting on whether this generally results in overestimation or underestimation. More studies are required:

clearer understanding of which individuals are more likely to under- or over-report may help to guide clinicians on assessing true levels of exercise or when other objective measures are indicated.

Further research in understanding the causes for inaccurate reporting could also be useful in developing more accurate self-report measures.

**Self-Report Inaccuracy: Understanding Why.** Meyer et al. (2011) developed a model for understanding compulsive exercise in EDs in which compulsive exercise is maintained by factors including perfectionism, rigidity, and eating disorder pathology. With these factors in mind, more research may help us to understand whether patients more engaged in compulsive exercise are more accurate on self-report measures due to greater perfectionism (e.g., in measurement and control of exercise), and/or more rigidity in adhering to goals, resulting in more awareness of their physical activity levels (Bezzina et al., 2019).

However, to further complicate this possibility, resistance to change may correlate to AN patients' tendency to underreport their physical activity, as a way to model treatment adherence whilst still engaging in problematic exercise (Bezzina et al., 2019). A difficult, key aspect of AN is that it is ego-syntonic in nature, leading to poor insight and low motivation to change (Vitousek et al., 1998). In general, lower motivation to change has been found to be associated with poorer patient outcomes in ED treatment including lower BMI (Geller et al., 2009), slower weight gain (Schebendach et al., 2012), higher rates of compulsive exercise (J. Mond et al., 2008), and poorer quality of life (Muñoz et al., 2012). The trans-theoretical model of motivation to change (Prochaska et al., 1992) suggests that individuals move between six stages of change and has been used within the field of EDs. It is possible that AN patients in early stages of change (such as precontemplation and contemplation) are more likely to under-report physical activity.

An individuals' level of psychological distress may also be a factor affecting the accuracy of self-report measures of physical activity. Symptoms of depression and anxiety are often comorbid with AN (Fernandez-Aranda et al., 2007; Godart et al., 2000). It is well established that depressed mood and anxiety are associated with a range of cognitive impairments including memory, attention,

flexibility, and planning (Ajilchi & Nejati, 2017; Rock et al., 2014). It is therefore possible that individuals with higher rates of such psychological distress are also suffering cognitive impairments affecting accuracy of recall (Bezzina et al., 2019).

### ***Proposals for Measuring/Defining Compulsive Exercise***

Clearly defining compulsive exercise allows us to more accurately measure it, with the aim of creating a useful consensus for both research and clinical interventions.

#### **Definition According to Features: Repetition, Rules, Affect Regulation, Fear/Anxiety.**

Dittmer et al. (2018) reported on a series of meetings by experienced clinicians at a specialized hospital for EDs, who put forth a transdiagnostic definition of compulsive exercise in ED (with applicability for both adolescent and adult patients with AN, bulimia nervosa (BN), atypical AN, and BN of low frequency and/or limited duration). They also derived a short clinical interview for the assessment of compulsive exercise and its subtypes, which can be used in different treatment settings. The clinicians outlined the most relevant criteria for defining compulsive exercise into two categories.

Criterion A outlines core features: excessive, driven, rigid exercise according to strict personal rules, and for the avoidance of feared consequences or aversive emotions (Dittmer, Jacobi, et al., 2018). There is no fixed quantity of exercise that registers it compulsive: clinicians must consider factors such as age, gender and physical condition when assessing quantity. They must also consider rigidity, and patients' subjective feelings of being "out of control" or "compelled". Feared consequences include weight gain, and negative emotions include feelings of "guilt", "depression", "anxiety", or "distress" when exercise is missed (Dalle Grave et al., 2008; Meyer et al., 2011; Young et al., 2017).

Criterion B is the negative impact on life: the physical and psychological burdens that may include interference with social relationships and occupational functioning; continuation of exercise despite injury or illness; and continuation despite a significant investment of time and a lack of

enjoyment (Dittmer et al., 2018). There is a third, optional area posited – Criterion C, which is level of insight, or motivation to change.

Further, the clinicians outline that compulsive exercise has three subtypes: “1) strenuous, highly intensive sports, 2) increased movement in everyday life, or 3) motor restlessness” (Dittmer et al., 2018, p. 2). To meet the definition of compulsive exercise, an individual must meet the above criteria during the past six months, together with one or more of the three subtypes. It is noted that in acute AN, motor restlessness can represent an involuntary, starvation-dependent phenomenon mediated by neurobiological factors (Casper, 2006; Casper, 2016). However, motor restlessness has also been seen in weight-recovered AN and normal weight BN patients (Dittmer, Jacobi, et al., 2018). Given its prevalence as well as its distinction from daily movement and rigorous exercise, it stands alone as a subtype.

**Definition According to Effects: Harm Caused.** Whether we call it compulsive exercise or problematic exercise, the behaviour described implies a loss of control over exercise behaviours “to the point of experiencing harm at a physical level (e.g., injuries or immune problems), psychological level (e.g., altered mood states or inability to concentrate), or social level (e.g., loss of social relationships or job)” (Alcaraz-Ibáñez et al., 2022, p. 326-327). This focus on the harm caused by exercise, rather than the objective quantity of the exercise itself, ensures a more accurate identification of the problem while being inclusive of a wide range of individuals, including professional athletes and those with physical disabilities.

## **Theme B: Exercise in Anorexia Nervosa**

### ***Prevalence***

A 2008 study assessed the prevalence of compulsive exercising to control shape or weight in adults with EDs, as well as associated features and treatment outcomes (Dalle Grave et al., 2008). The researchers found that of the 165 patients, 45.5% were classified as compulsive exercisers, with restricting-type anorexia nervosa (ANR) having the highest prevalence of compulsive exercisers (80%).

The study had some limitations. Participants were sourced from a single inpatient unit, and the patients were classified as having a severe ED. Therefore, results might not generalize to individuals with less severe symptomatology. Further studies are required involving wider samples. Finally, the assessment involved direct interview and self-report questionnaires; due to the high level of denial in AN (Couturier & Lock, 2006) it's possible that some participants gave unreliable answers (Dalle Grave et al., 2008).

A 2018 study compared the compulsiveness, self-reported quantity, and motives of exercise in patients with EDs versus healthy controls (Schlegl et al., 2018). The study involved 355 females between 13 and 60 years old, with 109 healthy controls and 226 voluntary inpatients with AN or BN. Researchers found that the quantity and compulsiveness of exercise habits were both significantly higher in the individuals with EDs compared to the healthy controls.

There were several strengths to this study, including the higher sample size and the use of the Compulsive Exercise Test (CET), a multidimensional and empirically derived instrument for measuring compulsive exercise. However, there were also limitations, similar to the study by Dalle Grave et al. (2008). The quantity of exercise was entirely self-reported, which may have led to inaccurate and biased data; accelerometers or other objective measures could be used in future studies. Additionally, all participants with EDs were inpatients with severe symptomatology and often long histories of EDs; future studies could examine EDs in different stages of recovery (Schlegl et al., 2018).

Both of these studies align with the broader associated literature, which finds that self-reported exercise quantity (Bratland-Sanda et al., 2010; Keyes et al., 2015; J. M. Mond & Calogero, 2009) as well as compulsive exercise assessed by instruments other than the CET (Keyes et al., 2015; J. M. Mond & Calogero, 2009) are consistently higher in patients with EDs.

### ***Motives and Correlations***

A 2011 review of 22 articles aimed to develop an empirically supported cognitive behavioural model of compulsive exercise within the context of EDs (Meyer et al., 2011). The systematic review

identified four key correlates of compulsive exercise among ED patients. Weight and shape concerns, affect regulation, compulsivity (i.e., avoidant coping), perfectionism and rigidity were all suggested as potentially serving a maintaining function for compulsive exercise.

**Weight and Shape Concerns: Body Image.** A more recent systematic review of 7 studies looked at the sociocultural influences of compulsive exercise (Reynolds et al., 2022). The studies involved mixed gender participants aged 10-24: the World Health Organization's definition of "young people" (WHO, 2014). The review highlighted three key factors underpinning the relationship between sociocultural influences and compulsive exercise in young people: body-related messages from significant others, unfavourable comparisons with body image ideals, and pressure to conform to these ideals. These findings support the idea that compulsive exercise behaviours and attitudes can be socially determined and relate to body image. The authors also noted the correlation of compulsive exercise and eating psychopathology. However, the data included in the review focused on exercise psychopathology; further research might look at whether sociocultural influences on exercise psychopathology differ in impact between those with EDs and healthy controls, as well as different age groups. The researchers also noted the importance of keeping research up to date with changing technological influences on communication and exercise behaviours (Reynolds et al., 2022).

**Affect Regulation.** Whilst weight and shape concerns are a significant component, compulsive exercise is more than just a strategy for burning calories. Another motive is the regulation of negative affect. A small study in 2016 demonstrated how compulsive exercise represents an essential means of emotion distraction and management for individuals with AN (Kolnes & Rodriguez-Morales, 2016). Compulsive exercise has been associated with higher levels of depression in ED patients, and high levels of anxiety in those with AN particularly (Peñas-Lledó et al., 2002). In another study among patients in the acute phase of AN, physical activity levels were predicted by the level of food restriction and anxiety symptoms, supporting the notion that physical activity may be a way of coping with anxiety in some patients (Holtkamp et al., 2004).

Many studies, and meta-analyses of such studies, have consistently found empirical support for the efficacy of exercise in preventing or alleviating depression, both in clinically and non-clinically depressed populations (Barreto Schuch et al., 2016; Craft & Perna, 2004; Hu et al., 2020). Therefore, use of compulsive exercise to alleviate or suppress adverse emotional states in patients with EDs has been explored (Geller et al., 2000; Peñas-Lledó et al., 2002). Since EDs commonly feature an inability to cope with adverse mood states (Fox, 2009), as well high rates of anxiety and depression, the maintenance of compulsive exercise makes sense as a relevant correlate.

**Compulsivity: Negative Reinforcement (Withdrawal Symptoms).** Withdrawal symptoms in this context may be defined as psychological effects that occur as a result of not exercising, shown by emotional symptoms or further exercise to avoid these symptoms. The most frequently reported symptoms of withdrawal in these circumstances are guilt, anxiety, depression, and irritability (Bamber et al., 2000). The presence of affective withdrawal symptoms is indicative of a psychological dependence on exercise, whereby exercise is maintained via negative reinforcement specifically to avoid the experience of such withdrawal. When this evidence is taken together with the correlation between compulsive exercise and affect regulation, it is reasonable to expect that some at-risk individuals (e.g., those with mood intolerance) are more likely to experience a psychological dependence on exercise (Meyer et al., 2011).

**Compulsivity: Guilt.** While guilt relates to the above category of negative reinforcement, it appears to be a particularly strong correlate of compulsive exercise and has therefore received extra consideration in the literature. Mond and colleagues (2006, 2009) have demonstrated that the degree of guilt experienced whenever exercise cannot be undertaken is one of the compulsive exercise components most strongly associated with eating disorder psychopathology and reduced quality of life. The importance of guilt is further supported by the finding that this guilt when unable to exercise discriminated between ED and non-ED groups (J. M. Mond & Calogero, 2009). The avoidance of perceived negative consequences and the experience of guilt when exercise is not

undertaken have been shown to be the components of compulsivity most strongly implicated in the maintenance of compulsive exercise (Meyer et al., 2011).

**Compulsivity: Perfectionism, Rigidity, and OCD.** Compulsive exercise has been consistently associated with higher levels of perfectionism in both eating disordered and non-eating disordered samples (Hall et al., 2007; Hill et al., 2015; Shroff et al., 2006). Furthermore, several studies report that compulsive exercisers tend to display an obsessional and rigid personality profile as well as a compulsive behaviour pattern (Davis et al., 1998; Yates, 2013). As a result, compulsive exercise is often viewed as being related to obsessive-compulsiveness (Davis et al., 1995; Spano, 2001).

The existing literature clearly suggests a significant relationship between AN and obsessive-compulsive personality traits (Serpell et al., 2002), with evidence to support a more obsessive-compulsive personality profile in exercising AN patients than their non-exercising counterparts (Davis et al., 1998; Davis & Kaptein, 2006).

### ***Physical Effects***

While the psychological components of compulsive exercise are extremely important to explore, an important (and often related) problem is risk that such exercise presents for individuals' physical health. The combination of undernourishment and over-exercise creates risk for a variety of serious medical complications. These can include electrolyte imbalances, muscle wasting, injuries, and sudden death, most often due to cardiac complications (Jáuregui-Garrido & Jáuregui-Lobera, 2012a).

Compulsive exercise can also result in a pattern of painful symptoms called "overtraining syndrome", which includes problems such as fatigue and increased rates of physical illness (Smith, 2012). The prevalence of osteopenia or osteoporosis in AN combined with the physical strain associated with over-exercising may exacerbate the risk of fractures; furthermore, increased fracture risk can continue many years after diagnosis, indicating permanent skeletal damage (Vestergaard et al., 2002). Overuse injuries such as tendonitis and tendinopathy represent painful, sometimes chronic conditions that occur during and after over-exercise (Aicale et al., 2018; Anderson et al.,

2000). It is clearly important to educate individuals with AN on the painful and potentially long-term consequences of compulsive exercise. However, perhaps more important is to support and educate them on mitigating risk in various ways, since over-exercise and painful effects may continue alongside (or despite) treatment. This will be further explored in chapter three.

### **Theme C: Risks and Benefits of Incorporating Exercise into AN Treatment**

#### ***Negative Consequences of Bed Rest***

A recent review of three guidelines and studies examined the evidence base of bed rest, which is a common intervention for severe AN (Ibrahim et al., 2019). Negative consequences of such rest were described, including lower heart rate, impaired bone turnover and increased risk of infection (DiVasta et al., 2017). Furthermore, no evidence was found to support bed rest in hospital treatment of AN. The researchers concluded that early mobilization is indicated that the metabolic demand of gentle activity can be safely managed by appropriate nutrition, and the risk of falls can be prevented by using alternative methods (Ibrahim et al., 2019, p. 81).

There were, however, several issues with the research. Ibrahim et al. (2019) noted that there have been no randomized controlled trials to compare the benefits and harms of bed rest as the focus of intervention. In addition, the studies featured small sample sizes, often with multiple interventions at once, complicating interpretations of the results. Papers not in English were also excluded, limiting the scope of the results. Further research should involve a higher number of participants and randomized controlled trials. In addition, future research directions should include a focus on improving mobilisation safely, such as resistance exercise and using technologies for monitoring and feedback (Ibrahim et al., 2019).

#### ***Potential Risks of Incorporating Exercise***

**Heart Health and Safety.** A common concern in ED literature is heart health: in 80% of patients with EDs, cardiac complications are observed (Casiero & Frishman, 2006). Bradycardia (a heart rate that is too low) is frequently detected in patients with AN as a response to malnutrition (Casiero & Frishman, 2006). Bradycardia is an important symptom for early diagnosis of AN, and it

improves with body-weight recovery. However, chronotropic incompetence (CI) in exercise is observed in some patients with AN despite amelioration of bradycardia in the recovery phase (Yoshida et al., 2019). CI is generally defined as an inability to increase heart rate adequately during exercise in order to match cardiac output to metabolic demands (Brubaker & Kitzman, 2011).

A study involving 92 women with AN between the ages of 13 and 20 looked at CI to exercise during the bodyweight recovery phase and found that more careful management of physical activity may be required for AN patients with CI (Yoshida et al., 2019). Rather than suggesting the elimination of exercise altogether or the extension of bed rest, this study points to the importance of CI as an indication of insufficient recovery. The authors suggested a gradual return to activity, evaluation of exercise tolerance using cardiopulmonary exercise tolerance tests, and careful daily management (Yoshida et al., 2019). Further studies, including those with different age groups, are important to further validate the safety and best practices of incorporating exercise into AN treatment.

A 2010 paper on cardiovascular compromise involved 38 adolescents and young adults with AN, with no comparison group (DiVasta et al., 2010). The exercise tolerance test was normal by all measures, using a 21-minute Bruce protocol treadmill stress test. These results suggested that cardiovascular exercise is safe in this population. However, since the mean age of participants was 16.5, more studies should be completed with older participants. Additionally, the mean BMI in this group was 15.9, which is higher than the guidelines for bed rest as an intervention set by the Medical Emergencies in Eating Disorders guidelines (Royal College of Psychiatrists, 2022). It is possible that more severely underweight patients could not tolerate such exercise safely.

**Delayed Weight Gain.** There are also concerns that exercise in AN treatment may delay weight gain, or even cause more weight loss. However, the research suggests that incorporating exercise in treatment does not result in a negative impact on BMI (Carei et al., 2010; Thien et al., 2000) or cause adverse effects on patient weight gain (Touyz et al., 1993). In fact, exercise may help with gaining weight. An early study to explore empirical evidence for the effectiveness of an exercise program in an ED treatment setting was conducted with inpatient women (Calogero & Pedrotty,

2004). The group featured participants with AN of both restrictive and binge-purge subtypes, BN, or EDNOS, with 127 in the exercise group and 127 controls. Significant group x diagnosis interactions revealed that the women in the exercise group who were diagnosed with AN gained roughly 40% more weight than those in the control group. Also, women in the exercise group demonstrated significantly reduced obligatory attitudes toward exercise compared to the control group.

Steps were taken in the study to make the exercise and control group sufficiently comparable to test the hypotheses (e.g., no significant differences between groups for current age, admission BMI, number of years with an ED). However, there were also limitations to the methodology. The lack of random assignment for the groups means that the non-participant (control) group may have been less motivated, compliant, or ready to recover, and/or more rigid with their exercise. Alternatively, they may in fact have been motivated by other factors (exercise groups were early in the morning or during visiting hours, and so individuals may have chosen to prioritise sleep or visitors in their recovery process). The pool was also exclusive – an inpatient female program with mostly European American women.

Limitations aside, the general trend of the research suggests that an exercise program targeting compulsive exercise in women with AN results in positive change. This may be due to some of the various benefits outlined below giving individuals more motivation and tolerance for weight gain.

#### ***Case Study: Maximal Strength Training***

Maximal strength training (MST) has been cited as an effective treatment in certain populations for osteopenia or osteoporosis, with MST proving more effective than submaximal strength training in increasing both muscle strength and bone mineral density (BMD) (Bratland-Sanda et al., 2018). Osteopenia is a common symptom of AN (Grinspoon et al., 2000), making the improvement of BMD an important factor for many patients, particularly since existing treatments are not adequately effective (Mehler et al., 2015).

MST has not yet been widely prescribed to AN patients. MST causes higher mechanical stress compared to submaximal strength training (Zernicke et al., 2006), thus there is uncertainty about the tolerance of such training among those with AN due to increased risk of fractures (Bratland-Sanda et al., 2018).

However, MST may offer a combination of psychological and physical improvements: certain qualities of MST may challenge the motives and experience of compulsive exercise in AN, as identified by Kolnes and Rodriguez-Morales (2016). The schedule of recovery breaks may help address the restlessness often experienced by those with AN (Kolnes & Rodriguez-Morales, 2016); additionally, heavy lifting requires concentration and focus, challenging the escape function of high-intensity aerobic exercise such as running (Bratland-Sanda et al., 2010; Kolnes & Rodriguez-Morales, 2016). The increase in physical strength may increase self-efficacy, self-esteem and feelings of empowerment (Bratland-Sanda et al., 2018).

A case study of a 25-year-old woman with long-standing AN (9 years), compulsive exercise, and osteopenia in her lumbar spine, was described by Bratland-Sanda and colleagues (2018). She was prescribed an MST intervention lasting 16 weeks. The participant improved muscle strength by 20-40%, with BMD in lumbar spine improving by 4%, which is considerably larger in effect than other alternative treatments for osteopenia/osteoporosis in individuals with AN (Mehler & MacKenzie, 2009). There were no significant detected changes in weight gain, AN psychopathology or level of compulsive exercise.

The subject self-reported perceived psychological benefits, which included feeling stronger (outside of being measurably stronger) and new bodily experiences. She also reported that the instructor's close supervision felt crucial to her perceived safety, motivation, and ability to complete the training sessions (Bratland-Sanda et al., 2018). Improvement in compulsive exercise habits or AN psychopathology by MST was not expected in the case study, but these outlined potential psychological and physical benefits warrant further investigation into the use of MST for those with AN, not just in the treatment of osteopenia, but for general improved quality of life.

However, while no deterioration in EDE global or subscale scores was observed, the participant reported temporary increased focus on body shape and weight in the first weeks of the intervention. She noted that additional psychological support may have been beneficial (this was offered but not utilized). This subject had a history of long-standing AN and recent failure of treatment, and therefore such an experience may not have occurred in a less severe case. Regardless, this points to a clear need for MST to be combined with other psychological treatment and close supervision in order to be ethical and successful.

Due to the potential risks facing participants in this initial investigation, there were ethical obligations in this case to maintain a small sample (Harriss & Atkinson, 2013). While a case study cannot be generalized to the wider population, these results show a need for follow-up studies.

#### ***Potential Benefits of Incorporating Exercise***

**Mental Health.** Along with the previously mentioned MST case study (Bratland-Sanda et al., 2018), three randomized controlled trials (Chantler et al., 2006; C. P. Szabo & Green, 2002; Thien et al., 2000) and one qualitative study (Duesund & Skårderud, 2016) reported that participating in exercise interventions resulted in enhanced quality of life and psychological wellbeing. While randomized controlled trials are considered the gold standard for research, qualitative research is imperative not only for better understanding of the AN and exercise experience (C. P. Szabo & Green, 2002; Touyz et al., 1993), but also for directing intervention development (Green & Britten, 1998).

**Reduced Eating Pathology.** Several studies have reported a positive association between exercise interventions and reduced ED symptoms in AN patients (Ng et al., 2013; Szabo & Green, 2002; Touyz et al., 1993). These included lower food-related emotional distress, and less food preoccupation. Furthermore, in all 10 studies reviewed by Moola et al. (2013), there were no reports of exacerbated ED symptoms as a result of incorporating exercise into treatment. The limited studies available and their small sample sizes indicate a need for further research. However, the data so far indicates that utilizing the benefits of exercise to reduce eating distress in a setting where compulsivity can be monitored and managed may be a helpful tool in treatment programs.

**Relief of Re-Feeding Symptoms: Cardiometabolic and Musculoskeletal Health.** Many adaptive changes occur in individuals with AN as the body attempts to adjust to the ongoing energy imbalance. These can include: increased insulin sensitivity or insulin resistance (Støving, 2019), dysregulated inflammatory cytokines (Corcos et al., 2001), and altered hormone regulation, including increased cortisol level (Schorr & Miller, 2017). Starvation causes loss of lean tissue, which impacts organ mass and function; lean body mass – including visceral organs such as the liver and heart, as well as bone and skeletal muscle – plays an important role in establishing the demand for energy metabolism (Moola et al., 2013).

Since patients with AN have adapted to starvation prior to hospitalization, almost all experience some adverse physical effects from feeding, including gastric distension, slowed gastric motility, nausea, abdominal pain, and edema formation (Sachs et al., 2015). This is a difficult addition to the psychological stress that patients are already facing with their increased food consumption.

Studies that have investigated exercise-induced changes in lean tissue have demonstrated improved metabolic health via the resultant impact on various areas including mitochondrial function (van Tienen et al., 2012) and lipid profiles (Haskell, 1984). Thus, the adaptive properties of muscle could potentially improve the catabolic state of those with AN and their physiological response to re-feeding. Contrastingly, inactivity during inpatient treatment (such as bed rest) may have harmful musculoskeletal and cardiometabolic consequences. Such inactivity likely compromises lean tissue growth and function, potentially delaying metabolic recovery and prolonging unpleasant physical symptoms that can exacerbate the psychological fears related to weight gain (Moola et al., 2013).

**Program Compliance.** Improved patient compliance has been reported as a result of the incorporation of exercise into treatment (Thien et al., 2000; Touyz et al., 1993). Compliance to treatment is a major barrier to care among patients with AN and fosters negative relationships between health providers and patients (Moola et al., 2013). Given the egosyntonic nature of AN, the high level of denial and of relapse, and the multifaceted nature of recovery, treatment compliance

and supportive staff-patient relationships are extremely important to patient outcomes. Given the importance of compliance, as well as the age of the relevant studies conducted, more research should be conducted on the effect of exercise programs on treatment compliance.

### ***Thoughts from the Population***

Griffiths et al. (1998) surveyed a sample of 48 inpatients (46 female, with a mean age of 18.3 years) to elicit their attitudes towards bed rest, finding that most patients perceived bed rest negatively. Researchers predicted that perception of punishment or humiliation would be the main complaints, but instead found that isolation and boredom were most prevalent. Participants preferred more individualisation and distraction in treatment, and less restriction (Griffiths et al., 1998). While this research is now dated, and the results perhaps unsurprising, it points to an important topic in the literature: assessing the psychological impacts of bed rest/exercise programs on individuals by the individuals themselves. This not only honours their experience but provides valuable information on treatment outcomes, enhancing our understanding of common causes of relapse.

In a survey of those with lived experience of an ED (n =81), researchers conducted a thematic analysis of free text responses around the benefits and risks of incorporating exercise into treatment (Nahman & Holland, 2022). Themes around the benefits included improved mental and physical health, and the opportunity to develop a healthier relationship with exercise. Themes around risks included limited or slowed recovery, and possible physical risks of exercising while at a low weight. Themes around the risks of *not* addressing exercise included leaving an important part of the disorder untreated and therefore negatively affecting recovery. The researchers concluded that those with lived ED experience feel that problematic exercise is an important part of the disorder to treat.

Due to the format and dissemination of the survey, there is a lack of demographic data on respondents including age, gender, and type of ED. Further research directions might focus on those currently struggling with EDs versus those who have recovered, friends and family members, and those with different types of EDs.

Additionally, the researchers noted that some of the survey responses could be interpreted as disordered, pointing to opinions based in ongoing struggle with compulsive exercising and other ED issues. This points to a much wider difficulty in the area of ED treatment: the challenges of balancing patients' humanity and autonomy with their safety.

### ***Autonomy & Harm Reduction***

It is generally understood that respect for people's autonomy and self-determination is a moral imperative, except in cases where individual autonomy will violate the autonomy and freedom of others. From this point of view, it may be argued that professionals involved in AN treatment (whether they are physicians, counsellors, or others) should inform participants of the risks involved in exercising, but once this has been understood, participants may provide informed consent and exercise as much or as little as they choose.

However, there is an argument that the desire to exercise, in these circumstances, is a direct symptom of AN, and as such cannot be autonomous. Consequently, the ethical option for healthcare providers would be to treat patients in their best interests, usually against their wishes (paternalistically) (Giordano, 2019). This might involve adjusting, limiting, or even banning exercise.

Nevertheless, even within this approach, it can be argued that patients' autonomy should be respected as much as possible. A strong need for independence and control underlies AN, and openly paternalistic acts are normally discouraged. Paternalism toward individuals with AN has proven to increase the sense of lack of control that is characteristic of the disorder, and therefore to compromise long-term recovery (Medeiros et al., 2014). Additionally, prioritizing cooperation over directiveness may help to establish a positive therapeutic alliance, and therefore strengthen motivation to recover (Medeiros et al., 2014).

Healthcare providers concerned with the long-term health and safety of their patients have additional reasons for allowing the patient to make as many choices about their exercise patterns as possible. A patient with AN who is prevented from exercising may instead exercise in secret; exercising alone is arguably riskier for those with AN due to the lack of monitoring of heart rate,

technique, and other factors, and a group or supervised setting can offer qualified personnel in case of emergency. This harm reduction approach allows for greater physical safety. If the exercise is then also accompanied by psychoeducation, talk therapy, and other interventions that address the how and why of the exercise, much greater progress may be made in reducing its compulsivity than if exercise is prevented or ignored altogether. The conclusion is that both from the point of view of respecting people's autonomy/self-determination and from the point of view of paternalism and beneficence, there are strong ethical reasons to allow patients with AN to take part in physical activity.

#### **Theme D: Incorporating Exercise into Treatment: Focuses of Previous & Current Models**

##### ***Physical Health and Safety***

A literature review of exercise in ED treatment identified 11 core themes describing techniques that have been successful thus far in using exercise therapeutically in ED treatment (Cook et al., 2016). These themes were: employ a team of relevant experts, monitor medical status, screen for exercise-related psychopathology, create a written contract of how therapeutic exercise will be used, include a psychoeducational element, focus on positive reinforcement, create a graded exercise program, begin with mild intensity exercise, tailor the mode of exercise to the needs of the individual, include a nutritional component, and debrief after exercise sessions (Cook et al., 2016). In this way, treatment can be individualized for each patient, and health and safety may be consistently monitored. This can help decrease risk of weight loss, physical injury, and mood disturbance, as well as offering appropriate support and education for sustainable change.

##### ***Body Image and Body Appreciation***

Poor body image is a pervasive struggle in EDs (Hrabosky et al., 2009). A distorted or negative relationship to the body is common, often with significant disconnection between self-perception and the reality of one's body (Mehler & Andersen, 2017). Body dissatisfaction is a multifaceted, persistent, and often challenging aspect of ED recovery; therefore, clinicians and

researchers are pressed to find modes of intervention that can be most effective in managing or improving such dissatisfaction (Alleva et al., 2015).

During inpatient treatment in particular, patients go through an intense period of change that often includes physical change in terms of weight and shape. For many patients the integration of the new body is very difficult. Becoming familiar with one's 'new', healthy body, and then moving on to body appreciation, is important for the efficacy and sustainability of recovery (Danielsen & Øyvind, 2012; Hausenblas et al., 2008). Due to the close relationship between body image disturbances and compulsive exercise (Meyer et al., 2011), both issues may be addressed in body-oriented therapy interventions, which include exercise. Adoption of healthy exercise behaviours may give AN patients an increased sense of the self as healthy, while the improvements in bodily strength and tone might bring about beneficial changes in body image (Hausenblas et al., 2008).

**Yoga.** One area of body-oriented exercise intervention that has garnered attention in recent years is yoga. The physical practice of yoga may have a therapeutic effect on patients with distorted body image by addressing their body schema in a relaxing and empowering way (Ostermann et al., 2019). However, the currently available research evidence for yoga as an adjunct treatment for EDs remains limited and unclear. Yoga practice has been found to increase present awareness, body satisfaction and self-acceptance in women with disordered eating (Hausenblas et al., 2008). A further review by Klein and Cook-Cottone (2013) investigated the effects of yoga in EDs but did not include any studies published after 2010 and did not report effect measures. Nonetheless, yoga interventions show a promising area of further research in AN treatment and possibly prevention, particularly due to yoga's role in impacting self-perception, negative body image, and attending to the needs of the body (Douglass, 2010; Neumark-Sztainer et al., 2018).

Despite the positive results participants have described about yoga treatment programs, they have also described many challenging aspects of yoga such as poses that bring about physical pain or negative attention to a particular aspect of their body (Neumark-Sztainer et al., 2018). Although these responses may appear discouraging, they may also reflect a connection to

uncomfortable emotions and experiences in the body that are typically avoided in EDs. This potential connection could have therapeutic benefits over time. A safe environment for participants to explore these challenges, with trauma-informed and therapeutically minded instructors, would be essential for using yoga as an intervention (Diers et al., 2020).

**Education.** Education is also a valuable intervention in the arena of body image and appreciation. Psychoeducation on how body image can be distorted by sociocultural pressures may help AN patients to explore the origins of negative messages, and therefore further distance themselves from negative self-talk about their bodies, as well as reducing self-blame (Holmes et al., 2017). Education on various biological functions of the body and the importance of nutrition may help to shift from a paradigm of fear around food to appreciation of its many functions for survival and enjoyment (Cook et al., 2016; Martenstyn et al., 2022).

**Body Functionality.** In slight opposition to this exploration of body image, another approach is to focus on functionality over image. That is, to accept that an AN patient's feelings about their physical appearance may be negative and distorted for a long time, and to separate assessment of appearance from assessment of worth. Prioritizing functionality over image – appreciating the many things one's body can do, rather than ways it may look – may help to shift appreciation to a healthier, more sustainable paradigm. Varied forms of exercise as an intervention could help to stimulate this appreciation of functionality by allowing participants to fully experience (in practice rather than in theory) the many different things their bodies can do.

### ***Openness***

It has been suggested that activity restrictions in AN treatment may often result in patients undertaking covert and secretive activity (Giordano, 2005; Holtkamp et al., 2004), practices that greatly compromise patient-provider trust and the therapeutic alliance. The importance of the therapeutic alliance is often foregrounded in explaining treatment outcomes for AN (Masson & Sheeshka, 2009; Sly et al., 2014). Specifically, a lack of trust has been cited by patients as a key reason for dropout from inpatient care (Vandereycken & Devidt, 2010). Since dropout and relapse

rates for treatment remain high - with dropout rates reaching up to 52.6% in adults hospitalized for AN (Roux et al., 2016) - this is clearly an area that requires attention. Providing a treatment program and environment in which openness is encouraged, in terms of exercise and indeed all aspects of treatment, might serve to strengthen trust and therefore alliances between patients and healthcare providers.

### ***Social Inclusion***

Given the sociocultural mandate to be active, broad restrictions may be an unhelpful and unsustainable approach to the long-term management of exercise in AN (Calogero & Pedrotty, 2004). Messages about exercise are guaranteed to be present in daily life and conversation outside of an inpatient setting, and therefore educating and preparing patients for a healthier relationship with exercise is an important part of sustainable treatment. Additionally, social isolation in AN contributes toward morbidity and poor quality of life (Calogero & Pedrotty, 2004; Moola et al., 2013). By facilitating social inclusion and participation, the social support benefits afforded through physical activity are particularly important for those who live with the stigma of mental illness (Richardson et al., 2005).

Fostering a positive and non-competitive atmosphere, where social interaction is a part of the exercise, can be a helpful antidote to the isolated, rigid, and repetitive overexercising that is often characteristic of compulsive exercise in AN. For instance, qualitative research by Duesund and Skårderud (2016) found that although exercise can be used as a positive distraction that refocuses negative attention away from the body, 'boring' exercise programs that lack variety, skill or social interplay can cause discomfort and enhance negative bodily focus.

### ***Connection of Mind and Body***

In their research of 63 individuals with AN and 61 with BN, Peñas-Lledó et al. (2002) found that levels of somatization were particularly high exclusively among individuals with AN who also exercised excessively. Somatization describes the physical (bodily) expression of stress and emotions through the mind-body connection. While we all somatise, the markedly high level in this population

suggests a correlation between eating psychopathology, exercise psychopathology, and high sensitivity/low tolerance to emotions experienced in both mind and body. Since these problematic eating and exercise behaviours are being used as a coping mechanism for stress and emotions, the relationship between mind and body for these individuals requires particular attention in treatment if they are to experience a more positive and sustainably healthy relationship with their whole selves.

An exploratory study in 2012 involved 55 adults (54 female), 30 of whom had AN, during inpatient ED treatment (Danielsen & Øyvind, 2012). While the treatment was not manualized at the time of the study, it focused on addressing the soma and relations between patients' bodies, emotions, and social situations (essentially, a biopsychosocial approach). Treatments included relaxation, massage, body awareness movements, mirror exercises, and outdoor activities. Initially, patients focused on relating to their bodily sensations; a variety of experiences and challenges related to body image work and modified physical activity were introduced as treatment progressed. There was also focus on psychoeducation and addressing dysfunctional body-related thoughts and emotions (Danielsen & Øyvind, 2012). As this was an exploratory study, the significant pattern of improvement (measured by various assessments including the Body Attitude Test, BMI and the EDI-2) cannot be directly attributed to the treatment. However, the results suggested that an integration of mind-body approaches led to improvement of body image and efficacy of treatment in general. Manualization of the approaches described and more research, including studies on specific EDs rather than transdiagnostic studies, could further explore the applicability of this type of treatment in the future.

Current AN treatments are most often 'cognicentric', attempting to manage the disorder at the level of behaviours and emotions. The success of these treatment interventions are an important indication that individuals with AN must be engaged holistically in treatment, since the disorder is fundamentally not only a psychological disorder but also a somatic one. Furthermore, patients with AN are often described as disembodied, disconnected from bodily sensations such as hunger, pain, and cold (Cook-Cottone, 2015). Thus, it is particularly important to incorporate body-based therapies

that encourage awareness and acceptance of embodied sensations. The research indicates that the incorporation of activity during treatment facilitates a sense of re-embodiment, helping patients to re-engage with bodily sensations. Qualitative research has also underscored the benefits of activity in cultivating a novel, non-anorexic identity (Axelsen, 2009).

### **Theme E: Gaps in the Field**

#### ***Issues of Methodology***

Generally, the research thus far has not consistently implemented a FITT formula (frequency, intensity, type, time) with thorough baseline and outcome measures examining details such as strength, body composition, and in-depth psychosocial assessments (Whaley et al., 2006). Moola et al. (2013) pointed out that future research needs to include clearer exercise definitions and doses in a more structured and systematic approach. Such clarity is essential for future research, particularly in examining different variables (such as type of exercise, severity of illness, and broader populations) on the mental health effects of incorporating exercise for individuals in treatment.

#### ***Underrepresented Populations***

**Gender.** Most AN research focuses on cisgender women. Diagnosis of EDs for other genders are on the rise, but women and girls receive the vast majority of diagnoses (Hoek, 2006; Striegel-Moore & Bulik, 2007). This is likely due to several factors. EDs can manifest in different ways in cisgender men, leading to lack of diagnosis; the heightened stigma attached to EDs for men may also prevent many from seeking help or participating in research.

Non-binary and transgender individuals, on the other hand, have received little to no attention in research until recent years. Additionally, many of these individuals may fear seeking mental health supports due to stigma or previous trauma due to their gender presentation. This is particularly troubling as such individuals are at extremely high risk for EDs, with increasing evidence that transgender and non-binary populations are at 2-4 times greater risk of experiencing ED symptoms in comparison to their cisgender counterparts (A. R. Gordon et al., 2021).

**Weight, Race, and Other Identities.** Inpatient programs, while an obvious choice for research in terms of accessibility and controlled environment, nonetheless represent an extremely limited section of individuals living with AN. Inpatient individuals are highly likely to have a particularly low BMI (often a condition for program admission), live in an area where such facilities are available and/or have the education and resources to access such care. Further, they are much more likely to be White women due to these factors and race-based stereotypes about EDs that affect detection of symptoms and access to care (Becker et al., 2003; Gordon et al., 2006; Rodgers et al., 2018).

Recruiting participants beyond the White, English-speaking, cisgender female samples that predominate within wider clinical and qualitative ED literature is therefore challenging for researchers (Holmes et al., 2021). While addressing the racial, sizeist, ableist, and other biases in the medical community are beyond the scope of this paper, it is worth addressing that this deeply affects the available research. Future studies involving non-underweight patients of various ethnic and cultural backgrounds are essential.

### Chapter Three: Discussion and Applied Practices

The purpose of this Capstone Project is to examine incorporating exercise as an approach to the treatment of compulsive exercise in AN. Due to the complex nature of both AN and compulsive exercise, including the importance of physical and psychological safety in both contexts, I divided the project into four purpose statements. Outlined below is a summary of the findings for each.

#### **1. To explore the issues of defining and measuring excessive/compulsive/problematic exercise.**

Problematic exercise is a helpful general term, in that it describes exercise that causes problems (negative effects). However, it is essential to useful research and practice to have clarity and specificity when defining and measuring exercise. A common term in the literature is excessive exercise, but this often describes or implies a quantitative measure, which is challenging to define given the wide scope of individuals' abilities and preferences. Another common term in the literature is compulsive exercise, and the two are often used interchangeably. However, compulsive exercise represents a more qualitative measure. The term describes a rigid exercise pattern driven by strict personal rules, with an aim to manage negative emotions or prevent feared consequences (Dittmer, Jacobi, et al., 2018), and which continues despite various negative physical, social, and/or psychological distress (Alcaraz-Ibáñez et al., 2022). Focusing on the features of and harm caused by exercise, rather than the objective quantity of the exercise itself, ensures a more accurate identification of the problem while being inclusive of a wide range of individuals. Therefore, compulsive exercise is the most appropriate term in this context.

Even with an accurate description, there are difficulties in measuring what constitutes compulsive exercise. Challenges in common measures include reliability, validity and accuracy, and particular attention must be paid to issues of inaccuracy in self-report measures. Understanding why these inaccuracies may exist, and how to mitigate them, is essential to deciding which measurement to use for which individual. Clearly defining compulsive exercise according both its features and its harmful effects helps us to measure it more accurately, creating useful consensus for both research and clinical practice.

## **2. To examine the prevalence, etiology and effects of problematic exercise in AN.**

Research has found that both self-reported exercise quantity and formally assessed compulsive exercise are consistently higher in patients with EDs (Bratland-Sanda et al., 2010; Keyes et al., 2015; Mond & Calogero, 2009). Furthermore, the literature suggests that compulsive exercise prevalence rates are highest in those with restricting-type anorexia nervosa (ANR) (Dalle Grave et al., 2008).

Key correlates of compulsive exercise among this population are weight and shape concerns (body image), affect regulation, perfectionism and rigidity, and compulsivity (avoidant coping, negative reinforcement, and guilt). Body image concerns are highly affected by sociocultural influences including body-related messages, unfavourable comparisons to arguably impossible body image ideals, and pressure to conform to these ideals (Reynolds et al., 2022). In terms of affect regulation, EDs commonly feature an inability to cope with adverse mood states (Fox, 2009), and compulsive exercise may represent a means of emotion distraction and management for such individuals – particularly those with AN (Kolnes & Rodriguez-Morales, 2016). Compulsive exercise has also been consistently associated with higher levels of perfectionism and compulsivity (Davis et al., 1998; Shroff et al., 2006; Yates, 2013), while other research highlights a significant relationship between AN and obsessive-compulsive personality traits (Serpell et al., 2002). A major maintaining factor of exercise compulsivity is psychological dependence on exercise, whereby exercise is maintained via negative reinforcement to avoid the experience affective withdrawal symptoms such as guilt, anxiety, depression, and irritability (Bamber et al., 2000).

While these psychological components are essential to better understanding and treatment, another significant area is the negative physical effects of compulsive exercise. “Overtraining syndrome” includes symptoms such as fatigue, overuse and chronic injuries, and increased rates of illness (Smith, 2012). The combination of over-exercise and eating pathology often creates risk for many other medical complications, including electrolyte imbalances, muscle wasting, and sudden death (Jáuregui-Garrido & Jáuregui-Lobera, 2012b). It is clear that this overlap of AN and compulsive

exercise represents a particularly high-risk population requiring more effective treatment interventions.

**3. To review risks and benefits of incorporating exercise into the treatment of AN, utilizing the research to date.**

The potential risks of incorporating exercise into AN treatment can be mitigated or even erased with appropriate care. In the case of heart health and safety, a gradual return to activity with close attention to nutritional needs, evaluation of exercise tolerance using cardiopulmonary exercise tolerance tests, and careful daily assessment can manage risk for AN patients, even for those with chronotropic incompetence. A gradual return to activity entails an exercise program which is graduated in exercise type, duration, and level of activity, aiming to improve quality of life without reducing necessary weight gain (Thien et al., 2000) or other health markers. This graded program may begin with regular stretching, and then add on various exercise activities over a course of weeks – isometric exercise, followed by low impact cardiovascular activity, and resistive strengthening activities (Thien et al., 2000).

In terms of delayed weight gain, the research shows that exercise may actually help to maintain and even accelerate weight gain in treatment programs (Calogero & Pedrotty, 2004), likely due to the various benefits of exercise leading to increased tolerance of and motivation for weight gain. These potential benefits include improved mental health, reduced eating pathology, relief of re-feeding symptoms, and increased program compliance (Ng et al., 2013; C. P. Szabo & Green, 2002; Thien et al., 2000; Touyz et al., 1993).

More research is important to further validate the safety and best practices of incorporating exercise into AN treatment. It is particularly important in this research to include thoughts from the population engaging or previously engaged in treatment, in order to get an honest and personal sense of what works and what doesn't in these contexts.

**4. To outline best practices for incorporating exercise into AN treatment.**

The research outlined in chapter two reveals four main focus areas from previous and current treatment models incorporating exercise. These are: health and safety; body appreciation (including an emphasis on body functionality over appearance, and education interventions around body image); mind-body connection (facilitating re-embodiment through movement and attention); and social inclusion (prioritizing social support and interaction as antithesis to isolation and rigidity). With the help of these findings, I have synthesized 12 guidelines under three categories for incorporating exercise into eating disorder treatment in a safe and sustainable way. There is much more work to be done to see how programs can support participants with different environments, ages, genders, and stages of illness. However, it is my hope that these best practices can help to inform and shape such interventions.

### **Best Practice Guidelines**

#### ***Safety and Preparation***

**Team Approach.** Employing a team of relevant experts (such as dietitians, physical trainers, physicians, and counsellors) fosters an expert, collaborative approach in developing individually tailored exercise programs. In this way patients can also be monitored for health and safety in various areas. This includes taking precautions to prevent harm from medical concerns such as chronotropic incompetence (Yoshida et al., 2019), preventing injury, monitoring mood, and tracking weight change. As Cook and colleagues (2016) noted, a collaborative approach can provide appropriate focus in multiple areas at once, from proper breathing and lifting techniques for strength training exercise and adequate recovery breaks, to broader topics such as nutrition and preparedness for medical complications in AN.

Ideally the team is also diverse in terms of background and training, with experience and knowledge in an intersectional feminist anti-oppressive framework that understands and acknowledges the intersections between gender, disordered eating, compulsive exercise, and mental health, as well as other social locations of oppression/marginalization.

**Assessment for Exercise Related Psychopathology.** Before beginning the treatment program, a comprehensive clinical interview should be used to assess compulsive exercise behaviours. The following questions are suggested by Dittmer et al. (2018), created by modifying questions of The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) for OCD (section F: anxiety disorders) (First et al., 1996):

A1: Do you have to exercise over and over again and can't resist doing so? What do you have to do?

A2: Why do you have to exercise? What would happen if you did not exercise?

B: Do you exercise more than you should or that makes sense?

C1: What effect does your exercise behaviour have on your life?

C2: Does your exercise behaviour bother you a lot?

C3: How much time do you spend exercising?

C4: Do you continue exercising when sick or injured? (p. 10)

It is also important to continue assessing during and after programs to ensure that pathological attitudes and behaviours towards eating and exercise are not being exacerbated. Recommended assessments include the EDE and CET (Young et al., 2017). However, as both assessments are self-report measures, health professionals should be aware of when underreporting is more likely – for example, for individuals in earlier stages of change, those experiencing higher rates of psychological distress and thereby suffering cognitive impairments, or those using underreporting to model treatment adherence (Bezzina et al., 2019). Other measures such as observation and accelerometers may be used to help get a clearer picture in such cases.

**Written Contract.** In order to cultivate commitment and accountability, a written contract should exist to outline in detail the program expectations, rules, goals, outcomes, and contingencies for progression and regression of exercise activity (Cook et al., 2016). This contract should be agreed upon by participants and all members of the treatment team, to encourage inclusivity and

collaboration. A contract provides a tangible sense of responsibility and can enhance feelings of safety and clarity for all involved in treatment.

**Harm Reduction.** The program should operate from a position of harm reduction. This involves the understanding that when a compulsive behaviour is prohibited, it is highly likely that this behaviour will be continued in secret. This greatly increases the risk of harm through a lack of monitoring, and compulsive exercise involves a loss of control over exercise behaviours to the point of harm experienced at a physical, psychological, and/or social level (Alcaraz-Ibáñez et al., 2022, p. 326-327). Harm reduction recognizes the importance of mitigating or avoiding risk factors as participants engage in the non-linear process of recovery. While the goal is to change exercise habits, the focus is on safety regardless of an individual's stage of change. This lens can help to foster a sense of trust between health professionals and participants, as there is a mutual understanding that changing exercise behaviours is a complex and long-term goal that requires openness and a focus on well-being.

### ***Psychological Support***

**Talk Therapy and Debriefing.** Bratland-Sanda et al. (2018) note the importance of not only offering psychological support but encouraging it during treatment. For best practices, psychological support should be included in the aforementioned written contract. The level of need and best type of support for each individual may be gauged by the assessments conducted at the beginning of the program. However, support should also be consistently available in case an increase or shift in pathology is triggered by the program (or other factors). Such support is essential to ethical and safe treatment.

Psychological support may also increase the success of clinical outcomes by addressing the psychological challenges that arise for the duration of the treatment, as well as helping individuals to develop skills to support themselves beyond the duration of the program. Talk therapy, as well as debriefing after interventions with all professionals involved, helps to monitor for increased pathology in participants. It can also facilitate a better understanding of thoughts and feelings evoked

by exercise and help individuals to develop body awareness. Debriefing can aid in refining, understanding, and celebrating shifts and goals. Through the power of language and relationship, this type of interpersonal support provides much-needed empathy and encouragement for participants, and may help to increase trust and openness between participants and professionals.

**Psychoeducation.** The importance of incorporating psychoeducation into treatment cannot be overstated. Various studies have shown the benefits of adapted exercise with a psychoeducative approach to treat AN and help patients develop a healthy relationship with exercise (Cook et al., 2016; Young et al., 2018). Psychoeducation in this context includes providing participants with knowledge around the ‘how and why’ of compulsive exercise, including how it negatively affects them physically, psychologically, socially and emotionally, what a healthy relationship with exercise entails, how to remain safe while exercising, and what triggers to pay attention to both inside and beyond the program. It also involves education on the wider scope of how society - including media, cultural gender ideologies, and personal relationships - plays into a problematic relationship with exercise, and how this can be practically mitigated in their daily lives.

Education provides empowerment by equipping participants with knowledge that can be carried into the future. It may also help with confronting and dispelling shame and self-blame, by enhancing individuals’ understanding that their struggles are not isolated and have various causes, contexts, and effects. Psychoeducation on body politics, including insidious and inaccurate sociocultural messages about health, appearance and worth, may help clients to recognize how these messages have affected their lives and being the journey to combatting them. Replacing problematic relationships or environments with more supportive ones are important to sustaining change; for example, much in the way an individual struggling with alcohol addiction may stay away from their local bar, a client in recovery from anorexia may abstain from dance classes in the short or long term.

**Mind-Body Focus/Interventions.** Since AN is a disorder that deeply affects both the psyche and the soma, treatment that addresses mind and body (and the connection between the two) is

highly important. Individuals with AN are often disconnected from bodily sensations (Cook-Cottone, 2015); incorporating physical activity helps patients to re-engage in bodily sensations with awareness and acceptance. Interventions that focus on connecting mind and body can help individuals to become more aware of pain, fatigue, and other physical sensations, thereby becoming more able to identify limits and prevent injury when exercising. Positive sensations such as strength, warmth, and satisfaction as a result of moderate exercise can help in cultivating a positive relationship between mind and body and improving body image.

Mind-body treatments can include massage, relaxation practices such as guided meditation, body awareness movements, mirror exercises, and trauma-informed yoga. Reflections on these activities, including processing the sensations, thoughts and feelings that arise, are also important to treatment. This may be achieved by interventions such as debriefing, journaling, and creative interventions such as art therapy.

### ***Maintenance and Sustainability***

**Flexibility.** In order for programs to be supportive and sustainable, it is important to tailor interventions according to the needs and capabilities of both participants and caregivers/organizations. The financial realities for all involved must be considered. Adjustments may include providing interventions in group settings rather than one-on-one to cut down on costs, and/or partnering with local community recreation centres to save on exercise equipment. However, virtual delivery of interventions is not recommended, particularly in the early stages of treatment, if safety and engagement cannot be properly monitored.

Flexibility may also involve providing various types or levels of exercise within one group to account for differences in ability, health, and stage of change. The very witnessing of this flexibility may be beneficial for participants who are attempting to heal from overly rigid and rule-based types of exercising. Flexibility in terms of locations, types of exercise, and adjustments for physical capabilities will also allow the program to be adopted and adapted by and for various populations and therefore help a wider range of people.

**Variety of Exercise.** Varied exercise can help to enhance participants' interest in and enjoyment of the program, as well as being in direct contrast to the rigid and repetitive nature of most compulsive exercise. This can help with the sustainability of behaviour change. Varied exercise may also promote enhanced health by including exercise that strengthens social bonds (e.g., team sports), as well as exercise that involves stretching or strengthening various areas of the body rather than only targeting goals such as weight loss and toning 'problem areas' of the body.

**Nutrition.** Nutrition must be carefully planned and monitored to sustain weight gain goals and account for the increased metabolic demands of exercise. There must also be careful maintenance of adequate levels of electrolytes and blood glucose. This regimen may be detailed and strict to begin with; however, a balance should be struck between equipping participants with the knowledge and tools for adequate nutrition, and not encouraging a rigid 'balance sheet' approach in which exercise must 'make up for' eating (i.e., debting) and vice versa. Compulsive exercise is often used as a control measure for eating, making for rigid and unhealthy patterns. Education and support around holistic, flexible, and self-compassionate nutrition habits should therefore be a focus. The treatment team must work to foster understanding and acceptance that food is important for a variety of functions other than fuel for exercise – including but not limited to social connection, cognitive function, and emotional regulation.

**Tailored and Graded Exercise.** Targeting quality of exercise over quantity is important modelling in any exercise treatment program. However, quantity must also be considered according to needs and goals. Graded exercise can help with safe and sustainable physical health improvements, enhance feelings of self-efficacy and progress, and bring variety to the program. The process of gradation can also bring clarity to physical, mental, or emotional reactions to exercise; if a certain exercise is introduced and brings about a reaction, support can be targeted. Tailored exercise can help participants to remain safe and engaged in the program. Both grading and tailoring can ensure that exercise matches nutritional intake, physical ability, and mental/emotional capacity for each individual at each stage, thereby enhancing program success.

Calogero and Pedrotty (2004) conducted a study on an exercise program aiming to reduce compulsive exercise for women in a residential eating disorder program. The format of this program has three levels, to allow for a gradation of treatment. *Level A: Sensing the Self* focuses primarily on paying attention to bodily sensations and signals during exercise, challenging comparison to others, and providing psychoeducation on the non-weight purposes of exercise. *Level B: Supporting the Self* focuses on increasing the intensity, frequency, and variety of exercise types, while still encouraging attention to physical sensations and challenging false beliefs. *Level C: Strengthening the Self* focuses on increasing autonomy in selecting weekly exercise activities, as well as tailoring treatment to target individual-specific exercise struggles. This model can be a useful reference for how safety, autonomy, education and skill development may be incorporated in a step-by-step fashion, while still allowing for flexibility and accounting for individual needs within a group program.

**Care Planning.** The terms ‘care plan’ and ‘care planning’ lack conceptual clarity, with various definitions existing in the realm of healthcare. Here, care planning may be defined as the process by which healthcare professionals and clients collaborate to create an action plan, to achieve goals and/or sustain behaviour change of most relevance and concern to the client (Burt et al., 2014). A care plan is defined as a written document recording the outcome of this planning process. Care planning aspires to promote care which is “consistent with scientific evidence and patient preferences, including the sharing of guidelines and information with patients to encourage participation” (Burt et al., 2014, p. 10).

In this context, care planning serves to optimise the exercise treatment program, carrying forward changes and goals for sustainable recovery. While the program’s initial treatment plan is as collaborative as possible, it is likely developed mainly by the healthcare professionals involved, with input from participants. However, a care plan at the end of the program must be even more patient-centred and autonomy-supportive, incorporating the learning and development the participant has experienced during the program, supporting patient initiatives, and featuring shared decision making.

It is also essential that care plans are realistic and sustainable. Effective care planning may therefore begin with assessments of current and pre-treatment eating and exercise behaviours, self-efficacy, and perceived barriers to self-management (Burt et al., 2014). Sustainable care plans include proactive follow-ups and adjustments for individual accessibility (including economic barriers, distance to healthcare providers or other services, and physical ability, to name a few). A realistic plan must consider how health comorbidities, physician-patient relations, sociodemographic issues, personalities/preferences, and quality of support network may affect care.

Ideally, the exercise treatment program provides a foundation of continuing care by connecting with and involving a wider network of resources for sustained treatment and recovery support. The program may partner with local mental health professionals, physiotherapists, trainers, fitness centres and other healthcare businesses. The program may develop an outpatient group, app, or website to aid in monitoring and encouraging progress, providing social support and accountability, consolidating resources, and providing ongoing psychoeducation.

### **Practical Considerations**

It is notable that as best practice guidelines, these recommendations are somewhat idealistic in the face of systemic and individual limitations. A program of this kind has significant costs, including highly skilled labour, appropriate venues, medical equipment, and much more. Therefore, running such a program may only be feasible in larger cities. Depending on where the costs are distributed, a program may also only be accessible in places with significant healthcare funding, or to individuals of a higher socioeconomic status.

Canada's current healthcare crisis (Canadian Medical Association, 2022) renders the sourcing of a professional healthcare team even more challenging. AN is a complex disorder requiring a multidisciplinary approach; the need for multiple professionals may require the further development of mechanisms to coordinate care at an organizational level, including high quality shared clinical information systems. In addition to appropriate information systems and protocols, the health care team climate is an important factor of program success. Given the current significant challenges

faced by healthcare providers, the health care team climate may be disturbed by stress, burnout, labour shortages, regulatory changes, and more. The scope of addressing and optimizing these systems is far beyond this paper, but nonetheless of great significance when considering the practicality of program implementation.

### **Research Limitations and Recommendations**

The future of these exercise intervention programs must include further research and drastically enhance the inclusion of underrepresented populations. While there is a growing body of research in this area of the field, various issues of methodology include: a lack of consistent operational definition for problematic exercise, issues with accuracy of self-report measures (including assessments of exercise habits), small sample sizes, a lack of randomized controlled trials, and multiple interventions being applied at once. These issues warrant further research with wider populations and clearer exercise definitions. Future research should also involve a more structured and systemic approach to interventions, varied assessments and exercise measures, and more randomized controlled trials. This may include implementing a FITT formula (frequency, intensity, type, time) with thorough baseline and outcome measures examining details such as body composition and in-depth psychosocial assessments (Whaley et al., 2006).

Additionally, almost all research to date focuses on White, English-speaking, underweight, cisgender females. Further research involving all genders, as well as individuals with various other intersections of weight, race, and other identities, must be conducted as soon as possible to learn more about how best to serve all populations. With further research, adjustments may also be made to the outlined best practices to best serve youth and athletes, as well as individuals struggling with significant comorbidities such as OCD. By following and further developing these best practices gathered from previous and future research, it is my hope that exercise can be increasingly included in AN treatment in a safe and sustainable way.

### **Conclusions and Synthesis**

Given the prevalence of compulsive exercise behaviours in those struggling with AN, and the severe adverse effects of these behaviours, it is clear that treating compulsive exercise is an important part of recovery for the population. Incorporating exercise into AN treatment has many potential benefits: exercise has been shown to reduce AN psychopathology such as body dissatisfaction, improve physical fitness, reduce excessiveness and compulsivity of exercise, and improve quality of life (Cook et al., 2016). The research thus far also suggests that potential risks (such as reduced weight gain or increased heart complications) can be managed or eliminated (DiVasta et al., 2010; Ibrahim et al., 2019; Yoshida et al., 2019).

The research gathered aligns with my own personal beliefs in the importance of collaborative, person-centred approaches – working with individuals in recovery whenever possible, rather than taking a more distant or authoritative approach. This allows individuals to reclaim their own sense of self and power, the loss of which is a common theme in AN. The use of CBT in the design of recovery interventions is also important for building sustainable behavioural change and self-care skills that can be carried through life, further promoting agency and freedom from illness. Exercise is an inevitable part of life - whether one chooses to engage in it or not, messages around exercise are ubiquitous; learning to honour and manage thoughts and behaviours within this larger environment is a valuable skill, particularly for those trying to heal their relationship with their bodies.

I also believe that messages not only around exercise, but also around wider cultural gender ideologies, power and voice must be addressed through a feminist lens, promoting awareness, agency and collaboration in recovery. While the bulk of feminist literature about EDs focuses on those who identify as women, these messages affect people of all genders. Encouraging individuals to participate in exercise interventions while simultaneously providing education, encouraging feedback and dialogue, and fostering collaboration in the process all help to challenge traditional, more patriarchal treatment practices. This process may be helped through the use of third wave therapies, encouraging mindfulness and a strengthening of the mind-body connection, and thereby

allowing trust within oneself. The use of third wave therapies can encourage mindful exercise: movement that is done with self-compassion, awareness and acceptance, focused on the process of becoming more self-connected and healthier.

Translating this research and theory into practice requires great attention to safety and preparation, with a focus on harm reduction. Appropriate assessment and staffing, consistent psychological support including psychoeducation, and an emphasis on flexibility in the design and facilitation of programs promotes sustainable and effective care.

It must also be noted that much more research is required in this field, with an emphasis on underserved populations and a focus on democratising care. Since 2018, I have been volunteering in the eating disorder community, and I am currently completing my internship at an eating disorders foundation. Here I see some of the barriers to recovery for those who are not as privileged as I was – year-long wait lists, sexism and weightism in the medical community, and geographical or financial barriers to accessing services, to name a few. While a single paper examining exercise in AN treatment cannot tackle this huge and ongoing issue, it is my hope that it will add to the literature that is advancing the conversation on long-term, sustainable recovery for all. I recognize that many health care professionals have similar goals and, despite a great deal of hard work, are limited by a lack of resources rather than a lack of passion. However, I also believe that holistic models of treatment will save money (and more importantly, many lives) in the long term. It is my hope that providing more ideas and guidelines on ways this may be possible might help to educate and inspire more individuals in the future.

### References

- Adkins, E. C., & Keel, P. K. (2005). Does “excessive” or “compulsive” best describe exercise as a symptom of bulimia nervosa? *International Journal of Eating Disorders*, *38*(1), 24–29.  
<https://doi.org/10.1002/EAT.20140>
- Aicale, R., Tarantino, D., & Maffulli, N. (2018). Overuse injuries in sport: a comprehensive overview. *Journal of Orthopaedic Surgery and Research*, *13*(1), 1–11.  
<https://doi.org/10.1186/S13018-018-1017-5>
- Ajlchi, B., & Nejati, V. (2017). Executive functions in students with depression, anxiety, and stress symptoms. *Basic and Clinical Neuroscience*, *8*(3), 223.  
<https://doi.org/10.18869/NIRP.BCN.8.3.223>
- Alberti, M., Galvani, C., el Ghoch, M., Capelli, C., Lanza, M., Calugi, S., & Dalle Grave, R. (2013). Assessment of physical activity in anorexia nervosa and treatment outcome. *Medicine and Science in Sports and Exercise*, *45*(9), 1643–1648.  
<https://doi.org/10.1249/MSS.0B013E31828E8F07>
- Alcaraz-Ibáñez, M., Paterna, A., Sicilia, Á., & Griffiths, M. D. (2022). Examining the reliability of the scores of self-report instruments assessing problematic exercise: A systematic review and meta-analysis. *Journal of Behavioral Addictions*, *1*.  
<https://doi.org/10.1556/2006.2022.00014>
- Alleva, J. M., Sheeran, P., Webb, T. L., Martijn, C., & Miles, E. (2015). A meta-analytic review of stand-alone interventions to improve body image. *PLOS ONE*, *10*(9), e0139177.  
<https://doi.org/10.1371/JOURNAL.PONE.0139177>
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders*.  
<https://doi.org/10.1176/APPI.BOOKS.9780890425596>
- American Psychiatric Association. (2021). *What are eating disorders?*  
<https://psychiatry.org/patients-families/eating-disorders/what-are-eating-disorders>

- American Psychiatric Association. (2022). *What is obsessive-compulsive disorder?*  
<https://psychiatry.org/patients-families/obsessive-compulsive-disorder/what-is-obsessive-compulsive-disorder>
- Anderson, B. J., Griesemer, B. A., Johnson, M. D., Martin, T. J., McLain, L. C., Rowl, T. W., & Small, E. (2000). Intensive training and sports specialization in young athletes. *Pediatrics*, *106*(1), 154–157. <https://doi.org/10.1542/peds.106.1.154>
- Arcelus, J., Mitchell, A. J., Wales, J., & Nielsen, S. (2011). Mortality rates in patients with anorexia nervosa and other eating disorders: A meta-analysis of 36 studies. *Archives of General Psychiatry*, *68*(7), 724–731.  
<https://doi.org/10.1001/ARCHGENPSYCHIATRY.2011.74>
- Axelsen, M. (2009). The power of leisure: “I was an anorexic; I’m now a healthy triathlete.” *Leisure Sciences*, *31*(4), 330–346. <https://doi.org/10.1080/01490400902988283>
- Bamber, D., Cockerill, I. M., & Carroll, D. (2000). The pathological status of exercise dependence. *British Journal of Sports Medicine*, *34*(2), 125–132. <https://doi.org/10.1136/BJSM.34.2.125>
- Bargiacchi, A., Clarke, J., Paulsen, A., & Leger, J. (2019). Refeeding in anorexia nervosa. *European Journal of Pediatrics*, *178*(3), 413–422. <https://doi.org/10.1007/S00431-018-3295-7>
- Barreto Schuch, F., Vancampfort, D., Richards, J., Rosenbaum, S., Ward, P. B., & Stubbs, B. (2016). Exercise as a treatment for depression: a meta-analysis adjusting for publication bias. *Elsevier*, *77*, 42–51. <https://doi.org/10.1016/j.jpsychires.2016.02.023>
- Beck, J. S., & Hindman, R. (2017). Cognitive therapy. In M. J. Dewan, B. N. Steenbarger, & R. P. Greenberg (Eds.), *The Art and Science of Brief Psychotherapies: An Illustrated Guide* (2nd ed., pp. 97–134). American Psychiatric Publishing.
- Becker, A. E., Franko, D. L., Speck, A., & Herzog, D. B. (2003). Ethnicity and differential access to care for eating disorder symptoms. *International Journal of Eating Disorders*, *33*(2), 205–212. <https://doi.org/10.1002/EAT.10129>

- Beyer, C. D., & Launeanu, M. (2016). *Seeking the body electric: The role of embodied affective experience in the process of recovery from anorexia nervosa*. Trinity Western University.
- Bezzina, L., Touyz, S., Young, S., Foroughi, N., Clemes, S., Meyer, C., Arcelus, J., Madden, S., Attia, E., Pike, K. M., & Hay, P. (2019). Accuracy of self-reported physical activity in patients with anorexia nervosa: links with clinical features. *Journal of Eating Disorders, 7*(1).  
<https://doi.org/10.1186/S40337-019-0258-Y>
- Bohart, A. C., Elliott, R., Greenberg, L. S., & Watson, J. C. (2002). Empathy. In J. C. Norcross (Ed.), *Psychotherapy relationships that work* (pp. 89–108). Oxford University Press.
- Boyd, C., Abraham, S., & Luscombe, G. (2007). Exercise behaviours and feelings in eating disorder and non-eating disorder groups. *European Eating Disorders Review : The Journal of the Eating Disorders Association, 15*(2), 112–118. <https://doi.org/10.1002/ERV.769>
- Bratland-Sanda, S., Øverby, N. C., Bottegaard, A., Heia, M., Støren, Ø., Sundgot-Borgen, J., & Torstveit, M. K. (2018). Maximal strength training as a therapeutic approach in long-standing anorexia nervosa: A case study of a woman with osteopenia, menstrual dysfunction, and compulsive exercise. *Clinical Case Studies, 17*(2), 91–103.  
<https://doi.org/10.1177/1534650118755949>
- Bratland-Sanda, S., Sundgot-Borgen, J., Øyvind, R., Rosenvinge, J. H., Hoffart, A., & Martinsen, E. W. (2010). “I’m not physically active - I only go for walks”: physical activity in patients with longstanding eating disorders. *The International Journal of Eating Disorders, 43*(1), 88–92.  
<https://doi.org/10.1002/EAT.20753>
- Brewerton, T., Stelfox, E., Hibbs, N., Hodges, E., & Cochrane, C. (1995). Comparison of eating disorder patients with and without compulsive exercising. *The International Journal of Eating Disorders, 17*(4), 413–416.
- Brubaker, P. H., & Kitzman, D. W. (2011). Chronotropic incompetence: Causes, consequences, and management. *Circulation, 123*(9), 1010.  
<https://doi.org/10.1161/CIRCULATIONAHA.110.940577>

- Brumberg, J. J. (2000). *Fasting girls: The history of anorexia nervosa*. Random House.
- Burt, J., Rick, J., Blakeman, T., Protheroe, J., Roland, M., & Bower, P. (2014). Care plans and care planning in long term conditions: a conceptual model. *Primary Health Care Research & Development, 15*(4), 342. <https://doi.org/10.1017/S1463423613000327>
- Calogero, R. M., & Pedrotty, K. N. (2004). The practice and process of healthy exercise: An investigation of the treatment of exercise abuse in women with eating disorders. *Eating Disorders, 12*(4), 273–291. <https://doi.org/10.1080/10640260490521352>
- Calogero, R. M., & Pedrotty-Stump, K. N. (2010). Incorporating exercise into eating disorder treatment and recovery: Cultivating a mindful approach. *Treatment of Eating Disorders, 425–441*. <https://doi.org/10.1016/B978-0-12-375668-8.10025-7>
- Canadian Medical Association. (2022). *Canada's health care crisis: What we need now*. <https://www.cma.ca/news/canadas-health-care-crisis-what-we-need-now>
- Carei, T. R., Fyfe-Johnson, A. L., Breuner, C. C., & Brown, M. A. (2010). Randomized controlled clinical trial of yoga in the treatment of eating disorders. *Journal of Adolescent Health, 46*(4), 346–351. <https://doi.org/10.1016/J.JADOHEALTH.2009.08.007>
- Casiero, D., & Frishman, W. H. (2006). Cardiovascular complications of eating disorders. *Cardiology in Review, 14*(5), 227–231. <https://doi.org/10.1097/01.CRD.0000216745.96062.7C>
- Casper, R. C. (2006). The “drive for activity” and ‘restlessness’ in anorexia nervosa: potential pathways. *Journal of Affective Disorders, 92*(1), 99–107. <https://doi.org/10.1016/J.JAD.2005.12.039>
- Casper, R. C. (2016). Restless activation and drive for activity in anorexia nervosa may reflect a disorder of energy homeostasis. *The International Journal of Eating Disorders, 49*(8), 750. <https://doi.org/10.1002/EAT.22575>
- Centers for Disease Control and Prevention (CDC). (n.d.). *Body mass index: Considerations for practitioners*. Retrieved October 12, 2022, from <http://apps.nccd.cdc.gov/dnpabmi/>

- Centers for Disease Control and Prevention (CDC). (2022). *About adult BMI*.  
[https://www.cdc.gov/healthyweight/assessing/bmi/adult\\_bmi/index.html](https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html)
- Centre for Addiction and Mental Health (CAMH). (2022). *Cognitive-behavioural therapy (CBT)*.  
<https://www.camh.ca/en/health-info/mental-illness-and-addiction-index/cognitive-behavioural-therapy>
- Chamberlain, S. R., & Grant, J. E. (2020). Is problematic exercise really problematic? A dimensional approach. *CNS Spectrums*, 25(1), 64–70.  
<https://doi.org/10.1017/S1092852919000762>
- Chantler, I., Szabo, C. P., & Green, K. (2006). Muscular strength changes in hospitalized anorexic patients after an eight week resistance training program. *International Journal of Sports Medicine*, 27(8), 660–665. <https://doi.org/10.1055/S-2005-865812/ID/18>
- Chubbs-Payne, A., Lee, J., Isserlin, L., Norris, M. L., Spettigue, W., Spence, K., & Longmuir, P. E. (2021). Attitudes toward physical activity as a treatment component for adolescents with anorexia nervosa: An exploratory qualitative study of patient perceptions. *The International Journal of Eating Disorders*, 54(3), 336–345.  
<https://doi.org/10.1002/EAT.23411>
- Cook, B. J., Wonderlich, S. A., Mitchell, J. E., Thompson, R., Sherman, R., & McCallum, K. (2016). Exercise in eating disorders treatment: Systematic review and proposal of guidelines. *Medicine and Science in Sports and Exercise*, 48(7), 1408.  
<https://doi.org/10.1249/MSS.0000000000000912>
- Cook-Cottone, C. P. (2015). Incorporating positive body image into the treatment of eating disorders: A model for attunement and mindful self-care. *Body Image*, 14, 158–167.  
<https://doi.org/10.1016/J.BODYIM.2015.03.004>
- Corcus, M., Guilbaud, O., Chaouat, G., Cayol, V., Speranza, M., Chambry, J., Paterniti, S., Moussa, M., Flament, M., & Jeammet, P. (2001). Cytokines and anorexia nervosa. *Psychosomatic Medicine*, 63(3), 502–504. <https://doi.org/10.1097/00006842-200105000-00021>

- Couturier, J. L., & Lock, J. (2006). Denial and minimization in adolescents with anorexia nervosa. *International Journal of Eating Disorders, 39*(3), 212–216.  
<https://doi.org/10.1002/eat.20241>
- Craft, L. L., & Perna, F. M. (2004). The benefits of exercise for the clinically depressed. *Primary Care Companion to The Journal of Clinical Psychiatry, 6*(3), 104.  
<https://doi.org/10.4088/PCC.V06N0301>
- Dalle Grave, R. (2009). Features and management of compulsive exercising in eating disorders. *The Physician and Sportsmedicine, 37*(3), 20–28.  
<https://doi.org/10.3810/PSM.2009.10.1725>
- Dalle Grave, R., Calugi, S., & Marchesini, G. (2008). Compulsive exercise to control shape or weight in eating disorders: prevalence, associated features, and treatment outcome. *Comprehensive Psychiatry, 49*(4), 346–352.  
<https://doi.org/10.1016/J.COMPPSYCH.2007.12.007>
- Danielsen, M., & Øyvind, R. (2012). Changes in body image during inpatient treatment for eating disorders predict outcome. *Eating Disorders, 20*(4), 261–275.  
<https://doi.org/10.1080/10640266.2012.689205>
- Davies, S., Parekh, K., Etelapaa, K., Wood, D., & Jaffa, T. (2008). The inpatient management of physical activity in young people with anorexia nervosa. *European Eating Disorders Review : The Journal of the Eating Disorders Association, 16*(5), 334–340.  
<https://doi.org/10.1002/ERV.847>
- Davis, C., & Kaptein, S. (2006). Anorexia nervosa with excessive exercise: a phenotype with close links to obsessive-compulsive disorder. *Psychiatry Research, 142*(2–3), 209–217.  
<https://doi.org/10.1016/J.PSYCHRES.2005.11.006>
- Davis, C., Kaptein, S., Kaplan, A. S., Olmsted, M. P., & Woodside, D. B. (1998). Obsessionality in anorexia nervosa: the moderating influence of exercise. *Psychosomatic Medicine, 60*(2), 192–197. <https://doi.org/10.1097/00006842-199803000-00015>

- Davis, C., Kennedy, S. H., Ralevski, E., Dionne, M., Brewer, H., Neitzert, C., & Ratusny, D. (1995). Obsessive compulsiveness and physical activity in anorexia nervosa and high-level exercising. *Journal of Psychosomatic Research, 39*(8), 967–976.  
[https://doi.org/10.1016/0022-3999\(95\)00064-X](https://doi.org/10.1016/0022-3999(95)00064-X)
- Davis, C., Kennedy, S. H., Ralevski, E., & Dionne, M. (1994). The role of physical activity in the development and maintenance of eating disorders. *Psychological Medicine, 24*(4), 957–967. <https://doi.org/10.1017/S0033291700029044>
- Diers, L., Rydell, S. A., Watts, A., & Neumark-Sztainer, D. (2020). A yoga-based therapy program designed to improve body image among an outpatient eating disordered population: program description and results from a mixed-methods pilot study. *Eating Disorders, 28*(4), 476–493. <https://doi.org/10.1080/10640266.2020.1740912>
- Dittmer, N., Jacobi, C., & Voderholzer, U. (2018). Compulsive exercise in eating disorders: proposal for a definition and a clinical assessment. *Journal of Eating Disorders, 6*(1).  
<https://doi.org/10.1186/S40337-018-0219-X>
- Dittmer, N., Voderholzer, U., von der Mühlen, M., Marwitz, M., Fumi, M., Mönch, C., Alexandridis, K., Cuntz, U., Jacobi, C., & Schlegl, S. (2018). Specialized group intervention for compulsive exercise in inpatients with eating disorders: feasibility and preliminary outcomes. *Journal of Eating Disorders, 6*(1). <https://doi.org/10.1186/S40337-018-0200-8>
- DiVasta, A. D., Feldman, H. A., Rubin, C. T., Gallagher, J. S., Stokes, N., Kiel, D. P., Snyder, B. D., & Gordon, C. M. (2017). The ability of low-magnitude mechanical signals to normalize bone turnover in adolescents hospitalized for anorexia nervosa. *Osteoporosis International, 28*(4), 1255–1263. <https://doi.org/10.1007/S00198-016-3851-9>
- DiVasta, A. D., Walls, C. E., Feldman, H. A., Quach, A. E., Woods, E. R., Gordon, C. M., & Alexander, M. E. (2010). Malnutrition and hemodynamic status in adolescents hospitalized for anorexia nervosa. *Archives of Pediatrics & Adolescent Medicine, 164*(8), 706–713.  
<https://doi.org/10.1001/ARCHPEDIATRICS.2010.138>

- Douglass, L. (2010). Thinking through the body: The conceptualization of yoga as therapy for individuals with eating disorders. *Eating Disorders: The Journal of Treatment & Prevention*, 19(1), 83–96. <https://doi.org/10.1080/10640266.2011.533607>
- Duesund, L., & Skårderud, F. (2016). Use the body and forget the body: Treating anorexia nervosa with adapted physical activity. *Clinical Child Psychology and Psychiatry*, 8(1), 53–72. <https://doi.org/10.1177/1359104503008001007>
- Duncan, T. K., Sebar, B., & Lee, J. (2014). Reclamation of power and self: a meta-synthesis exploring the process of recovery from anorexia nervosa. *Advances in Eating Disorders: Theory, Research and Practice*, 3(2), 177–190. <https://doi.org/10.1080/21662630.2014.978804>
- Edakubo, S., & Fushimi, K. (2020). Mortality and risk assessment for anorexia nervosa in acute-care hospitals: A nationwide administrative database analysis. *BMC Psychiatry*, 20(1), 1–8. <https://doi.org/10.1186/S12888-020-2433-8/TABLES/5>
- Fernandez-Aranda, F., Pinheiro, A. P., Tozzi, F., la Via, M., Thornton, L., Plotnicov, K., Kaye, W., Fichter, M., Halmi, K., Kaplan, A., Woodside, D. B., Klump, K., Strober, M., Crow, S., Mitchell, J., Rotondo, A., Keel, P., Berrettini, W., Rickels, K. E., ... Bulik, C. (2007). Symptom profile of major depressive disorder in women with eating disorders. *The Australian and New Zealand Journal of Psychiatry*, 41(1), 24–31. <https://doi.org/10.1080/00048670601057718>
- Fichter, M. M., & Quadflieg, N. (2016). Mortality in eating disorders - results of a large prospective clinical longitudinal study. *International Journal of Eating Disorders*, 49(4), 391–401. <https://doi.org/10.1002/EAT.22501>
- First, M. B., Gibbon, M., Spitzer, R. L., & Williams, J. B. W. (1996). *Structured clinical interview for DSM-IV Axis I disorders, clinician version (SCID-CV)*. American Psychiatric Press, Inc. [https://www.scirp.org/\(S\(351jmbntvnsjt1aadkposzje\)\)/reference/referencespapers.aspx?referenceid=1302256](https://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/referencespapers.aspx?referenceid=1302256)

- Fox, J. R. E. (2009). A qualitative exploration of the perception of emotions in anorexia nervosa: a basic emotion and developmental perspective. *Clinical Psychology & Psychotherapy*, 16(4), 276–302. <https://doi.org/10.1002/CP.631>
- Galsworthy-Francis, L., & Allan, S. (2014). Cognitive behavioural therapy for anorexia nervosa: A systematic review. *Clinical Psychology Review*, 34(1), 54–72. <https://doi.org/10.1016/J.CPR.2013.11.001>
- Geller, J., Cassin, S. E., Brown, K. E., & Srikameswaran, S. (2009). Factors associated with improvements in readiness for change: Low vs. normal BMI eating disorders. *International Journal of Eating Disorders*, 42(1), 40–46. <https://doi.org/10.1002/EAT.20574>
- Geller, J., Cockell, S. J., Hewitt, P. L., Goldner, E. M., & Gordon, F. L. (2000). Inhibited expression of negative emotions and interpersonal orientation in anorexia nervosa. *Article in International Journal of Eating Disorders*. [https://doi.org/10.1002/1098-108X\(200007\)28:13.0.CO;2-U](https://doi.org/10.1002/1098-108X(200007)28:13.0.CO;2-U)
- Gilbert, S., & Thompson, J. K. (1996). Feminist explanations of the development of eating disorders: Common themes, research findings, and methodological issues. *Clinical Psychology: Science and Practice*, 3(3), 183–202. <https://doi.org/10.1111/J.1468-2850.1996.TB00070.X>
- Giordano, S. (2005). Risk and supervised exercise: the example of anorexia to illustrate a new ethical issue in the traditional debates of medical ethics. *Journal of Medical Ethics*, 31(1), 15–20. <https://doi.org/10.1136/JME.2003.004812>
- Giordano, S. (2019). Anorexia nervosa: A case for exceptionalism in ethical decision making. *Philosophy, Psychiatry and Psychology*, 26(4), 315–331. <https://doi.org/10.1353/PPP.2019.0047>
- Godart, N. T., Flament, M. F., Lecrubier, Y., & Jeammet, P. (2000). Anxiety disorders in anorexia nervosa and bulimia nervosa: co-morbidity and chronology of appearance. *European Psychiatry*, 15(1), 38–45. [https://doi.org/10.1016/S0924-9338\(00\)00212-1](https://doi.org/10.1016/S0924-9338(00)00212-1)

- Gordon, A. R., Moore, L. B., & Guss, C. (2021). Eating disorders among transgender and gender non-binary people. *Eating Disorders in Boys and Men*, 265–281.  
[https://doi.org/10.1007/978-3-030-67127-3\\_18](https://doi.org/10.1007/978-3-030-67127-3_18)
- Gordon, K. H., Brattole, M. M., Wingate, L. R. R., & Joiner, T. E. (2006). The impact of client race on clinician detection of eating disorders. *Behavior Therapy*, 37(4), 319–325.  
<https://doi.org/10.1016/J.BETH.2005.12.002>
- Green, J., & Britten, N. (1998). Qualitative research and evidence based medicine. *BMJ*, 316(7139), 1230–1232. <https://doi.org/10.1136/BMJ.316.7139.1230>
- Griffiths, R., Gross, G., Russell, J., Thornton, C., Beumont, P. J., Schotte, D., & Touyz, S. W. (1998). Perceptions of bed rest by anorexic patients. *International Journal of Eating Disorders*, 23(4), 443–447.
- Grinspoon, S., Thomas, E., Pitts, S., Gross, E., Mickley, D., Miller, K., Herzog, D., & Klibanski, A. (2000). Prevalence and predictive factors for regional osteopenia in women with anorexia nervosa. *Annals of Internal Medicine*, 133(10). <https://doi.org/10.7326/0003-4819-133-10-200011210-00011>
- Hall, H. K., Kerr, A. W., Kozub, S. A., & Finnie, S. B. (2007). Motivational antecedents of obligatory exercise: The influence of achievement goals and multidimensional perfectionism. *Psychology of Sport and Exercise*, 8(3), 297–316.  
<https://doi.org/10.1016/J.PSYCHSPORT.2006.04.007>
- Harriss, D. J., & Atkinson, G. (2013). Ethical standards in sport and exercise science research: 2014 update. *International Journal of Sports Medicine*, 34(12), 1025–1028.  
<https://doi.org/10.1055/S-0033-1358756>
- Haskell, W. L. (1984). Exercise-induced changes in plasma lipids and lipoproteins. *Preventive Medicine*, 13(1), 23–36. [https://doi.org/10.1016/0091-7435\(84\)90038-0](https://doi.org/10.1016/0091-7435(84)90038-0)

Hausenblas, H. A., Cook, B. J., & Chittester, N. I. (2008). Can exercise treat eating disorders?

*Exercise and Sport Sciences Reviews*, 36(1), 43–47.

<https://doi.org/10.1097/JES.0B013E31815E4040>

Hausenblas, H. A., Schreiber, K., & Smoliga, J. M. (2017). Addiction to exercise. *BMJ (Clinical*

*Research Ed.)*, 357, j1745. <https://doi.org/10.1136/BMJ.J1745>

Hayes, S. C., & Hofmann, S. G. (2017). The third wave of cognitive behavioral therapy and the

rise of process-based care. *World Psychiatry*, 16(3), 245.

<https://doi.org/10.1002/WPS.20442>

Hoek, H. W. (2006). Incidence, prevalence and mortality of anorexia nervosa and other eating

disorders. *Current Opinion in Psychiatry*, 19(4), 389–394.

<https://doi.org/10.1097/01.YCO.0000228759.95237.78>

Holmes, S., Drake, S., Odgers, K., & Wilson, J. (2017). Feminist approaches to Anorexia Nervosa:

A qualitative study of a treatment group. *Journal of Eating Disorders*, 5(1), 1–15.

<https://doi.org/10.1186/S40337-017-0166-Y/TABLES/1>

Holmes, S., Malson, H., & Semlyen, J. (2021). Regulating “untrustworthy patients”:

Constructions of “trust” and “distrust” in accounts of inpatient treatment for anorexia.

*Feminism & Psychology*, 31(1), 41–61. <https://doi.org/10.1177/0959353520967516>

Holtkamp, K., Hebebrand, J., & Herpertz-Dahlmann, B. (2004). The contribution of anxiety and

food restriction on physical activity levels in acute anorexia nervosa. *International Journal*

*of Eating Disorders*, 36(2), 163–171. <https://doi.org/10.1002/EAT.20035>

Hrabosky, J. I., Cash, T. F., Veale, D., Neziroglu, F., Soll, E. A., Garner, D. M., Strachan-Kinser, M.,

Bakke, B., Clauss, L. J., & Phillips, K. A. (2009). Multidimensional body image comparisons

among patients with eating disorders, body dysmorphic disorder, and clinical controls: A

multisite study. *Body Image*, 6(3), 155–163.

<https://doi.org/10.1016/J.BODYIM.2009.03.001>

- Hu, M. X., Turner, D., Generaal, E., Bos, D., Ikram, M. K., Ikram, M. A., Cuijpers, P., & Penninx, B. W. J. H. (2020). Exercise interventions for the prevention of depression: A systematic review of meta-analyses. *BMC Public Health, 20*(1), 1–11.  
<https://doi.org/10.1186/S12889-020-09323-Y/FIGURES/2>
- Humphreys, S. (2010). The unethical use of BMI in contemporary general practice. *The British Journal of General Practice, 60*(578), 696. <https://doi.org/10.3399/BJGP10X515548>
- Ibrahim, A., Cutinha, D., & Ayton, A. (2019). What is the evidence for using bed rest as part of hospital treatment of severe anorexia nervosa? *Evidence-Based Mental Health, 22*(2), 77–82. <https://doi.org/10.1136/EBMENTAL-2018-300064>
- Jankauskiene, R., Baceviciene, M., & Trinkuniene, L. (2020). Examining body appreciation and disordered eating in adolescents of different sports practice: cross-sectional study. *International Journal of Environmental Research and Public Health, 17*.  
<https://doi.org/10.3390/ijerph17114044>
- Jáuregui-Garrido, B., & Jáuregui-Lobera, I. (2012). Sudden death in eating disorders. *Vascular Health and Risk Management, 8*(1), 91. <https://doi.org/10.2147/VHRM.S28652>
- Kashubeck-West, S., & Tagger, L. (2012). Feminist multicultural perspectives on body image and eating disorders in women. *The Oxford Handbook of Feminist Multicultural Counseling Psychology, 392–410*. <https://doi.org/10.1093/OXFORDHB/9780199744220.013.0021>
- Kass, A. E., Kolko, R. P., & Wilfley, D. E. (2013). Psychological treatments for eating disorders. *Current Opinion in Psychiatry, 26*(6), 549.  
<https://doi.org/10.1097/YCO.0B013E328365A30E>
- Keyes, A., Woerwag-Mehta, S., Bartholdy, S., Koskina, A., Middleton, B., Connan, F., Webster, P., Schmidt, U., & Campbell, I. C. (2015). Physical activity and the drive to exercise in anorexia nervosa. *The International Journal of Eating Disorders, 48*(1), 46–54.  
<https://doi.org/10.1002/EAT.22354>

- Klein, J., & Cook-Cottone, C. (2013). The effects of yoga on eating disorder symptoms and correlates: A review. *International Journal of Yoga Therapy, 23*(2), 41–50.  
<https://doi.org/10.17761/IJYT.23.2.2718421234K31854>
- Kolnes, L. J., & Rodriguez-Morales, L. (2016). The meaning of compulsive exercise in women with anorexia nervosa: An interpretative phenomenological analysis. *Mental Health and Physical Activity, 10*, 48–61. <https://doi.org/10.1016/J.MHPA.2015.12.002>
- Kwee, J. L., & Launeanu, M. (2019). Practical strategies for promoting embodiment in eating disorder prevention and treatment. In H. L. McBride & J. L. Kwee (Eds.), *Embodiment and eating disorders: Theory, research, prevention, and treatment* (pp. 342–357). Routledge.
- Lichtenstein, M. B., Nielsen, R. O., Gudex, C., Hinze, C. J., & Jørgensen, U. (2018). Exercise addiction is associated with emotional distress in injured and non-injured regular exercisers. *Addictive Behaviors Reports, 8*, 33–39.  
<https://doi.org/10.1016/J.ABREP.2018.06.001>
- Manley, R. S., & Standish, K. (2005). Should adolescents with eating disorders be allowed to exercise? *Renfrew Perspective, Winter*, 17–20.
- Marques, A., Peralta, M., Sarmiento, H., Loureiro, V., Gouveia, É. R., & Gaspar de Matos, M. (2019). Prevalence of risk for exercise dependence: A systematic review. *Sports Medicine (Auckland, N.Z.), 49*(2), 319–330. <https://doi.org/10.1007/S40279-018-1011-4>
- Martenstyn, J. A., Aouad, P., Touyz, S., & Maguire, S. (2022). Treatment of compulsive exercise in eating disorders and muscle dysmorphia: A systematic review and meta-analysis. *Clinical Psychology: Science and Practice, 29*(2), 143–161.  
<https://doi.org/10.1037/CPS0000064>
- Masson, P. C., & Sheeshka, J. D. (2009). Clinicians' perspectives on the premature termination of treatment in patients with eating disorders. *Eating Disorders, 17*(2), 109–125.  
<https://doi.org/10.1080/10640260802714548>

- Medeiros, G. C., Sampaio, D. G., & Corchs, F. (2014). Anorexia nervosa, paternalism and clinical practice. *Archives of Clinical Psychiatry (São Paulo)*, *41*(5), 135–135.  
<https://doi.org/10.1590/0101-60830000000028>
- Mehler, P. S., & Andersen, A. E. (2017). *Eating disorders: A comprehensive guide to medical care and complications*. John Hopkins University Press.
- Mehler, P. S., Krantz, M. J., & Sachs, K. v. (2015). Treatments of medical complications of anorexia nervosa and bulimia nervosa. *Journal of Eating Disorders*, *3*(1).  
<https://doi.org/10.1186/S40337-015-0041-7>
- Mehler, P. S., & MacKenzie, T. D. (2009). Treatment of osteopenia and osteoporosis in anorexia nervosa: a systematic review of the literature. *The International Journal of Eating Disorders*, *42*(3), 195–201. <https://doi.org/10.1002/EAT.20593>
- Merriam-Webster. (2022). *Exercise definition & meaning*. <https://www.merriam-webster.com/dictionary/exercise>
- Meyer, C., & Taranis, L. (2011). Exercise in the eating disorders: Terms and definitions. *European Eating Disorders Review*, *19*(3), 169–173. <https://doi.org/10.1002/ERV.1121>
- Meyer, C., Taranis, L., Goodwin, H., & Haycraft, E. (2011). Compulsive exercise and eating disorders. *European Eating Disorders Review : The Journal of the Eating Disorders Association*, *19*(3), 174–189. <https://doi.org/10.1002/ERV.1122>
- Mond, J., & Gorrell, S. (2021). “Excessive exercise” in eating disorders research: problems of definition and perspective. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity* *26*:4, *26*(4), 1017–1020. <https://doi.org/10.1007/S40519-020-01075-3>
- Mond, J. M., & Calogero, R. M. (2009). Excessive exercise in eating disorder patients and in healthy women. *Australian and New Zealand Journal of Psychiatry*, *43*(3), 227–234.  
<https://doi.org/10.1080/00048670802653323>

- Mond, J. M., Hay, P. J., Rodgers, B., & Owen, C. (2006). An update on the definition of “excessive exercise” in eating disorders research. *The International Journal of Eating Disorders, 39*(2), 147–153. <https://doi.org/10.1002/EAT.20214>
- Mond, J., Myers, T. C., Crosby, R., Hay, P., & Mitchell, J. (2008). “Excessive exercise” and eating-disordered behaviour in young adult women: further evidence from a primary care sample. *European Eating Disorders Review: The Journal of the Eating Disorders Association, 16*(3), 215–221. <https://doi.org/10.1002/ERV.855>
- Moola, F. J., Gairdner, S. E., & Amara, C. E. (2013). Exercise in the care of patients with anorexia nervosa: A systematic review of the literature. *Mental Health and Physical Activity, 6*(2), 59–68. <https://doi.org/10.1016/J.MHPA.2013.04.002>
- Muñoz, P., Quintana, J. M., las Hayas, C., Padierna, A., Aguirre, U., & González-Torres, M. A. (2012). Quality of life and motivation to change in eating disorders. Perception patient-psychiatrist. *Eating Behaviors, 13*(2), 131–134. <https://doi.org/10.1016/J.EATBEH.2011.11.008>
- Nahman, C., & Holland, J. (2022). Incorporating interventions for unhealthy exercise into eating disorders treatment. *Sports Psychiatry, 1*–7. <https://doi.org/10.1024/2674-0052/A000020>
- National Cancer Institute. (n.d.). *Definition of bone mineral density*. Retrieved October 12, 2022, from <https://www.cancer.gov/publications/dictionaries/cancer-terms/def/bone-mineral-density>
- National Eating Disorders Association. (2022a). *Anorexia nervosa*. <https://www.nationaleatingdisorders.org/learn/by-eating-disorder/anorexia>
- National Eating Disorders Association. (2022b). *Bulimia nervosa*. <https://www.nationaleatingdisorders.org/learn/by-eating-disorder/bulimia>
- Neumärker, K.-J. (1998). Mortality and sudden death in anorexia nervosa. *International Journal of Eating Disorders, 21*(3), 205–212.

- Neumark-Sztainer, D., Watts, A. W., & Rydell, S. (2018). Yoga and body image: How do young adults practicing yoga describe its impact on their body image? *Body Image, 27*, 156–168.  
<https://doi.org/10.1016/J.BODYIM.2018.09.001>
- Ng, L. W. C., Ng, D. P., & Wong, W. P. (2013). Is supervised exercise training safe in patients with anorexia nervosa? A meta-analysis. *Physiotherapy (United Kingdom), 99*(1), 1–11.  
<https://doi.org/10.1016/j.physio.2012.05.006>
- Noetel, M., Dawson, L., Hay, P., & Touyz, S. (2017). The assessment and treatment of unhealthy exercise in adolescents with anorexia nervosa: A Delphi study to synthesize clinical knowledge. *International Journal of Eating Disorders, 50*(4), 378–388.  
<https://doi.org/10.1002/EAT.22657>
- Ostermann, T., Vogel, H., Boehm, K., & Cramer, H. (2019). Effects of yoga on eating disorders—A systematic review. *Complementary Therapies in Medicine, 46*, 73–80.  
<https://doi.org/10.1016/J.CTIM.2019.07.021>
- Peñas-Lledó, E., Vaz Leal, F. J., & Waller, G. (2002). Excessive exercise in anorexia nervosa and bulimia nervosa: Relation to eating characteristics and general psychopathology. *International Journal of Eating Disorders, 31*(4), 370–375.  
<https://doi.org/10.1002/EAT.10042>
- Prentice, A. M., & Jebb, S. A. (2001). Beyond body mass index. *Obesity Reviews, 2*(3), 141–147.  
<https://doi.org/10.1046/J.1467-789X.2001.00031.X>
- Prochaska, J. O., DiClemente, C. C., & Norcross, J. C. (1992). In search of how people change. Applications to addictive behaviors. *The American Psychologist, 47*(9), 1102–1114.  
<https://doi.org/10.1037//0003-066X.47.9.1102>
- Prochaska, J. O., & Norcross, J. C. (2018). *Systems of psychotherapy* (9th ed.). Oxford University Press.

- Reynolds, K. A., Plateau, C. R., & Haycraft, E. (2022). Sociocultural influences on compulsive exercise in young people: A systematic review. *Adolescent Research Review, 1*, 1–16. <https://doi.org/10.1007/S40894-022-00180-X/TABLES/3>
- Richardson, C. R., Faulkner, G., McDevitt, J., Skrinar, G. S., Hutchinson, D. S., & Piette, J. D. (2005). Integrating physical activity into mental health services for persons with serious mental illness. *Psychiatric Services, 56*(3), 324–331. <https://doi.org/10.1176/APPI.PS.56.3.324>
- Rock, P. L., Roiser, J. P., Riedel, W. J., & Blackwell, A. D. (2014). Cognitive impairment in depression: a systematic review and meta-analysis. *Psychological Medicine, 44*(10), 2029–2040. <https://doi.org/10.1017/S0033291713002535>
- Rodgers, R. F., Berry, R., & Franko, D. L. (2018). Eating disorders in ethnic minorities: an update. *Current Psychiatry Reports, 20*(10), 1–11. <https://doi.org/10.1007/S11920-018-0938-3>
- Roux, H., Ali, A., Lambert, S., Radon, L., Huas, C., Curt, F., Berthoz, S., Godart, N., Lalanne, C., Duclos, J., Mattar, L., Thiébaud, M. R., Vibert, S., Hubert, T., Courty, A., Ringuenet, D., Benoit, J. P., Blanchet, C., Moro, M. R., ... Auger, C. (2016). Predictive factors of dropout from inpatient treatment for anorexia nervosa. *BMC Psychiatry, 16*(1), 1–11. <https://doi.org/10.1186/S12888-016-1010-7/TABLES/6>
- Royal College of Psychiatrists. (2022). *Medical emergencies in eating disorders: Guidance on recognition and management*. [www.aomrc.org.uk](http://www.aomrc.org.uk)
- Sachs, K., Andersen, D., Sommer, J., Winkelman, A., & Mehler, P. S. (2015). Avoiding medical complications during the refeeding of patients with anorexia nervosa. *Eating Disorders, 23*(5), 411–421. <https://doi.org/10.1080/10640266.2014.1000111>
- Schebendach, J., Mayer, L. E. S., Devlin, M. J., Attia, E., & Walsh, B. T. (2012). Dietary energy density and diet variety as risk factors for relapse in anorexia nervosa: A replication. *The International Journal of Eating Disorders, 45*(1), 79. <https://doi.org/10.1002/EAT.20922>

- Schlegl, S., Dittmer, N., Hoffmann, S., & Voderholzer, U. (2018). Self-reported quantity, compulsiveness and motives of exercise in patients with eating disorders and healthy controls: Differences and similarities. *Journal of Eating Disorders*, *6*(1), 1–10. <https://doi.org/10.1186/S40337-018-0202-6/TABLES/2>
- Schorr, M., & Miller, K. K. (2017). The endocrine manifestations of anorexia nervosa: mechanisms and management. *Nature Reviews. Endocrinology*, *13*(3), 174. <https://doi.org/10.1038/NREND0.2016.175>
- Seid, R. P. (1994). Too “close to the bone”: The historical context for women’s obsession with slenderness. In P. Fallon, M. A. Katzman, & S. C. Wooley (Eds.), *Feminist Perspectives on Eating Disorders* (pp. 3–16). Guildford Press.
- Serpell, L., Livingstone, A., Neiderman, M., & Lask, B. (2002). Anorexia nervosa: Obsessive-compulsive disorder, obsessive-compulsive personality disorder, or neither? *Clinical Psychology Review*, *22*(5), 647–669. [https://doi.org/10.1016/S0272-7358\(01\)00112-X](https://doi.org/10.1016/S0272-7358(01)00112-X)
- Shetty, S., Kapoor, N., Bondu, J., Thomas, N., & Paul, T. (2016). Bone turnover markers: Emerging tool in the management of osteoporosis. *Indian Journal of Endocrinology and Metabolism*, *20*(6), 846. <https://doi.org/10.4103/2230-8210.192914>
- Shroff, H., Reba, L., Thornton, L. M., Tozzi, F., Klump, K. L., Berrettini, W. H., Brandt, H., Crawford, S., Crow, S., Fichter, M. M., Goldman, D., Halmi, K. A., Johnson, C., Kaplan, A. S., Keel, P., LaVia, M., Mitchell, J., Rotondo, A., Strober, M., ... Bulik, C. M. (2006). Features associated with excessive exercise in women with eating disorders. *International Journal of Eating Disorders*, *39*(6), 454–461. <https://doi.org/10.1002/EAT.20247>
- Siegel, D. J. (2007). *The mindful brain: reflection and attunement in the cultivation of well-being*. 387. <https://wwwnorton.com/books/9780393704709>
- Sly, R., Morgan, J. F., Mountford, V. A., Sawyer, F., Evans, C., & Lacey, J. H. (2014). Rules of engagement: Qualitative experiences of therapeutic alliance when receiving in-patient

- treatment for anorexia nervosa. *Eating Disorders*, 22(3), 233–243.  
<https://doi.org/10.1080/10640266.2013.867742>
- Smith, L. L. (2012). Overtraining, excessive exercise, and altered immunity. *Sports Medicine* 2003 33:5, 33(5), 347–364. <https://doi.org/10.2165/00007256-200333050-00002>
- Spano, L. (2001). The relationship between exercise and anxiety, obsessive-compulsiveness, and narcissism. *Personality and Individual Differences*, 30(1), 87–93.  
[https://doi.org/10.1016/S0191-8869\(00\)00012-X](https://doi.org/10.1016/S0191-8869(00)00012-X)
- Steinhausen, H.-C. (2002). The Outcome of Anorexia Nervosa in the 20th Century. *Am J Psychiatry*, 159(8).
- Støvring, R. K. (2019). Mechanisms in endocrinology: Anorexia nervosa and endocrinology: a clinical update. *European Journal of Endocrinology*, 180(1), R9–R27.  
<https://doi.org/10.1530/EJE-18-0596>
- Striegel-Moore, R. H., & Bulik, C. M. (2007). Risk factors for eating disorders. *American Psychologist*, 62(3), 181–198. <https://doi.org/10.1037/0003-066X.62.3.181>
- Stynes, G., Leão, C. S., & McHugh, L. (2022). Exploring the effectiveness of mindfulness-based and third wave interventions in addressing self-stigma, shame and their impacts on psychosocial functioning: A systematic review. *Journal of Contextual Behavioral Science*, 23, 174–189. <https://doi.org/10.1016/J.JCBS.2022.01.006>
- Szabo, A., Griffiths, M. D., de La Vega Marcos, R., Mervó, B., & Demetrovics, Z. (2015). Focus: Addiction: Methodological and conceptual limitations in exercise addiction research. *The Yale Journal of Biology and Medicine*, 88(3), 303. [/pmc/articles/PMC4553651/](https://doi.org/10.1093/yjbm/bbv033)
- Szabo, C. P., & Green, K. (2002). Hospitalized anorexics and resistance training: impact on body composition and psychological well-being. A preliminary study. *Eating and Weight Disorders: EWD*, 7(4), 293–297. <https://doi.org/10.1007/BF03324975>
- Taranis, L., Touyz, S., & Meyer, C. (2011). Disordered eating and exercise: development and preliminary validation of the compulsive exercise test (CET). *European Eating Disorders*

*Review : The Journal of the Eating Disorders Association, 19(3), 256–268.*

<https://doi.org/10.1002/ERV.1108>

Thien, V., Thomas, A., Markin, D., & Birmingham, C. L. (2000). Pilot study of a graded exercise program for the treatment of anorexia nervosa. *The International Journal of Eating Disorders, 28(1)*, 101–106.

Touyz, S. W., Lennerts, W., Arthur, B., & Beumont, P. J. V. (1993). Anaerobic exercise as an adjunct to refeeding patients with anorexia nervosa: Does it compromise weight gain? *Undefined, 1(3)*, 177–182. <https://doi.org/10.1002/ERV.2400010306>

University of Sydney. (2022). Overview of eating disorder examination (EDE) and questionnaire. *Comorbidity Guidelines*. <https://comorbidityguidelines.org.au/standardised-screening-and-assessment/the-eating-disorder-examination-ed-e-and-questionnaire-edeq>

van Elburg, A. A., Hoek, H. W., Kas, M. J. H., & van Engeland, H. (2007). Nurse evaluation of hyperactivity in anorexia nervosa: a comparative study. *European Eating Disorders Review, 15(6)*, 425–429. <https://doi.org/10.1002/ERV.803>

van Tienen, F. H. J., Praet, S. F. E., de Feyter, H. M., van den Broek, N. M., Lindsey, P. J., Schoonderwoerd, K. G. C., de Coo, I. F. M., Nicolay, K., Prompers, J. J., Smeets, H. J. M., & van Loon, L. J. C. (2012). Physical activity is the key determinant of skeletal muscle mitochondrial function in type 2 diabetes. *The Journal of Clinical Endocrinology & Metabolism, 97(9)*, 3261–3269. <https://doi.org/10.1210/JC.2011-3454>

Vandereycken, W., & Devidt, K. (2010). Dropping out from a specialized inpatient treatment for eating disorders: The perception of patients and staff. *Eating Disorders: The Journal of Treatment & Prevention, 18(2)*, 140–147. <https://doi.org/10.1080/10640260903585557>

Vestergaard, P., Emborg, C., Støving, R. K., Hagen, C., Mosekilde, L., & Brixen, K. (2002). Fractures in patients with anorexia nervosa, bulimia nervosa, and other eating disorders—A nationwide register study. *International Journal of Eating Disorders, 32(3)*, 301–308. <https://doi.org/10.1002/EAT.10101>

- Vitousek, K., Watson, S., & Wilson, G. T. (1998). Enhancing motivation for change in treatment-resistant eating disorders. *Clinical Psychology Review, 18*(4), 391–420.  
[https://doi.org/10.1016/S0272-7358\(98\)00012-9](https://doi.org/10.1016/S0272-7358(98)00012-9)
- Whaley, M. H., Brubaker, P. H., Otto, R. M. (Robert M., & Armstrong, L. E. (2006). *ACSM's guidelines for exercise testing and prescription*. 366.
- World Health Organization. (2014). *Adolescence: a period needing special attention - recognizing-adolescence*. <https://apps.who.int/adolescent/second-decade/section2/page1/recognizing-adolescence.html>
- Yang, Y. J. (2019). An overview of current physical activity recommendations in primary care. *Korean Journal of Family Medicine, 40*(3), 135. <https://doi.org/10.4082/KJFM.19.0038>
- Yates, A. (2013). Compulsive exercise and the eating disorders: Toward an integrated theory of activity. In *Compulsive Exercise And The Eating Disorders: Toward An Integrated Theory Of Activity*. Taylor and Francis. <https://doi.org/10.4324/9780203776797>
- Yoshida, Y., Maeda, J., Fukushima, H., Tokita, N., Yamagishi, H., & Tokumura, M. (2019). Chronotropic incompetence to exercise in anorexia nervosa patients during the body-weight recovery phase as an index of insufficient treatment. *Heart and Vessels, 34*(4), 711–715. <https://doi.org/10.1007/S00380-018-1282-6>
- Young, S., Touyz, S., Meyer, C., Arcelus, J., Rhodes, P., Madden, S., Pike, K., Attia, E., Crosby, R. D., & Hay, P. (2018). Relationships between compulsive exercise, quality of life, psychological distress and motivation to change in adults with anorexia nervosa. *Journal of Eating Disorders, 6*(1). <https://doi.org/10.1186/S40337-018-0188-0>
- Young, S., Touyz, S., Meyer, C., Arcelus, J., Rhodes, P., Madden, S., Pike, K., Attia, E., Crosby, R. D., Wales, J., & Hay, P. (2017). Validity of exercise measures in adults with anorexia nervosa: The EDE, compulsive exercise test and other self-report scales. *The International Journal of Eating Disorders, 50*(5), 533–541. <https://doi.org/10.1002/EAT.22633>

Zernicke, R., MacKay, C., & Lorincz, C. (2006). Mechanisms of bone remodeling during weight-bearing exercise. *Applied Physiology, Nutrition, and Metabolism*, 31(6), 655–660.

<https://doi.org/10.1139/H06-051>