Understanding compulsive exercise and eating disorders:

From lived experience to clinical treatment approaches

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Abstract

Compulsive exercise is a common symptom of eating disorders that is notoriously difficult to resolve and predictive of worsened treatment outcomes (e.g., longer time in treatment and shorter periods between relapses). Compulsive exercise is characterized by an obsessive drive to exercise, rigid exercise rules, and the use of exercise as a means to prevent or reduce negative emotions, such as feelings of distress or anxiety. Despite some advancements in the field, identifying and treating compulsive exercise is limited by an insufficient understanding of its development, maintenance, treatment, and recovery processes. To address this limited understanding, the overall purpose of my dissertation was to explore experiences living with, being treated for, and recovering from compulsive exercise among individuals with eating disorders. Study 1 involved a social media analysis to explore how people are discussing and sharing experiences with compulsive exercise on social media sites. The findings further advanced characterizations of the attitudes and behaviours associated with compulsive exercise, recovery experiences, and highlighted the need for more awareness. Study 2 involved a series of life history narrative interviews among women with compulsive exercise and bulimia nervosa to gain an in-depth account of their personal experiences from early childhood to early adulthood. Participants highlighted the psychological, social, and cultural factors that played a role in the development of their eating disorder and compulsive exercise, and identified the need for improved prevention and treatment efforts for compulsive exercise. To address this need, Study 3 involved a systematic review of compulsive exercise treatment interventions to understand the current approaches and their efficacy. The findings demonstrated that exercise-based psychoeducation and experiential training is effective at reducing compulsive exercise. Overall, my findings help develop a stronger understanding of living with compulsive exercise and

provide insight into current effective treatment programs for compulsive exercise. My research also further identified the urgent need for prevention efforts for body, eating, and particularly exercise disturbances.

Résumé

L'exercice compulsif, un symptôme fréquent des troubles alimentaires, est difficile à résoudre et est également un prédicteur de l'aggravation des résultats du traitement (par exemple, une durée de traitement plus longue et des périodes entre les rechutes plus courtes). L'exercice compulsif est caractérisé par un besoin obsessionnel de faire de l'exercice, de suivre des règles d'exercice rigides et d'utiliser l'exercice comme un moyen pour prévenir ou réduire les émotions négatives, tels que la détresse ou l'anxiété. Malgré les avancées dans le domaine, l'identification et le traitement de l'exercice compulsif sont limités par une compréhension insuffisante de ses processus de développement, de maintenance, de traitement et de récupération. Pour répondre à ce manque, l'objectif global de ma thèse était d'explorer les expériences de vie, le traitement et la récupération de l'exercice compulsif chez les personnes souffrants d'un trouble alimentaire. L'étude 1 consistait à effectuer une analyse des médias sociaux afin d'explorer comment les gens discutent et partagent leurs expériences en lien avec l'exercice compulsif. Les résultats ont fait avancer les descriptions des attitudes, des comportements et des expériences de récupération associées à l'exercice compulsif en plus de souligner un besoin de sensibilisation. L'étude 2 comportait une série d'entretiens narratifs d'histoires de vie réalisés avec des personnes atteintes de boulimie et des personnes qui font de l'exercice de manière compulsive afin d'obtenir une histoire détaillée de leurs expériences personnelles tout au long de leur vie. Les participants ont souligné les facteurs psychologiques, sociaux et culturels ayant joués un rôle dans le développement de leurs troubles alimentaires et de l'exercice compulsif. Ils ont également identifié le besoin d'améliorer les efforts de prévention et de traitement de l'exercice compulsif. Pour répondre à ce besoin, l'étude 3 consistait à effectuer une revue systématique des interventions de traitement de l'exercice compulsif afin de comprendre les approches actuelles et

leur efficacité. Les résultats ont démontré que la psychoéducation basée sur l'exercice ainsi que l’engagement lors d’exercices supervisés sont efficaces pour réduire l'exercice compulsif. Globalement, mes résultats permettent une meilleure compréhension du parcours de vie des gens qui font de l'exercice de manière compulsive et donnent un aperçu des programmes de traitements efficaces actuels de l'exercice compulsif. Ma recherche a également permis d’identifier le besoin urgent de faire des efforts de prévention pour les troubles d’image corporelle et d'alimentation, particulièrement ceux en lien avec l'exercice.

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friends that will probably never read this, thank you for being an escape from the academic life when I needed it.

"I believe in movement as a way to liberate our life force, not to change our body."

– Carmen Cool

Contributions to Original Knowledge

My dissertation is comprised of three original manuscripts that each uniquely contribute to the literature. My first study relied upon novel methods using a social media listening tool to gather relevant posts from various social media sites to explore experiences with compulsive exercise and eating disorders as shared online. This is the first study on compulsive exercise that relied on naturally occurring data from social media sites and is the most extensive analysis of qualitative data on compulsive exercise to date. The findings provide original contributions to the literature: (a) rich descriptions of compulsive exercise thoughts and behaviours that reinforce the current definitions of compulsive exercise, (b) barriers and motives for compulsive exercise recovery, (c) compulsive exercise recovery strategies, (d) the need for clarity around healthy exercise in compulsive exercise recovery as expressed by those confused in recovery, and (e) the need for more awareness around compulsive exercise for family, friends, the general public, and healthcare professionals. My second study was the first to explore lifelong in-depth experiences with exercise and eating among women with bulimia nervosa, and to focus on the sociocultural factors involved in developing, maintaining, and recovering from compulsive exercise. This study was the first to use creative nonfiction stories to portray the complex interplay of psychological and sociocultural factors that play a role in compulsive exercise and eating disorders. Creative nonfiction stories allowed for deeply personal accounts of living with compulsive exercise with the goal of evoking emotions and action in the readers. The stories are also an accessible research output that can be used to increase awareness and a better understanding of compulsive exercise not just for academics, but also for clinicians, the general public, those with lived experience, and their family and friends. My third manuscript was the first systematic review of interventions aimed at treating compulsive exercise. The findings

described the current approaches toward treating compulsive exercise which all included exercise psychoeducation, with the majority including exercise sessions. Generally, the interventions were found to be efficacious at reducing or treating compulsive exercise and even improving eating psychopathology. My review also highlighted the current challenges of compulsive exercise literature, whereby a variety of terms, conceptualizations, and assessment tools are used for compulsive exercise which hinders the ability to move this field forward in an efficient manner.

Contributions of Authors

My dissertation includes three original manuscripts, led and written by me, with supervision and contributions from my supervisor, Dr. Lindsay Duncan, and my co-authors, who are undergraduate students from the Department of Kinesiology and Physical Education.

Contributions to Chapter Three

The manuscript entitled "'Compulsive exercise is a socially acceptable prison cell': Exploring experiences with compulsive exercise across social media" is published in the *International Journal of Eating Disorders* and was co-authored by myself and my supervisor, Dr. Lindsay Duncan.

- Laura Hallward: As first author, I led the conceptualization, data collection, data analyses, and all phases of writing the manuscript. I was responsible for submitting the manuscript to the journal, and all edits and phases of the review process. I serve as the corresponding author on the publication.
- Lindsay Duncan: Dr. Duncan contributed to the conceptualization of the study, served as a critical friend in the data analysis, and played a major role in editing and refining the manuscript up to publication.

Contributions to Chapter Four

The manuscript entitled "Personal accounts of compulsive exercise and bulimia nervosa: An exploration of psychosocial influences through creative nonfiction storytelling" is currently under peer-review at *Psychology of Sport and Exercise*, co-authored by myself, Olivia Feng, and Dr. Lindsay Duncan.

- Laura Hallward: As first author, I was involved in the conceptualization, ethics submission, data collection, data analysis, all phases of writing the manuscript, and submitting to the journal. I serve as the corresponding author.
- Olivia Feng: Olivia assisted with the development of interview guides for data collection, assisted with data analysis, and was involved in editing the manuscript.
- Lindsay Duncan: Dr. Duncan helped with the conceptualization of the study, served as a critical friend throughout the analysis, and was involved in editing and refining the manuscript for submission to the journal.

Contributions to Chapter Five

The manuscript entitled "A systematic review of treatment approaches for compulsive exercise among individuals with eating disorders" is currently published in *Eating Disorders*, co-authored by myself, Annissa Di Marino, and Dr. Lindsay Duncan.

- Laura Hallward: As first author, I was responsible for the conceptualization of the study, data collection, data analysis, and all phases of writing the manuscript. I submitted the manuscript and took the lead role on all edits throughout the peer-review process. I serve as the corresponding author on the manuscript.
- Annissa Di Marino: Annissa assisted with the data collection process and data extraction.
- Lindsay Duncan: Dr. Duncan played a role in the conceptualization of the study, data analysis, and editing the manuscript throughout the writing and peer-review process.

Preface

My dissertation is organized following a manuscript-based format, including three studies, for a total of six chapters. Chapter One provides a brief introduction to the topic of compulsive exercise and eating disorders, as well as the overall goal of my dissertation and the subsequent purpose statements for each of my manuscripts. Chapter Two provides a detailed literature review of the eating disorder and compulsive exercise field. Chapter Three includes an original manuscript, published in the *International Journal of Eating Disorders*, exploring social media posts on compulsive exercise. Chapter Four is an original manuscript of two creative nonfiction stories among four women with compulsive exercise and bulimia nervosa, currently under review at the journal of *Psychology of Sport and Exercise Psychology*. Chapter Five presents an original manuscript in *Eating Disorders*, which is a systematic review examining the efficacy of compulsive exercise treatment interventions. Chapter Six encompasses a general discussion, situating the findings from my three manuscripts within the current literature, discussing the contributions of my findings, and presenting future research directions.

Chapter One: Introduction

Regular physical activity is said to be one of the most beneficial things people can do for their health and can lead to many positive outcomes (Piercy et al., 2018). Physical activity has been associated with lowered risk for all-cause mortality, cardiovascular disease, diabetes, and certain cancers. Engaging in regular activity can help psychological health as it has been shown to reduce anxiety and depression, and improve cognition and sleep (e.g., Piercy et al., 2018; Rebar et al., 2015). Given the health benefits of physical activity and exercise (a specific form of physical activity that is planned, structured, and repetitive with the goal of maintaining or improving fitness; Caspersen et al., 1985), North Americans are encouraged to engage in moderate to vigorous physical activity for at least 150 minutes per week, and include strength training sessions on two or more days a week (Canadian Society for Exercise Physiology, 2016; Piercy et al., 2018). Additional health benefits can also be accrued for individuals engaging in more than 300 minutes of moderate-intensity physical activity a week (Piercy et al., 2018). There is no doubt that physical activity can be valuable for everyone; however, is exercise *always* considered healthy? People may engage in high quantities or excessive amounts of exercise and have a negative relationship to exercise, such as using exercise as a punishment for their body or feeling guilty when they are unable to exercise (Dalle Grave, 2009). These dysfunctional exercise beliefs, attitudes, and behaviours can lead to detrimental consequences that can affect several areas of an individual's life (Dalle Grave et al., 2008).

A dysfunctional relationship with exercise can be especially detrimental when accompanied by disordered eating or eating disorders (EDs), as exercise can exacerbate ED symptoms, lead to longer ED treatment times, and predict shorter periods between relapses (Davis et al., 1994; Hay et al., 2018; Meyer & Taranis, 2011). Dysfunctional exercise is a broad

term that describes many types of problematic exercise attitudes and behaviours, which encompasses a more specific form, compulsive exercise (CE). CE has been deemed the most appropriate term for describing dysfunctional exercise among eating disordered samples and non-clinical samples (Meyer & Taranis, 2011), and will be used throughout this dissertation. Despite the high prevalence and deleterious consequences of CE within the context of EDs, there are considerable gaps in knowledge around CE which limits the prevention and treatment of this condition.

Overall Objectives

The overall purpose of my dissertation was to develop a deeper understanding of experiences living with, being treated for, and recovering from CE among individuals with EDs. To accomplish this goal, we conducted three studies that each addressed specific research questions. The first study had the goal of broadly exploring an array of lived experiences with CE as shared across social media sites. Using social media to access a large sample of experiences increased the likelihood of gaining insight into a variety of lived CE experiences. The purpose of my second study was to explore lived experiences with CE, specifically within the context of bulimia nervosa, and to focus on the interplay of the psychological and sociocultural factors that influence CE. The aim of my third study was to examine the efficacy of current CE treatment programs targeting individuals with EDs. By understanding the content of CE treatment interventions and their efficacy at reducing and treating CE, it allows for a better understanding of treatment experiences and recovery processes of CE.

Chapter Two: Literature Review

Eating Disorders

In Canada, 2-3% of the population is living with an ED, disproportionately affecting adolescent girls and women (Langlois et al., 2011). In fact, EDs are the most prevalent in North America with lifetime ED rates of 4.6%, but the prevalence of EDs is growing globally, with estimated prevalence rates of 2.2% in Europe and 3.5% in Asia (Galmiche et al., 2019). EDs commonly present with other psychiatric comorbidities, such as depression, anxiety disorders, and substance abuse. As a result, EDs are one of the most difficult mental illnesses to treat (Vancampfort et al., 2014), and have the highest mortality rate compared to any other mental illness (Smink et al., 2012). Fortunately, individuals with EDs can be successfully treated and recover from the disorder (Noordenbos, 2013). According to the Diagnostic and Statistical Manual of Mental Disorders (DSM)-5, the Feeding and Eating Disorders category includes three main diagnoses: anorexia nervosa, bulimia nervosa, and binge eating disorder. The DSM-5 further defines subtypes of these three main EDs, and includes lesser-known EDs, such as other specified feeding or eating disorder (OSFED), which was formerly recognized as eating disorder not otherwise specified (EDNOS) in the DSM-IV (American Psychiatric Association, 2013).

Anorexia Nervosa

Anorexia nervosa in the DSM-5 is characterized by three main criteria: (a) restricted energy intake leading to a significantly low body weight (i.e., less than what is minimally expected in the context of age, sex, developmental trajectory, and physical health), (b) intense fear of weight gain, or engaging in persistent behaviours that interfere with weight gain, despite a significantly low weight, and (c) disturbed perception of one's body weight or shape and lack of recognition of the gravity of low body weight (American Psychiatric Association, 2013).

Anorexia nervosa can be broken down into two subcategories: restricting type and binge-eating/purging type. Restricting type describes individuals who are a low weight due to restriction of energy intake such as a low caloric intake from skipping meals. Binge-eating/purging type describes individuals who are of low weight, but engage in episodes of binge eating or purging behaviours through vomiting, laxatives, and diuretics, or non-purging compensatory behaviours such as excessive exercise (American Psychiatric Association, 2013).

Bulimia Nervosa

Bulimia nervosa is characterized by recurrent episodes of binge eating and compensatory behaviours. An episode of binge eating involves eating, in a discrete amount of time, an amount of food larger than what most individuals eat in a similar period of time and similar circumstances, while experiencing a perceived lack of control over eating during the episode (American Psychiatric Association, 2013). Binge episodes are followed by inappropriate compensatory behaviours, like self-induced vomiting, the use of laxatives, diuretics, or other medications, fasting, or excessive exercise to prevent weight gain. The binge eating episodes and compensatory behaviours both occur at least once a week for three months, on average (American Psychiatric Association, 2013). Self-evaluation of one's body is influenced by body shape and weight. Bulimia nervosa and anorexia nervosa binge/purging subtype are similar, but there is no weight loss or low weight criteria associated with bulimia nervosa (American Psychiatric Association, 2013).

Binge Eating Disorder

Binge eating disorder is marked by recurrent episodes of binge eating (i.e., in a discrete period of time, eating an amount of food that is larger than what most would eat in that time or circumstances, and with a sense of lack of control over eating; American Psychiatric

Association, 2013). A binge-eating episode is characterized by three (or more) of the following: eating more rapidly than normal, eating until uncomfortably full, eating large amounts of food when not physically hungry, eating alone due to feeling embarrassed by how much one is eating, and feeling disgusted with oneself, depressed, or very guilty after the episode. Individuals generally feel a sense of distress due to their binge eating. On average, binge eating episodes occur at least once a week for 3 months (American Psychiatric Association, 2013). Unlike bulimia nervosa, binge eating disorder is not associated with inappropriate compensatory behaviours (American Psychiatric Association, 2013).

Other Specified Feeding or Eating Disorder (OSFED)

The other specified feeding or ED category is used to describe individuals in which characteristics or symptoms of a feeding or ED causes clinically-significant distress in social and occupational situations, or in other important areas, but do not meet full criteria for any of the feeding or EDs (American Psychiatric Association, 2013). Clinicians or health professionals use this category to communicate specifically the reason(s) for which the individual does not meet the criteria for any specific feeding or EDs. Examples of reasons include atypical anorexia nervosa where all criteria for anorexia nervosa are met, except no significant weight loss was observed and the individual's weight is within or above the normal range; bulimia nervosa (of low frequency and/or limited duration) where all bulimia nervosa criteria are met, except the binge eating and compensatory behaviours occur, on average, less than once a week and/or for less than 3 months; binge eating disorder (of low frequency and/or limited duration) where all binge eating disorder criteria are met, except the binge eating episodes occur, on average, less than once a week and/or for less than 3 months, and; purging disorder which includes purging behaviours to manipulate weight or shape, such as vomiting, or using laxatives, diuretics, or

other medications with the absence of binge eating episodes (American Psychiatric Association, 2013).

Dysfunctional Exercise

The conceptualization of dysfunctional exercise is widely debated in the literature, with researchers using different terms, definitions, and assessment tools (Allegre et al., 2006). At least 31 different terms have been used to described dysfunctional exercise (Adkins & Keel, 2005), but the most commonly-used terms include excessive exercise, exercise addiction, exercise dependence, obligatory exercise, and CE (Berczik et al., 2012; Meyer & Taranis, 2011). Although there are nuances in each of these terms that infer slight differences in their meaning, they are often used interchangeably in research and practice, leading to subsequent confusion and difficulty studying the phenomenon (R. R. Davies, 2015). For example, the term exercise addiction is conceptualized based on theories of behavioural addiction (Brown, 1993), such as gambling addiction. De Coverley Veale (1987) used the term exercise dependence, which he compared to alcohol or drug dependence, and developed criteria to operationalize exercise dependence based on the DSM-IV criteria for diagnosing substance dependence (American Psychiatric Association, 2000). Other researchers have explained that the term addiction encompasses both compulsion and dependence (i.e., addiction = compulsion + dependence; Berczik et al., 2012; Szabo, 2010). Some researchers (e.g., Calogero & Pedrotty-Stump, 2010) prefer to use a broader term, such as dysfunctional exercise to encapsulate the range of possible dysfunctional exercise attitudes, beliefs, and behaviours. Regardless of the term used, definitions of dysfunctional exercise include either a quantitative component (i.e., frequency, volume, duration) and/or a qualitative component (i.e., obsessive, rule-driven; Meyer & Taranis, 2011). These various conceptualizations have been used to study dysfunctional exercise in different

populations including clinical samples (i.e., those with EDs) and non-clinical samples (i.e., those without EDs).

Compulsive Exercise

The term CE has received the most support, to date, as a clinically- and theoretically-appropriate term to describe dysfunctional exercise in both clinical and non-clinical samples (R. R. Davies, 2015; Meyer & Taranis, 2011; Mond & Calogero, 2009; Noetel et al., 2017). Particularly, the term compulsion is most suitable given that it emphasizes qualitative markers that are more indicative of dysfunctional exercise compared to quantitative measures. There is strong evidence indicating that exercise frequency and duration are unrelated to eating psychopathology, even in clinical samples (Meyer & Taranis, 2011). The negative psychological relationship people develop with exercise, such as feeling distress when ceasing or unable to exercise and developing obsessive exercise thoughts, is more indicative of a compulsive relationship with exercise than quantities of exercise (Noetel et al., 2017). Past research has shown that the compulsive dimension of exercise is positively and significantly associated with increased disordered eating attitudes and eating psychopathology (e.g., Adkins & Keel, 2005; Mond et al., 2004; Mond & Calogero, 2009). Given CE is often associated with higher eating psychopathology, it suggests the particular problematic nature of CE in clinical samples; therefore, my dissertation will focus mainly on CE among individuals with EDs.

Defining Compulsive Exercise

Although CE is not recognized as a clinical disorder in the DSM-5, outlining characteristics or criteria to define CE is beneficial for understanding CE for research and clinical purposes. A Delphi study was conducted with a panel of international experts in the field of EDs to synthesize clinical knowledge on defining, assessing, and treating CE among

adolescents with anorexia nervosa (Noetel et al., 2017). Panelists agreed CE was the most appropriate term to describe dysfunctional exercise, but the criterion for consensus was not achieved for defining CE. The experts did, however, come to a consensus on several characteristics of CE: exercise is excessive in frequency, intensity, and duration; exercise is used to compensate for caloric intake; the individual experiences distress when unable to exercise; the individual exercises despite pain, injury, or illness; exercise is performed in secret; exercise routines are rigid; exercise interferes with other aspects of one's life; the individual obsesses about exercise; the individual is driven to increase exercise intensity; and the individual has distorted beliefs about exercise (Noetel et al., 2017). Despite coming to a consensus on a number of characteristics of CE, there remains criteria researchers and clinicians cannot agree on (e.g., CE involves exercising despite a lack of enjoyment), warranting further research to come to a consensus definition.

Using the criteria characterizing CE by Noetel et al. (2017), Dittmer, Jacobi, and Voderholzer (2018) further contributed to the research by proposing a precise transdiagnostic definition of CE applicable to adolescents and adults with anorexia nervosa, bulimia nervosa, and OSFED. Through an iterative process, a panel of senior clinicians and researchers from the fields of clinical psychology, psychiatry, and exercise therapy proposed to define CE by two core criteria and one optional criterion (Dittmer, Jacobi, & Voderholzer, 2018). Criterion A emphasizes how individuals feel driven to engage in excessive exercise in response to an obsession or rigid rules. For these individuals, the goal of exercise is to prevent negative consequences or reduce distress, often based on distorted beliefs about exercise. Criterion B refers to engaging in CE as time-consuming (> 1 hour/day), which interferes with daily routines, occupations, or social relationships, or exercise is maintained despite injury, illness, or lack of

enjoyment. The optional criterion C addresses the notion that at some point during the course of CE the individual acknowledges that exercise is excessive or unreasonable. Given that not all individuals will recognize the impact of their CE, it remains an optional component of the definition (Dittmer, Jacobi, & Voderholzer, 2018). Furthermore, three CE subtypes were proposed: (1) vigorous exercise, (2) a marked increase in daily movement, and (3) motor restlessness. Vigorous exercise refers to engaging in strenuous exercise activities, like regularly running, cycling, swimming, resistance training, etc., despite being underweight or feeling physically weak. A marked increase in daily movements includes an increase in activities such as walking or biking to work instead of taking the car or bus, taking the stairs instead of the elevator, strenuous housework, taking long walks independent of the weather, and standing instead of sitting for prolonged periods. Motor restlessness describes difficulty with sitting still and includes movements such as arm movements, leg fidgeting, and tensing and releasing muscles (Dittmer, Jacobi, & Voderholzer, 2018)

Bratland-Sanda et al. (2019) raised some issues around the proposed definition of CE, noting there should be a difference between exercise obsessions (i.e., rigid rules and the need to exercise) and CE behaviours (i.e., the exercise behaviours themselves). The emphasis on the excessive and time-consuming components of CE underestimates the burden caused by obsessive exercise thoughts, particularly among individuals not engaging in substantial amounts of exercise. The “exercise paradox” has been used to describe individuals who display high levels of CE, creating psychological burden, but objectively engage in a low volume of exercise (< 150 minutes of physical activity per week), often present in bulimia nervosa and binge eating disorder. For example, individuals may have obsessive beliefs around the need to exercise to create a self-image of being healthy, to seek benefits from being socially admired by peers for an

active lifestyle, to counteract a binge, and/or to avoid shame or guilt associated with purging, yet fail to translate such intentions or beliefs into actions. As such, Bratland-Sanda et al. (2019) proposed to include a fourth subtype of CE, called "excessive obsessions," to account for those who may experience the exercise paradox. Advocating for such a subtype is to ensure that individuals who are not physically engaging in excessive exercise receive the recognition and appropriate treatment for the psychological burden and focus on promoting healthy exercise motives and enjoyment (Bratland-Sanda et al., 2019). Although the proposed definition was developed for those with anorexia nervosa, bulimia nervosa, and OSFED, the suggested inclusion of the excessive obsessions subtype could make the definition applicable to individuals with binge eating disorder as well.

The current definition proposed by Dittmer, Jacobi, and Voderholzer (2018) includes the term "excessive exercise" in Criterion A and Criterion B refers to CE as time-consuming (> 1 hour/day). The authors stress the importance of determining whether exercise is excessive by taking into account the individual's physical condition, energy intake, BMI, age, and gender. Additionally, the 1-hour cut off for exercise in Criterion B was set based on the recommendations from the World Health Organization's recommendations for physical activity, which are up to 1 hour a day for adolescents and 150 minutes per week for adults. Given these quantities were developed for healthy adolescents and adults, the researchers conclude surpassing 1 hour a day would be harmful for those with an ED (Dittmer, Jacobi, & Voderholzer, 2018). Despite the fact that research supports that the quantity of exercise is unrelated to eating psychopathology (e.g., Meyer & Taranis, 2011; Mond & Calogero, 2009), there remains criteria and conversations around quantities of exercise and CE. It is evident that researchers and clinicians need to continue to work towards a common conceptualization of CE.

Compulsive versus compensatory exercise. The differences or nuances between compensatory exercise versus CE have been briefly discussed in the literature. Compensatory exercise describes exercise used to compensate for the effects of caloric intake (food or drinks) on weight or shape (American Psychiatric Association, 2013). According to this definition, individuals exercise solely to alter weight and shape. Contrarily, CE describes engaging in exercise for a broader set of reasons, such as to prevent or reduce feelings of distress (Meyer & Taranis, 2011). Previous research has shown that individuals with EDs engage in exercise for a variety of reasons, not just as a means to control weight and shape, but for affective or cognitive reasons as well (e.g., Meyer et al., 2011). CE may capture aspects of compensatory exercise, without the two being synonymous (L. A. Holland et al., 2014), whereby compensatory exercise describes a narrower motive for exercise compared to CE.

Prevalence of Compulsive Exercise across Eating Disorder Types

The prevalence of CE and how it varies among ED types has been examined among a number of studies with mixed findings. However, two recent studies with large sample sizes (one among adolescents and the other among adults) from a specialized ED unit in Sweden have provided some clarity. Among a sample of 3,255 adolescents with EDs (95.7% girls), 36% of girls and 29% of boys reported CE, and the prevalence of CE significantly differed across ED types (Levallius et al., 2017). The highest rate of CE was reported in adolescent girls with bulimia nervosa (50%), followed by EDNOS (40%), and anorexia nervosa (26%). Among the boys, similar rates of CE were observed in EDNOS and anorexia nervosa (where bulimia nervosa was omitted due to low diagnostic rates; Levallius et al., 2017). Among the sample of 9,117 adults with EDs (96.4% women), just under 50% of the sample reported experiencing CE, with women reporting slightly higher rates (48.2%) than men (45.5%; Monell et al., 2018). The

prevalence of CE differed significantly between ED types, where patients with EDNOS experienced the highest rates, followed by bulimia nervosa, anorexia nervosa, and then binge eating disorder (Monell et al., 2018).

Development and Maintenance of Compulsive Exercise

The factors involved in the development and maintenance of CE are still under investigation (Costa et al., 2016). This is not surprising given that the exact etiology of many mental illnesses, including EDs, are unknown, and the same can be said for CE (Costa et al., 2016; L. A. Holland et al., 2014). There has been considerable research investigating the etiology of EDs, with evidence indicating it likely involves a complex interplay of biological (e.g., genetic inheritance), psychological (e.g., personality), and sociocultural factors (e.g., media exposure; Culbert et al., 2015). The research examining the etiology of CE is less advanced, mainly consisting of studies with correlational designs, limiting the ability to make strong conclusions about causal factors of CE. Gradually, there are more studies being published that used longitudinal designs. Gorrell et al. (2021) conducted a systematic review of 18 articles on psychosocial variables that have found to be longitudinally associated with CE in the context of EDs. The variables demonstrating strong associations with CE across multiple studies included weight and shape concerns (e.g., body dissatisfaction, muscularity), thin-ideal internalization, affect regulation, and obsessive-compulsiveness. Based on the strength of the evidence, weight and shape concerns and negative affect were the two most reliable factors associated with CE (Gorrell et al., 2021). Meyer et al. (2011) conducted an extensive review solely on the psychological correlates of CE in the presence of eating psychopathology and developed the cognitive behavioural model of CE (Figure 1) to explain the potential factors involved with the etiology, development, and maintenance of CE from a cognitive behavioural perspective. They

identified four key correlates of CE: eating psychopathology, affect regulation, obsessive-compulsiveness, and perfectionism (Meyer et al., 2011). Further research has investigated other psychological factors related to CE such as personality traits (e.g., narcissism, neuroticism, and extraversion). Similar to the cognitive model developed by Meyer et al. (2011), White and Halliwell (2010) proposed a sociocultural model to predict excessive exercise (see Figure 2). Psychosocial body image indicators (e.g., body dissatisfaction, thin-ideal internalization, and appearance-based pressures) and sociocultural factors (e.g. media exposure) associated with CE will be discussed. Given the limited research on factors involved in the development and maintenance of CE, not all studies were among a clinical sample of individuals diagnosed with EDs, but among samples with ED symptomology.

Psychological Factors

Eating Psychopathology. Eating psychopathology appears to be the strongest predictor of CE. The symptomatology of CE and EDs are very similar, with CE and EDs showing high comorbidity (Lichtenstein et al., 2017). Eating psychopathology is characterized by a persistent disturbance of eating or eating-related behaviours that results in altered consumption or absorption of food which significantly impairs physical health or psychosocial functioning (Castellini et al., 2014). Individuals can present with varying levels of eating psychopathology, falling along a spectrum of eating-related problems that can range from dieting, to disordered eating, to clinical EDs (American Psychiatric Association, 2013). When individuals present with lower levels of eating psychopathology, they may present with dieting behaviours. As people move along the spectrum towards disordered eating, individuals often experience irregular eating attitudes or behaviours, that are not necessarily severe enough to result in an ED diagnosis

(American Psychiatric Association, 2013). At the other end of the spectrum, with higher levels of eating psychopathology, lies clinical ED diagnoses, as described in the DSM.

The same distinctive psychopathology underlies EDs and subclinical EDs, such as dietary restraint, binge eating, compensatory purging, body checking, and weight preoccupation. (Castellini et al., 2014). Additionally, individuals with EDs often experience issues with unhealthy beliefs, attitudes, and behaviours surrounding exercise. The notion of CE has been documented in the literature for decades, but with a growing focus on research investigating the links between CE and EDs.

The association between CE and eating psychopathology has been reported in both clinical and non-clinical samples. Among clinical eating disordered samples, CE was significantly associated with higher scores on measures of eating psychopathology including weight and shape concerns, dietary restraints, drive for thinness, and body dissatisfaction (Meyer et al., 2011). Among 115 women with anorexia or bulimia nervosa, those with higher CE scores reported higher body dissatisfaction and distress from weight gain (i.e., characteristics of eating psychopathology) than women with lower CE (Brewerton et al., 1995). Mond and colleagues (e.g., 2004, 2009) have consistently reported that eating psychopathology is strongly correlated with the *exercising for weight or shape control* dimension of CE, both in clinical and non-clinical samples of women. Among a non-eating disordered sample, CE was correlated with higher scores on measures of body dissatisfaction, eating and weight restriction, drive for thinness, and bulimic tendencies (Meyer et al., 2011). Attributes of CE, including feelings of intense guilt when exercise cannot be performed and exercising for weight and shape concerns, were more strongly associated with higher levels of eating psychopathology than other dimensions of CE in a sample of 498 non-clinical women (Taranis & Meyer, 2011). There is

clear evidence to support that eating psychopathology is strongly related to CE in both clinical and non-clinical samples.

Affect Regulation. Exercise is well-known for its affect regulatory role, meaning exercise can be helpful in maintaining or increasing positive feelings and minimizing or regulating negative feelings. In fact, affect regulation is one of the most commonly-endorsed motives for exercise among the general population (Callaghan, 2004). Among eating disordered populations, CE serves as a dysfunctional coping mechanism to manage uncomfortable emotions (Meyer et al., 2011). CE and eating psychopathology have been associated with negative affect and mood disorders in clinical ED and non-clinical ED populations, highlighting the role CE can play as a mood modulator (Meyer et al., 2011). Within eating disordered samples, elevated levels of negative affect were associated with CE, and the relationship between drive for thinness and physical activity levels was most pronounced among the women reporting the highest levels of negative affect (e.g., Brewerton et al., 1995; Vansteelandt et al., 2007). Within non-clinical samples, CE has also been associated with increased levels of negative affect. Thome and Espelage (2004) surveyed 324 university students (n = 235 women), and found that among women with higher severity of eating psychopathology, exercise was associated with negative affect and higher levels of depression and anxiety. CE has also been found to be associated with high levels of anxiety and depression in clinical samples of men and women (e.g., Brewerton et al., 1995; Thome & Espelage, 2004). Overall, these results indicate that when people experience high levels of negative affect, anxiety, or depression, they may engage in CE to compensate for or suppress the adverse emotional states.

CE may become the primary or only means to alleviate or prevent negative mood states within a clinical ED population. As a result, researchers have proposed that CE is maintained as

an affect regulation strategy (Geller et al., 2000). People with EDs most often endorse affect regulation as the reason for initiating and maintaining CE (American Psychiatric Association, 2000). Within the literature, there are two proposed affect regulation mechanisms for the maintenance of CE: positive reinforcement and negative reinforcement (Meyer et al., 2011).

Positive Reinforcement. Exercise is known for its mood boosting effects and post-exercise euphoric states. However, CE is typically not characterized by positive reinforcement as few compulsive exercisers maintain exercise for its euphoric states (Davis, 2000). Among individuals with an ED, exercise for enjoyment is one of the least endorsed motives, and exercise is primarily maintained for secondary reinforcing factors, such as weight and shape changes (Fairburn et al., 2003), followed by affect regulation (Geller et al., 2000).

Negative Reinforcement. Exercise can help reduce negative affective states; however, CE is primarily maintained as a means to mitigate the negative affective withdrawal symptoms that can occur if exercise is not performed (Bamber et al., 2003; Hausenblas & Symons Downs, 2002a), creating a form of negative reinforcement (Meyer et al., 2011). Withdrawal symptoms have been deemed the cardinal characteristic of CE (Szabo, 1995) and have received considerable support as a characteristic of CE (Meyer et al., 2011). Withdrawal symptoms are described as psychological effects that occur when exercise cannot be performed, which manifests into either emotional symptoms or leads to further exercise to avoid such symptoms (American Psychiatric Association, 2000). The most commonly-reported withdrawal symptoms include guilt, anxiety, depression, irritability, restlessness, tension, and sluggishness (Bamber et al., 2000), and can appear in as little as 24-hours without exercise (Sachs, 1981). The experience of withdrawal symptoms has been documented in both clinical ED and non-clinical ED samples

(Szabo, 1995). Perhaps CE develops and is maintained by the need for mood modulatory strategies and to avoid withdrawal symptoms from exercise.

Personality Traits. Associations between CE and several personality traits has been examined, including obsessive-compulsiveness, perfectionism, and narcissism. CE is often viewed as related to obsessive-compulsiveness, and most personality research on CE has focused on the association with obsessive-compulsive personality traits or symptomatology (Meyer et al., 2011). In a sample of women clinically diagnosed with EDs (n = 64), an association was found between CE, obsessive beliefs, and obsessive-compulsive behaviours, which was not present in the healthy controls (n = 75). CE has also been consistently linked with high levels of perfectionism in clinical and non-clinical samples (e.g., Hausenblas & Symons Downs, 2002b; Shroff et al., 2006). Hausenblas and Symons Downs (2002b) administered measures of CE and perfectionism to a sample of 862 university students (50% men). Results from the cross-sectional survey indicated that the student group at-risk for CE scored significantly higher on perfectionism versus those not at risk. Among a sample of 169 regular exercisers, perfectionism and CE were positively correlated (Costa et al., 2016). People with narcissistic tendencies may exercise as a means to enhance self-worth. Narcissists focus attention to external aspects of their body and require approval from others, thereby engaging in exercise for fitness and appearance-based motives (Miller & Mesagno, 2014). Miller and Mesagno (2014) found a positive correlation between CE and narcissism among a sample of 90 regular exercisers. Additionally, they found that a combination of narcissism and perfectionism predicted a larger degree of CE than either construct alone (Miller & Mesagno, 2014), indicating a combination of personality traits may put a person further at risk for developing CE.

Psychosocial and Sociocultural Factors

The majority of research on the development and maintenance of CE has investigated the psychological factors associated with CE, but these factors can also be influenced by psychosocial and sociocultural factors, such as the media, thin- and fit-idealization, body image concerns, and pressure from family and friends. There is a growing body of literature investigating psychosocial and sociocultural factors related to CE. The proposed model by White and Halliwell (2010) was adapted from a sociocultural model predicting disordered eating with the goal of now predicting excessive exercise (see Figure 2). Excessive exercise within this model was conceptualized to include both quantitative (i.e., frequency and duration of exercise) and qualitative (i.e., a compulsive need for exercise) components, aligning with the concept of CE. White and Halliwell (2010) proposed that sociocultural pressure (i.e., perceived pressure from family, friends, and the media to lose weight, to build muscles, and modeling of behaviours to change appearance) would be directly related to the focus on exercise (i.e., frequency, duration, and importance of exercise) and a compulsive need for exercise (i.e., CE). Additionally, the relationship between sociocultural pressure and exercise outcomes would be mediated by investment on appearance (i.e., importance placed on being attractive and managing appearance) and body image disturbance (including negative body affect, body dissatisfaction, and body anxiety). The model was tested among a sample of 412 adolescents (M_{age} = 14.94, SD = 1.17). Findings showed that a focus on exercise (i.e., frequency, importance, and duration of exercise) did not play a role in the model. The relationship between sociocultural pressure and a compulsive need to exercise was fully mediated by investment on appearance and body image disturbances. These findings suggest that sociocultural factors can play a role in developing CE.

Media. Mass media, including television, movies, magazines, among others have been identified as the most pervasive and powerful sources that perpetuate appearance-based ideals and social influences (Groesz et al., 2002). With advancements in technology, digital media and social media sites have become widespread in the lives of all individuals, including adolescents and young adults (Derenne & Beresin, 2018). Social media, particularly platforms that rely heavily on visuals (e.g., Instagram), have been criticized for their potential negative consequences on the psychological well-being of its users. There is a seemingly endless stream of images promoting the thin-ideal, and more recently the fit- or athletic-ideal (characterized by things like a toned abdomen, firmer lower body, and muscular upper body), with a growing amount of literature investigating the role of media with CE. Sumter et al. (2018) explored exposure to fitspirational social media content and its relationship to CE. A sample of 359 women (M_{age} = 22.53 years, SD = 2.62) were asked how often they visited each of the following four types of fitspirational social media accounts on average during the past three months: fitness, healthy eating, weight loss, and mental-wellbeing accounts. Results indicated the average frequency of viewing all four types of fitspiration content was positively related to CE, and viewing fitness content in particular was predictive of CE. Fit-ideal internalization was positively related to all four types of fitspirational social media use, and thin-ideal internalization moderated the relationship between weight loss fitspirational social media use and CE (Sumter et al., 2018). G. Holland and Tiggemann (2017) examined ED symptoms and CE among a sample of women who posted fitspiration photos (i.e., photos designed to inspire a healthy lifestyle through exercise and eating well) on Instagram compared to women who posted travel photos. Findings from this cross-sectional study indicated that women who posted fitspiration photos

reported higher scores on CE and ED symptoms (bulimia, drive for muscularity and thinness) compared to women posting travel photos (G. Holland & Tiggemann, 2017).

Thin- and Fit-Idealization. Within the ED literature, media exposure, thin-ideal internalization, and perceived pressure to be thin have prospectively predicted increased levels of eating psychopathology among adolescent girls and young women (e.g., Culbert et al., 2015). Within the CE literature, researchers have focused on the thin-ideal but further included the fit- or athletic-idealization. In a cross-sectional study with 388 women (M_{age} = 21.46, SD = 4.51), athletic-ideal internalization was positively correlated with ED symptoms (dieting and bulimic symptoms) and CE (Bell et al., 2016). Homan (2010) conducted a longitudinal study among 156 college women (M_{age} = 19.2, SD = 1.1) and found that, at baseline, athletic- and thin-ideal internalization were positively associated with dieting, body dissatisfaction, and CE. Baseline athletic- and thin-ideal internalization both uniquely predicted increases in CE over a 7-month period, suggesting that both appearance-based ideals individually lead to a negative relationship with exercise (Homan, 2010). Martin and Racine (2017) extended previous research by investigating associations between personality traits (neuroticism, extraversion, and conscientiousness), thin- and athletic-idealization, body dissatisfaction, and CE among 531 university students. CE was found to be positively correlated with body dissatisfaction, thin- and athletic-ideal internalization, and extraversion. Higher levels of neuroticism, extraversion, and conscientiousness were all significantly related to CE, mediated by athletic-ideal internalization. Thin-ideal internalization did not mediate any relationships between personality traits and CE. Findings suggest that distinct personality traits are associated with CE, through the internalization of athletic ideals.

Body Dissatisfaction. Several studies also solely examined the relationships between body image concerns (e.g., body dissatisfaction) and CE. In a cross-sectional study among a sample of exercise practitioners (M_{age} = 26.58, SD = 7.76), whereby 80% of them demonstrated ED symptoms, body dissatisfaction was positively and significantly associated with CE (Freire et al., 2020). Gori et al. (2021) further explored associations between body dissatisfaction, body image concerns, and CE among a sample of regular exercisers (with approximately 64% of the sample reporting at least one ED symptom). Body dissatisfaction and body image concerns were both individually and significantly related to CE (Gori et al., 2021).

Pressure from Family and Friends. In a prospective 12-month study among 332 adolescents, Goodwin et al. (2014) investigated potential longitudinal sociocultural risk factors for CE among boys and girls (ages 13 to 15 years). Among the boys, messages or comments from family and peers to be more muscular were predictive of CE, and among the girls, feeling pressure to be thin from the media predicted CE. These associations remained true when eating psychopathology was controlled for, but the associations disappeared when baseline scores of CE were considered. These findings suggest a compulsive drive for exercise may be distinct from general eating psychopathology, and specific sociocultural risk factors for CE must be addressed. Furthermore, Lease et al. (2016) examined the association between negative messages on weight and exercise expressed by their mother and CE among a group of 298 young women gym goers. The participants completed measures of maternal weight messages, body image, exercise, and disordered eating. When controlling for disordered eating, it was apparent that negative maternal messages about weight and eating were associated with CE attitudes and behaviours among the young women. Disordered eating among the gym goers was also

positively significantly correlated with CE (Lease et al., 2016). Collectively these studies suggest pressure from family and friends to look a certain way may lead to the development of CE.

Summary

There are a number of psychological and sociocultural factors that are independently and collectively associated with CE. There is a growing number of longitudinal studies examining the relationships between these factors and CE, but more research is needed to develop stronger associations and perhaps even some causal links of CE. Without clearly documented risk and maintenance factors, effective prevention and treatment efforts for CE have been hindered. Preventing and treating CE is particularly important given the negative consequences that can arise from CE, and particularly among individuals who have an ED.

Consequences of Compulsive Exercise

Healthy exercise is associated with many positive benefits, both physically and psychologically (Piercy et al., 2018). However, when exercise becomes compulsive, there is the risk of experiencing physical and psychological problems, disrupting proper daily functioning, and developing conflicts within social relationships (Weinstein & Weinstein, 2014). The consequences of CE may differ considerably between individuals and may be further exacerbated by ED symptomology, the level of eating psychopathology, the type of ED, quantities of exercise, etc., that can vary among individuals.

Physical Consequences

The physical consequences associated with CE are often a result of engaging in high amounts of exercise. Although it is the cognitive relationship to exercise that is more indicative of CE (Meyer & Taranis, 2011), CE is also characterized by engaging in exercise despite injury and illness (Dittmer, Jacobi, & Voderholzer, 2018) which can further negatively impact physical

health. Some of the negative physical consequences of CE can include overuse injuries (e.g., stress fractures), amenorrhea in women, cardiac complications, and endocrine, metabolic, and immune dysfunction. Furthermore, individuals may experience persistent fatigue and sleep disturbances (Hausenblas et al., 2017; Noetel et al., 2016). In a series of validation studies of the Exercise Dependence Scale which included 2,420 participants, it was found that people at risk for exercise dependence scored highest on the belief they could exercise in light of pain and discomfort, indicating their desire to exercise at all costs (Hausenblas & Symons Downs, 2002b).

Psychological Consequences

Perhaps the most detrimental consequence of CE is the role it plays in the etiology, development, and maintenance of eating psychopathology (Dalle Grave, 2009; Davis et al., 1994). As previously discussed, eating psychopathology has been proposed to play a role in the maintenance of CE (Meyer et al., 2011); however, there is more evidence to support the reciprocal relationship. Among individuals with EDs, CE has been identified as one of the last symptoms to subside (Davis et al., 1994), has been associated with longer treatment times, and has been predictive of shorter periods between ED relapse (Hay et al., 2018). CE has been associated with elevated ED symptomology, including dietary restraint, drive for thinness, weight and shape concerns, body dissatisfaction, perfectionism, and lower BMI (Fietz et al., 2014). These findings highlight the serious detrimental implications of CE for the recovery and treatment of EDs.

CE has also been associated with lowered quality of life. In a sample of 169 healthy women who frequently exercise, CE and eating psychopathology were associated with reduced quality of life. Weight control and feeling guilty after missed exercise were the two dimensions of CE most negatively correlated with quality of life. However, when eating psychopathology

was controlled for, there was no association between CE and quality of life, perhaps highlighting that CE may not be as clinically relevant without the presence of eating psychopathology (Mond et al., 2004). Cook et al. (2014) conducted a similar study investigating the relationship between CE, EDs, and an ED-specific measure of health-related quality of life among 387 female university students (of which 43 met diagnostic criteria for an ED). CE and EDs were associated with lowered health-related quality of life, and EDs and CE may interact to further exacerbate lowered quality of life (Cook et al., 2014). Both of these studies have shown the harmful role eating psychopathology can play in the relationship between CE and reduced quality of life. Young et al. (2018) investigated quality of life and CE in a sample of 78 individuals with EDs and found CE was moderately correlated with low ED quality of life, and lower general physical-health quality of life. Overall, the negative impact of CE on quality of life may be further exacerbated by eating psychopathology, highlighting the need to address both CE and eating psychopathology to help improve quality of life.

Social Consequences

When exercise becomes compulsive and a central priority in one's life, interpersonal relationships can be hindered and can lead to social isolation. For example, CE can lead to marital strain and worsened relationships with colleagues at work, family members, and/or friends (Landolfi, 2013). However, research into the social consequences that arise from CE is scarce. It is apparent that social activities can be hindered by CE given its inclusion in the Exercise Dependence Scale (Hausenblas & Symons Downs, 2002b). One subscale is the Reduction in Other Activities which assesses the degree to which social, occupational, or recreational activities are disrupted or reduced due to exercise. For example, items include, "My exercise interfered with work/school responsibilities" or "I decline social initiations because they

interfere with my exercise" (Hausenblas & Symons Downs, 2002b). This subscale of the questionnaire highlights the negative social consequences of CE. Scores on the Reduction in Other Activities subscale were also significantly higher among a sample of 46 women from an ED inpatient clinic compared to age-matched healthy controls (n = 51; Bratland-Sanda et al., 2011). Additionally, a case study conducted on a 25-year-old women with CE found she was falling behind in schoolwork, her long-term relationship ended, and she was financially in debt due to supporting her extreme levels of exercise (Griffiths, 1997). Given the negative consequences that can arise from CE, interfering with several domains of an individual's life, it is evident that preventing the onset of CE or treating it is important for the overall well-being of an individual.

Prevention and Treatment of Compulsive Exercise

There are several factors hindering the current prevention and treatment efforts of CE. First, the field is plagued with various terms, conceptualizations, definitions, and assessment tools for CE (Allegre et al., 2006). Only recently has CE been deemed the most appropriate term for dysfunctional exercise in the context of eating psychopathology, and an international consensus on a clear definition has yet to be determined (Dittmer, Jacobi, & Voderholzer, 2018; Noetel et al., 2017). Second, as previously discussed, research findings have only documented factors associated with CE (Costa et al., 2016; Egorov & Szabo, 2013), which makes it difficult to develop effective prevention programs targeting uncertain risk factors. Similarly, without a clear description of the factors that lead to the maintenance of CE, treatment approaches are hindered. Third, there is no agreement among clinicians or healthcare professionals about what constitutes healthy exercise among individuals being treated and recovering from an ED and CE (S. Davies et al., 2008). If the goal of treatment for CE is to regulate and (re)establish healthy

exercise (Hausenblas et al., 2017), a clear conceptualization of healthy exercise is needed to assess treatment goals and recovery outcomes. Despite these limitations, researchers have focused their efforts mainly towards treating CE, with almost no research on prevention efforts.

Compulsive Exercise Prevention

The ultimate goal would be to prevent CE initially, but there is a scarcity of research focused specifically on CE prevention. Yager and O'Dea (2010) implemented an intervention to promote healthy body image, reduce ED risk, and prevent excessive exercise for trainee health and physical education teachers. Although details were provided about the topics covered in the intervention, it was unclear specifically which elements of the intervention targeted the prevention of excessive exercise (Yager & O'Dea, 2010). The goal of prevention research is to target the risk factors that lead to the onset of CE (L. A. Holland et al., 2014). As previously explained, the field of research investigating risk factors for the onset of CE is limited (Costa et al., 2016; Egorov & Szabo, 2013), which makes it difficult to develop prevention programs to target these unknown risk factors. One approach toward preventing CE can be the prevention of EDs, and there is an extensive field of literature focused on the prevention of EDs. Given there is more evidence and hypothesized models to support the maintenance factors of CE (Szabo, 2010), there is currently more research investigating possible treatments for CE.

Compulsive Exercise Treatment

The goal of treating CE is not to eliminate exercise completely, but to help individuals recognize and reduce their maladaptive cognitions and behaviours, and to regulate and (re)establish a healthy relationship with exercise (Hausenblas et al., 2017). Although treatment for EDs has been well documented and established (e.g., Cooper & Fairburn, 2013), there is little agreement as to the "best" treatment for CE (Lichtenstein et al., 2017). CE and EDs share a high

comorbidity (Lichtenstein et al., 2017), but when these conditions co-occur the risk is that only one will be addressed—typically the ED—with the assumption that treating the ED will treat CE as well (Calogero & Pedrotty-Stump, 2010; Freimuth et al., 2011). Although EDs and CE exert a significant maintaining effect on each other, there are subtle, but crucial differences, highlighting the importance of explicitly addressing CE and the ED to successfully treat them both (Taranis et al., 2011; Touyz et al., 2017). Despite the need for protocols to treat CE, there remains a lack of standardized guidelines for assessing and treating CE among individuals with EDs (Touyz et al., 2017).

There is a growing field of research aimed at developing approaches to treating CE and implementing them within ED treatment, with the hopes of eventually developing standardized protocols. Researchers have also proposed potential guidelines to treat CE based on previous literature (Cook et al., 2016) and clinical experiences treating CE in an inpatient ED treatment center (Danielsen et al., 2018). Current proposed recommendations include: (a) assessing exercise psychopathology at ED treatment admission, (b) implementing a multidisciplinary treatment team approach with exercise specialists, (c) incorporating regular exercise sessions while ensuring patient safety, and (d) incorporating exercise psychoeducation (Cook et al., 2016; Danielsen et al., 2018). The two recommendations that have received the most attention and support include exercise sessions and psychoeducation.

Exercise Sessions. Clinicians have commonly prescribed bed rest and abstinence during ED treatment as they feared exercise would be an obstacle for weight restoration. However, ceasing exercise completely during treatment has been proposed as unrealistic and potentially detrimental to health outcomes in the long run (R. R. Davies, 2015). Removing the opportunity to exercise might exacerbate the lack of control patients already feel during treatment (Moola et

al., 2015), and it can be difficult for staff members to supervise or enforce exercise policies, leaving individuals engaging in covert activity (R. R. Davies, 2015; Moola et al., 2015). Restricting or ceasing exercise has been associated with negative withdrawal symptoms, like guilt, irritability, anxiety, and depression (Meyer et al., 2011). Individuals in treatment are left confused about what are considered "normal" or "healthy" levels of exercise, which can lead individuals to resume unhealthy exercise post-treatment or lead people to fear movement after treatment as it might lead to a relapse (Moola et al., 2015). Restricting or prohibiting exercise during treatment can prove to be challenging and detrimental for treatment outcomes and recovery.

Although the historically-based practice of exercise abstinence during treatment remains predominant, there is growing evidence that challenges this notion. There is empirically-based support for the positive benefits of exercise during treatment (Cook et al., 2016; Meyer et al., 2008; Scott & Blyderveen, 2014). Several reviews have examined positive outcomes among individuals with various EDs when implementing exercise during treatment (that is deemed medically safe for patients and is nutritionally supported). Among individuals with anorexia nervosa, exercise training did not compromise weight gain, and in some cases led to increased weight gain, with additional improvements in quality of life, psychological well-being, and eating psychopathology (Moola et al., 2013; Ng et al., 2013). In a review of exercise interventions among individuals with anorexia nervosa, bulimia nervosa, and EDNOS, positive impacts on body composition, body satisfaction, quality of life, and mood states were reported (Hausenblas et al., 2008). These findings contradict the commonly held belief that exercise further exacerbates eating psychopathology and hinders weight restoration, and highlights other positive benefits of exercise during treatment.

Given the evidence supporting that exercise can be safely performed during ED treatment, researchers have implemented exercise as a means to help address and treat CE. Following proposed recommendations, exercise sessions for treating CE should involve various forms of movement and be delivered in a graded format (Cook et al., 2016). This would involve introducing individuals initially to light-intensity exercise, like yoga, stretching, posture and balance work, and walking, before progressing into moderate- or high-intensity exercises like aerobic and resistance training, and outdoor or sport activities (e.g., Calogero & Pedrotty, 2004). Exercise should be tailored to the individual, given their unique needs. Individuals should also reconnect with exercise or movement that provides them joy and social connection (Dittmer, Voderholzer, et al., 2018).

Exercise Psychoeducation. Psychoeducation is a treatment approach that teaches the knowledge and skills to cope with or overcome challenges related to a mental health disorder or syndrome (Pettersen et al., 2011). Psychoeducation can be a powerful treatment approach to address the negative exercise attitudes and beliefs that maintain CE. Based on previous recommendations and literature (Cook et al., 2016; Danielsen et al., 2018; Hay et al., 2018), psychoeducation for CE can include information about what constitutes healthy exercise mentally and physically; training principles; body awareness and body-oriented therapy; benefits of rest and relaxation; debriefing on thoughts evoked during exercise; cognitive skills to challenge negative attitudes, beliefs, and behaviours toward exercise; exploring alternative coping mechanisms; and relapse prevention. Psychoeducation can be essential for challenging the dysfunctional attitudes and beliefs about exercise, weight, and shape that maintain CE.

Treatment Programs. To date, several studies have tested CE treatment programs within ED treatment, incorporating some, if not many, of the proposed recommendations from

Cook et al. (2016) and Danielsen et al. (2018). The Loughborough Eating-Disorders Activity Programme (LEAP) was designed as the first cognitive behavioural therapy-based treatment for CE targeting individuals with anorexia nervosa (Hay et al., 2018; Touyz et al., 2017). The program was designed based on the cognitive behavioural model of CE (Figure 1; Meyer et al., 2011), mainly relying on exercise psychoeducation to teach individuals the knowledge and skills needed to regain control over exercise cognitions and behaviours (Hay et al., 2018). The Healthy Exercise Behaviour intervention was developed by Dittmer, Voderholzer, et al. (2018) to reduce the compulsive quality of exercise, develop a more flexible exercise regimen, (re)establish healthy exercise behaviours, and teach individuals how to re-experience joy, social interactions, and relaxation when exercising. The program is manual-based, but additionally included exercise sessions that progressively increased in intensity and variety of exercise activities (Dittmer, Voderholzer, et al., 2018). The Freiburg sport therapy program was created for individuals with anorexia and bulimia nervosa in outpatient treatment to reduce unhealthy exercise, drive for thinness, and body dissatisfaction (Schlegel et al., 2015). The sport program involved group sessions that included an initial check-in, an educational topic incorporating aspects of psychoeducation, an hour of playing sports, and concluded with reflections and potential homework for next week, such as self-monitoring of exercise behaviour (Schlegel et al., 2015). The treatment interventions have all shown varying degrees of success, but more research is needed to understand the effectiveness of current programs and continue to develop and test alternative programs to determine which approaches may be “best” for treating CE.

Research-Clinical Gap

Researchers are reporting positive findings of incorporating exercise during ED treatment and using psychoeducation to treat CE, and are optimistic about the potential implications for

clinical practice (Quesnel et al., 2018). However, health professionals working in clinical settings appear to be more hesitant. Health professionals in the field of EDs have said that exercise during treatment is almost a taboo area, but there is the perception that exercise plays an "unofficial role" in treatment (Quesnel et al., 2018). However, with no clear evidence-based guidelines for best practices, health professionals report a lack of knowledge about how to safely prescribe exercise and how to effectively incorporate it during treatment (e.g., Calogero & Pedrotty, 2004; Touyz et al., 2017). There is a culture of the "fear of unknown" when integrating exercise in practice. Without proper protocols, health professionals fear exercise will cause regressions in recovery, patients will not meet nutritional requirements with the additional energy expenditure, exercise will further damage physical health, such as lead to cardiac complications, and exercise during treatment will lead to negative long-term outcomes (Quesnel et al., 2018). Nonetheless, there is a gap between research and clinical practice, and without clear protocols and guidelines for incorporating exercise safely during ED treatment and how to effectively treat CE, many professionals avoid, or hesitate, to translate research into practice (Calogero & Pedrotty, 2004).

While clinicians avoid addressing exercise in treatment, individuals with CE and EDs are calling for improvements in how exercise is addressed in treatment. In a number of qualitative studies, individuals with anorexia nervosa and CE described how treatment often involved the complete cessation of exercise (Chubbs-Payne et al., 2021; Kolnes & Rodriguez-morales, 2016; Moola et al., 2015; Young et al., 2015). Engaging in activity could result in being removed from treatment, although most participants reported exercising covertly. Participants left treatment either unsure about what constitutes "normal" exercise or resumed exercise, relapsed, and returned to treatment. Fortunately, a small sample of adolescent girls and young women in

treatment had access to structured exercise programs and psychoeducation. They found learning about healthy exercise and receiving support while exercising to be beneficial. For those in recovery, participants tried to engage in novel forms of exercise or novel exercise settings and found healthy reasons to exercise. Patients recommended safely incorporating exercise in treatment through psychoeducation and counselling to prepare them for post-treatment exercise (Chubbs-Payne et al., 2021; Kolnes & Rodriguez-morales, 2016; Moola et al., 2015; Young et al., 2015).

Rationale and Purpose

CE impacts a high proportion of individuals with all types of EDs, leading to a number of consequences, both solely due to CE and due to its role in further exacerbating the ED. The etiology of CE is unknown, but is highly related to EDs, and is associated with a number of biological, psychological, and social factors. There is a growing number of studies investigating CE treatment, but there remains a gap between research-based knowledge, clinical practice, and the needs and desires of individuals with CE. In order to develop effective prevention and treatment efforts, it takes a shared understanding amongst academics, healthcare professionals, and those with lived CE and ED experience, of what it is to experience all phases of CE. Therefore, the overall purpose of my dissertation was to explore experiences living with, being treated for, and recovering from CE among individuals with EDs. To address my overall dissertation purpose, we conducted a series of three studies. My first study (Chapter Three), sought to explore lived experiences of CE and EDs as shared on social media sites. The purpose of study 2 (Chapter Four) was to explore the complex interplay of psychological and sociocultural factors that influence the development, maintenance, treatment, and recovery from

CE. My last study (Chapter Five) aimed to examine current CE interventions and their impact on reducing or treating CE among clinical samples.

Bridging Text

Chapters One and Two provided an introduction and detailed summary of the literature on CE, with a focus on CE in the context of EDs. A number of limitations and gaps were identified in the literature, mainly the need for a deeper understanding of CE. One avenue that can help bridge the gap between research and clinical practice is through qualitative research (McGilley & Szablewski, 2010). Conducting qualitative research that sheds light on the personal experiences of living with, recovering from, and being treated for CE can help create a better understanding of CE. Most qualitative research, to date, has been limited by small, homogenous samples of females, mainly with anorexia nervosa (Brunet et al., 2021; Chubbs-Payne et al., 2021; Hockin-Boyers & Warin, 2021; Kolnes & Rodriguez-morales, 2016; Moola et al., 2015; Young et al., 2015). Chapter Three addresses the need to include more diverse voices of individuals with lived experience to further understand CE. Social media (e.g., Instagram and Twitter) has become a popular destination for individuals to openly share personal experiences, information, and ideas (Derenne & Beresin, 2018), and naturally provides a large, diverse sample of individuals which could be beneficial towards better understanding CE. Therefore, Chapter Three describes a manuscript that capitalized on the vastness of social media to capture many different voices and experiences with CE as shared in social media posts.

Chapter Three: Study 1

"Compulsive exercise is a socially acceptable prison cell": Exploring experiences with compulsive exercise across social media

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Abstract

Objective: Investigations into online eating disorder (ED) communities have allowed for a rich exploration of lived experiences focused on a number of aspects, such as recovery and support groups. There is a lack of understanding around compulsive exercise (CE), which is often a characterizing condition of EDs. Exploring the lived experiences of CE as discussed online could provide helpful insight towards a better understanding of CE. Therefore, the purpose of this study was to explore experiences around CE and EDs shared on social media sites. **Method:** Social media posts related to CE and EDs from Reddit, Twitter, Instagram, and forums were collected for 12 months. A thematic analysis of 881 posts was used to identify common themes among individuals' lived experiences with CE. **Results:** Five themes (and three subthemes) were identified across the social media posts: (1) seeking control, but ultimately CE takes hold, (2) burning off binges, but at what expense?, (3) recovery is a battle, but worth it, (4) is my exercise healthy?, and (5) frustration with comments about CE. **Discussion:** The lived experiences of CE among individuals with EDs have provided support for current definitions of CE and shared novel insight into the recovery experience. Individuals online also highlighted the need for improvement in treatment around CE specifically, and greater awareness around CE for the general public and healthcare providers.

Keywords: compulsive exercise, eating disorders, lived experience, qualitative research, recovery, social media

Introduction

Compulsive exercise (CE) is a concerning symptom of eating disorders (EDs) with as many as 85% of individuals with EDs experiencing CE (Fietz et al., 2014; Meyer et al., 2011). Among individuals with EDs, CE remains a significant barrier to recovery, as it is often one of the last symptoms to subside (Davis et al., 1994), is associated with longer treatment, and is predictive of shorter relapse periods (Hay et al., 2018). Given the role CE plays in the etiology, development, and maintenance of EDs (Dalle Grave, 2009; Davis et al., 1994), prevention and treatment are crucial, but have been limited by an unclear conceptualization of CE. Currently, there is no universally recognized definition of CE. Dittmer et al. (2018) have provided the most recent proposed definition, describing CE as driven, obsessive, following rigid rules, and used to prevent negative consequences. CE is said to be time-consuming and negatively impacts daily life, such as work and social relationships, and continues despite injury, illness, or lack of enjoyment (Dittmer et al., 2018). Although the proposed definition includes a focus on excessive and time-consuming exercise, research also indicates that quantities of exercise are not predictive of CE (Meyer & Taranis, 2011). Rather, cognitions around exercise, such as feeling extreme guilt for missing a workout, are the strongest indicators of CE (Meyer & Taranis, 2011). Despite some advancements in defining CE, there remains a lack of shared understanding of CE among academics, health professionals, and those experiencing CE (Mond & Gorrell, 2021; Noetel et al., 2017).

To develop a deeper and shared understanding of CE, particularly the cognitions around exercise, exploration of the lived experiences of individuals with CE and EDs should be prioritized. Among the few qualitative studies exploring exercise and EDs, individuals discussed engaging in exercise for controlling weight and negative affect, the anxiety of abstaining from

exercise during treatment, and leaving treatment feeling unequipped to manage their exercise (Moola et al., 2015; Young et al., 2015). However, these studies were not focused exclusively on CE and were limited by small homogenous samples of females with anorexia nervosa. Qualitative research on a larger, more diverse group of individuals with lived experiences of CE has yet to be conducted.

Social media has increasingly become a popular space for individuals with EDs to share information, experiences, and ideas through photos, videos, captions, and articles (Derenne & Beresin, 2018). The online ED community has gained attention, both for its concerning ability to spread harmful pro-ED content (e.g., Sowles et al., 2018) and for its ability to provide a supportive online pro-recovery environment (e.g., Herrick, Hallward, & Duncan, 2020). Studies of social media posts have benefitted from naturally occurring data and a breadth of voices that have contributed to understanding EDs (Kiyimba et al., 2019), such as definitions of recovery (Kenny et al., 2020) and common sources of social support during recovery (Campbell Eichhorn, 2008). A qualitative analysis of social media content focused on CE has yet to be explored and could further contribute to understanding various components of CE alongside EDs that have not yet been documented in the literature. Therefore, the purpose of this study was to explore experiences around CE and EDs shared on social media sites.

Methods

Data Collection

A social listening software, Synthesio™, was used to gather content related to CE from social media sites, including Reddit, forums, Instagram, and Twitter. Synthesio™ gathers all publicly-available content from the internet, based on specific search terms. Keywords related to CE and EDs (Figure 1) were used to conduct a thorough search to gather data from April 1, 2019

to March 31, 2020 across social media sites. The search yielded 881 posts including, but not limited to, original posts or questions, replies or comments, or photo captions. The data were downloaded and managed in QRS International's NVivo software for analysis. Refer to Table 1 for more information on data collection and analysis.

Data Analysis

Given the quantity and breadth of the posts, an inductive thematic analysis (Braun & Clarke, 2006) was chosen to identify common patterns and meanings across the social media posts (see Table 1). The authors situate themselves in an interpretivist paradigm, and were guided by assumptions of ontological relativism (i.e., reality is multiple, created, and mind dependent) and epistemological constructivism (i.e., knowledge is constructed and subjective; Guba & Lincoln, 1994). Both authors have faced personal challenges with disordered eating and EDs, as well as navigating their relationship with healthy exercise and CE. The authors acknowledge their own subjectivities influenced their interpretation of the data, but engaged in critically assessing their own and each other's views throughout the thematic analysis to create themes reflective of the data. Briefly, the authors followed the six steps outlined by Braun and Clarke (2006). The authors familiarized themselves by reading all of the data several times. The first author proceeded to code the data, creating an initial list of codes. The senior author reviewed the codes and the coded data several times throughout the coding. Through an iterative process, both authors added and removed codes as necessary and began to group the codes into themes, and a final list of themes was determined.

Ethical Considerations

All of the data collected were publicly-available content, which are considered public domain; therefore, in line with other similar studies, consent was not obtained (e.g., Kenny et al.,

2020; Lundin, 2017). However, steps were taken to ensure ethical practices were informed by the Internet Research Ethical Guidelines 3.0 (Franzke et al., 2020), such as gathering posts from public Twitter and Instagram accounts, and forums that did not require member access. Forums, like Reddit, are popular for anonymous accounts to allow individuals to discuss sensitive information, such as EDs (Sowles et al., 2018). To further ensure anonymity and help protect the identity of the posters, no usernames, identifying information, or visual content were included in the reporting of the results.

Results

A total of 881 posts from Reddit, forums, Instagram, and Twitter were analyzed (see Table 2 for all forums included and frequencies of posts). Using a thematic analysis, five themes and three subthemes were identified (see Figure 2). The experiences of CE captured in the themes and subthemes show notable tensions and mixed emotions that exist in how people feel about living with and managing their CE.

Seeking control, but ultimately CE takes hold

People often expressed the idea of "having to" or "needing to" exercise as a means to seek control of their life. The need to exercise often involved having specific rules around exercise such as rigid routines, only sitting for 20 minutes at a time, and needing to achieve set calorie burns or step counts at all costs. One female on Instagram referred back to a time when "I'd stopped eating and was exercising excessively in order to feel in control of something." A male on Reddit spoke about the need to control his life and his emotions:

> I realized I was using diet and exercise as a means of control during a time in my life where the stress of social life, schoolwork and a long distance relationship made so much feel *out* of my control.

Through the process of using exercise to seek control of their life, exercise evolved into CE which took hold of the individual. One female on Reddit shared:

> It feels like my brain is broken and not in my control. I know that I am actually in control and no one else can stop me from doing this besides myself...but it still feels like my brain is working against me.

On Twitter, an individual expressed how CE "literally controls everything," echoing similar feelings by other posts saying, "I literally cannot stop myself" or "I'm addicted to every aspect of this, as hellish as it is." It was a common sentiment that exercise initially was used as a way to be in control of their lives, but eventually led to feeling out of control.

Burning off binges, but at what expense?

Many posters described using exercise as means to burn calories to compensate for binging. This involved engaging in behaviours like completing 10,000 to 60,000 steps per day, exercising for hours, and multiple workouts a day. An Instagram post described, "Hours of running. Hours on the elliptical. Hours of trying to burn as many calories as possible to make up for the horrendous amount I'd consumed in the days prior." One person on MyProAna recounted her experience: "Yesterday [I] had the worst binge of my life. … Ended up exercising + forcing myself doing 60k+ steps before midnight because I can't handle the guilt." Another person on MyProAna expressed spending "5 hours of my birthday exercising to burn off the calories I had eaten and then cried for an hour because I felt so helpless." Binging, or eating certain types of food, was associated with feelings of shame, guilt, and judgment, where exercise was used in attempt to relieve these emotions. Rather than feeling relief after exercise as people may have expected, CE further led to negative emotions and consequences. One post on Reddit described how CE "pretty much ruined school and socializing normally for me. … The resulting mental

and physical side effects have become so severe that I just can hardly stand to live anymore." An array of injuries was mentioned, such as long-lasting joint pain, hormonal imbalances, amenorrhea, and stress fractures. When unable to exercise, people expressed feeling extreme guilt, disgust, anxiety, and defeat. One female on MyProAna wrote, "How about wanting to die any time you're too sick to meet your step count?" and another on Reddit said, "If I skip a day, [it] feels like I've absolutely failed." More broadly, people with CE described hating themselves, being miserable, in pain, or depressed all the time.

Recovery is a battle, but worth it

Individuals often noted that recovering from CE is a very difficult process, even calling it a "battle" where people "fought like HELL." While the CE recovery battle involved loss, sacrifices, challenges, and anguish, it was often contrasted with a sense of optimism and freedom while recovering. In an Instagram post, a female described her battle with running: "Giving up running voluntarily was one of the hardest things I've ever done, but I'm so glad I did it. Sure, I still miss running sometimes. But having my mental and physical health kind of overrides that." Another female expressed, "Has it been hard? Yes! I have felt like I'm losing my identity of the fitness obsessed girl. And seeing a new body has been challenging. But so so so worth it." One individual even reflected opposing feelings during recovery: "I've never experienced anything so terrifying and so liberating at the same time." The following three subthemes portray conflicting experiences during the recovery process: the turbulent battle, those experiencing joy with exercise, and those hesitant to face recovery.

It's a slippery slope

The recovery battle was ongoing, with many aware they had to keep fighting in recovery to avoid relapsing or falling back into compulsive tendencies. On Reddit, one poster who was

exercising in recovery, said, “I can see myself very easily slipping into exercising excessively. It's tough.” One individual on MyProAna, talking about her relapse-recovery cycle, said, “Exercise is helping me soooo much, I've honestly missed it. Even though I can already see myself spiraling into exercise addiction again if I'm not too careful.” Others tried to rationalize with themselves, saying one form of exercise was less harmful than another. Some in recovery wanted to begin exercising again, but said, “Each attempt I have made in the past to focus on physical health and fitness has put me on the path to relapse.” Other individuals were hesitant to resume exercise as they feared it could become an issue again: “I haven’t joined a gym yet for the sole reason I don’t want to get sucked back into spending the majority of my free time there.”

Exercise can be enjoyable

In contrast to those fighting in recovery, some people described the freedom they found with CE recovery as they (re)discovered exercising for enjoyment and positive motives. Rather than exercising as a punishment or obligation, one person expressed, “I now work out because I love to move.” One female on MyProAna explained her shift in mentality around exercise based on previous experiences:

> I have decided to exercise first and foremost for my health rather than my weight, and it works and shows! … When I exercise in moderation my mind and body thank me. I'm excited to go running each morning and I feel my stamina and mental health improving.

Other individuals expressed how they worked on healing their relationship with exercise through recovery, and the difference between exercising for joy versus compulsively:

> Stopping CE meant honestly stopping exercise cold turkey for quite some time, then afterwards, when I was ready, it meant rediscovering what I genuinely liked and disliked, not what the ED brain wanted me to do. Because I've always genuinely loved exercising,

> the problem for me arose when it felt more like something I "had" to do no matter what, rather than an optional choice.

I want to finally recover, but I'm not ready to let it go

Several individuals shared the hopelessness they felt while engaged in CE and the desire to "reclaim my life" and "not feel like a prisoner in my own body." Others pleaded by saying, "I don't want to live a day with this hell in my head anymore" or "I need this parasite gone so badly. I want to be normal." Many expressed what they hoped would come with recovery: "I just want to feel better, feel good, not hate myself, have the fitness to do the things I used to love doing." On a forum, a poster wrote, "I want to be free from the ED, the thoughts, the body hate and excessive exercise. I want to be able to eat ice cream and not feel incredible guilt and shame." While the desire to recover was strongly advocated by many with this sense of desperation to no longer experience CE, this yearning was contrasted by feelings of fear and hesitancy to leave CE behind. One post on MyProAna entitled "Who else is sick of this" indicated some desire to recover, but also said, "I also have a huge fear of gaining everything I worked so hard for…all those months of restricting and excessive exercise would all be for nothing." One male on Reddit found it difficult to let go of the thoughts encouraging him to remain in the depths of the disorder:

> I know I have to change, I'm always exhausted, irritable, and have little patience for my wife (and children), but at the same time I can't calm the voice in my head that urges me to go run off the extra snack I had in the day.

Many people came to social media to express the misery of living with CE, but also their trepidation to leave it behind and commit to recovery.

Is my exercise healthy?

Individuals sought opinions from others about whether their exercise routine is healthy or what constitutes healthy exercise in CE recovery. On a Reddit thread entitled "How much exercise is too much?" one female described her past experiences with CE and was looking for advice: **"**I'm finally viewing exercise in what I think is a healthy light and getting into a good routine with the gym, but I still struggle to know when I'm doing too much/pushing myself too much." Another Reddit user had difficulty finding that balance:

> I go to the gym three times a week and I actually just ordered an exercise bike. It's hard to walk the line between health and fitness and just like...full blown anorexia. Like on the one hand, I'm really enjoying becoming stronger. I really do want to improve my cardiovascular health. Also I get very restless at night because I don't get enough exercise during the day, so exercise helps me sleep and helps with anxiety.

People were unsure what exercise should look like in recovery, asking, "How do you know that you've done too much exercise?" One person who experienced CE for years, commented, "It REALLY is hard for me to gauge what normal is," referring to an exercise routine. Some were even uncertain about the role of exercise in recovery, questioning, "Can I exercise in recovery? Is it good for me?"

Frustration with comments about CE

Many turned to social media as a venue to rant and share their frustration with the general lack of awareness around CE from family and friends. They were often praised by others for their appearance or dedication to "health," but family and friends were unaware of the disordered thoughts and behaviours driving people to such extremes. One female remarked that "Compulsive exercise is a socially acceptable prison cell," which encapsulated the sentiments and frustration expressed by others. One post on Reddit explained:

> Coworkers and friends CONSTANTLY say things like “I wish I could run like you” “I wish I had your body” etc. What they do not know is I am constantly battling myself in my head. They do not see me pushing myself to run sometimes until I am in so much pain that I am crying. They cannot fathom what exercise addiction is.

Not only do comments and lack of awareness come from family and friends, but even healthcare professionals. For example, one post about an experience with a doctor explained, “She did say that CE was the lesser of two evils when it comes to my purging methods, which made me feel invalid and makes me want to throw up more.” In a tweet, someone shared their experience with a doctor: “[Doctor:] ‘Frequent exercise will solve your CFS [chronic fatigue syndrome] and chronic pain. You might even lose weight.’ Me: ‘I have a history of severe anorexia and an exercise addiction. It’s in my chart. Right next to all the times it almost killed me.’ Doctor: ‘That’s an excuse.’”

Discussion

The purpose of this study was to explore individuals’ experiences with CE and EDs as expressed on social media. Our findings revealed that people shared a breadth of topics around CE. The first three themes captured tension that existed across, and even, within individuals, whereby people experienced conflict between seeking versus losing control, the battle of recovery versus the freedom following recovery, and desiring recovery versus ambivalence. The two latter themes spoke to a need for more education and awareness around CE as people came to social media to seek input on healthy exercise and vent about the lack of CE awareness.

Overall, the experiences shared online aligned with the criteria in the proposed definition of CE by Dittmer et al. (2018), such as excessive exercise, rigid rules, controlling emotions, and the negative consequences. The posts online provided rich, authentic descriptions of how these

criteria translate into actual thoughts and behaviours that vary across people, which further supports the proposed definition. There were also a number of posters that emphasized their obsessive, all-consuming thoughts and feelings around exercise, which aligns with an "exercise obsessions" subtype of CE proposed by Bratland-Sanda et al. (2019). The "exercise obsessions" subtype characterizes individuals who do not engage in excessive exercise, but possess obsessive thoughts about the need to exercise. Further research must continue to explore lived experiences to consider all potential aspects of CE to develop a universally accepted definition.

The experiences around CE recovery present in our data paralleled those previously identified in ED recovery literature (Bohrer et al., 2020; Kenny et al., 2020), but many posters online shared unique thoughts and experiences with CE recovery. For some, committing to CE recovery meant stopping exercise they may have once enjoyed, missing the positive affect from exercise, or the fear of erasing all the time and effort once dedicated to exercising. These unique characteristics of CE recovery highlight the fact CE needs to be specifically addressed within ED treatment to address these cognitions and ambivalence towards recovery. Traditionally, exercise is forbidden in treatment as clinicians fear it interferes with weight restoration (Calogero & Pedrotty, 2004); however, exercise abstinence can be detrimental to long-term outcomes (R. R. Davies, 2015). Patients report leaving treatment confused about what is considered "normal" levels of exercise and fear any exercise is disordered and/or will lead to relapse (Moola et al., 2015). These fears were echoed in the posts online, as individuals explained that engaging in exercise during recovery can be a slippery slope back to CE, wanting to recover, but perhaps not knowing how to or what constitutes normal or healthy exercise.

Individuals should have the opportunity in treatment to experience healthy exercise and to (re)establish a positive relationship with exercise to promote healthy and appropriate exercise

behavior in the future (Hausenblas et al., 2017). Current CE treatment is showing efficacy (Hallward et al., 2021), however, there remains a lack of clarity around what constitutes healthy exercise, with many treatment centres reporting no clear, written definition of healthy exercise (S. Davies et al., 2008). The majority of centres indicated healthy exercise should be individually defined for each patient, and exercise should be reasonable given dietary intake, not excessive, and not harmful to one's health but rather promotes health (S. Davies et al., 2008). In line with trying to conceptualize healthy exercise, Calogero et al. (2019) proposed the concept of attunement with exercise which is an adaptive mindset towards exercise, contrasting the dysfunctional exercise cognitions of CE. Attuned exercise involves mindful attention, self-acceptance, self-compassion, joyful movement, and being connected with the body. Some people shared online their version of healthy exercise, such as enjoying exercise and doing it for their mental health, providing support for some of the characteristics of a more positive relationship to exercise, such as attunement with exercise, described in the literature (e.g., Calogero et al., 2019). Although there is progress towards describing healthy exercise, some people with CE lack the knowledge and strategies to shift their CE into healthy exercise during recovery.

Within our data, however, there was a sub-group of posters who managed to make steps toward recovery and develop healthier relationships with exercise. People shared online that shifting their mindset around exercise was essential; leaving behind rigid rules, exercise as punishment, and appearance-based goals, and instead listening to their body and mind, resting more, and exploring different types of exercise. These findings align with previous research indicating maladaptive exercise cognitions are associated with CE (Meyer & Taranis, 2011), and further provides evidence that shifting the mindset around exercise is a key mechanism for recovery. The shared positive recovery experiences provide online support and tangible

information for those ambivalent about or desiring recovery. Additionally, promising CE treatment approaches emphasize the importance of psychoeducation to address negative exercise beliefs and (re)establish healthy exercise (Hallward et al., 2021), and the multiple approaches to finding healthy exercise shared online could be valuable content for psychoeducation programs. More resources should be available online as well, such as on ED organization's websites, that provide basic education around healthy exercise and some tools to help recover from CE.

Many individuals used social media to complain about receiving praise for their dedication to exercise from others who were unaware of how destructive their behaviour was. Previous research has documented the negative impact that harmful comments from family and friends can have on those with EDs, often due to a lack of awareness or misconceptions of EDs (Levine, 2017). Comments from friends and family can inadvertently reinforce CE thoughts and behaviours, leading to worsened relationships and exacerbating symptoms. Most concerning were the experiences that noted the lack of training or awareness around EDs and CE among some health professionals, which can result in mistreatment, invalidation, or even worsening of the ED and/or CE. Individuals with EDs have previously noted negative experiences with health professionals such as failing to detect symptoms, being uninterested in treating them, and thinking EDs were only about physical symptoms (Johns et al., 2019). Healthcare professionals have also expressed negative attitudes towards patients with EDs, including frustration, resentment, and even feeling incompetent to treat the patients (Johns et al., 2019; Thompson-Brenner et al., 2012). With exercise, practitioners report a lack of knowledge and fear the impact exercise could have on patients, often leaving CE untreated (Quesnel et al., 2018). The experiences found on social media, corroborated by previous research, speak to the dire need for basic education on EDs and CE, for all healthcare professionals.

Limitations and Future Directions

Exploring lived experiences of CE through the broad spectrum of social media has tremendous value, but there are some limitations to this approach. First, the online nature of the data limited our access to relevant demographic and/or diagnostic information that could provide context to the individuals' posts. As a result, we are not able to explore whether the experiences described are unique to certain groups, such as certain ED diagnoses. Furthermore, we cannot infer from all people posting whether they experienced disordered eating or an ED. However, some posts did mention their diagnoses and described various ED behaviours that categorize different types of EDs. The anonymity of social media can also encourage people to share more vulnerable authentic experiences, and provides a platform to hear from a greater breadth of voices, such as those who do not seek treatment (Kiyimba et al., 2019). Second, our data collection tool limited the ability to capture the truly social nature of social media (i.e., full conversations which would include the initial post along with replies from other users). This inability to capture the interactions meant that the data could only provide somewhat surface-level insight into the variety of content people are sharing about CE on social media. Future research could investigate online communities that include demographic information and involve conversations between users to explore how individuals interact with one another, providing further insight into support in recovery, or how CE could be perpetuated online, as examples. Third, it was beyond the scope of our research to thoroughly compare and contrast themes across social media sites. Future research could investigate more closely differences between social media sites, or explore one platform in more depth, such as Instagram and include visual content. There is also merit in exploring lived experiences of individuals with CE using more in-depth qualitative methods to gain more insight into the different phases of CE.

Conclusion

This was the first study to explore experiences with CE as shared on social media using a large qualitative data set. Literature on EDs has benefitted from a multitude of qualitative approaches, that each contribute unique findings toward understanding EDs (e.g., Kenny et al., 2020). Exploring CE through this novel data collection method has implications for academics, clinicians, and those with CE. Our findings further provided support for the current proposed definition of CE, and documented novel themes around CE recovery which can be used to develop a definition of CE recovery. Individuals shared their experiences with healthy exercise, which could be shared on social media to inspire recovery and educate others with CE, family, friends, and even health professionals. Furthermore, the characteristics used to describe healthy exercise from posters online support current discussions in the literature on healthy exercise, and could be integrated into the design of future CE treatment programs. Our data provide a diversity of experiences of CE that can help create a better understanding of the condition for all, and can improve the necessary prevention and treatment approaches for CE among individuals with EDs.

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Table 1

Description of data collection and thematic analysis of the social media posts

Thematic analysis steps	Description
Step 0: Data collection	Keywords for the search were selected based on terms used in the literature and through an iterative process (see Figure 1 for search terms). The Synthesio™ tool can retrospectively search, at most, the past 12 months; therefore, a year of posts was collected from April 1, 2019 to March 31, 2020. All posts (including the post title, where relevant, and the media source) were downloaded to Microsoft Excel and transferred to QRS International's NVivo software for data analysis. No videos, images, or audio content were collected.
Step 1: Becoming familiar with the data	The authors familiarized themselves by reading and rereading the data. The authors noted any general patterns and highlighted impactful and noteworthy posts.
Step 2: Generating preliminary codes	The first author provided initial codes of the first month of data. The senior author reviewed the codes as a critical friend, providing critique and input to further challenge the first author. This process continued for each month of data, at which point a final list of codes was agreed upon by both authors.
Step 3: Identifying themes	The authors grouped relevant codes into broader themes and subthemes that revealed the different lived experiences with compulsive exercise.
Step 4: Revision or refinement of themes	The first author used the current list of themes and subthemes to recode the data, to assure the codes were appropriate for each theme and subtheme, and that they encapsulated the breadth of experiences in the social media posts.
Step 5: Theme conceptualization	The final list of themes and subthemes was agreed upon by both authors. The authors created descriptive theme names, and developed subtheme names they felt reflected the patterns and sentiment of the data.
Step 6: Writing results	During another review of the data, multiple relevant quotations from the posts were noted for each subtheme to portray the essence of each theme/subtheme, relying on the words of the posters with the lived experience. When the poster self-identified their gender in written form in the post, the authors indicated their gender along with their quotation.

Table 2

Frequencies of posts from each social media site

Source	Frequency of posts (% of total posts)
Reddit	446 (50.6)
Instagram	132 (15.0)
Twitter	73 (8.3)
Forums	230 (26.1)
MyProAna	190 (21.6)
My Fitness Pal Forums	16 (1.8)
Bodybuilding.com Forum	5 (0.6)
DC Urban Mom Forums	4 (0.5)
Kiwi Farms	4 (0.5)
The Student Room Forums	4 (0.5)
Ray Peat Forum	3 (0.3)
PistonHeads Gassing Station	2 (0.2)
HealthUnlocked Communities	1 (0.1)
Voat – Have your say	1 (0.1)

Note. The 881 posts came from 13 social media sites. The frequency and percentage of posts from each site are indicated. The platforms were not purposefully selected, but rather were identified through the Synthesio™ search as they contained publicly-available posts with relevant keywords, published between April 1, 2019 and March 31, 2020. Forums are online discussion boards where people, often anonymous, can have conversations with one another, posing questions and replying, on any conceivable topic. The majority (82%) of forum posts were from MyProAna, and although the name suggests it is a pro-ED community, it does also provide a platform for ED support and recovery. The average post was 193 words in length (*SD* = 235, range = 3-4,738).

Figure 1

Search terms and strategy used within Synthesio™, the data collection search tool

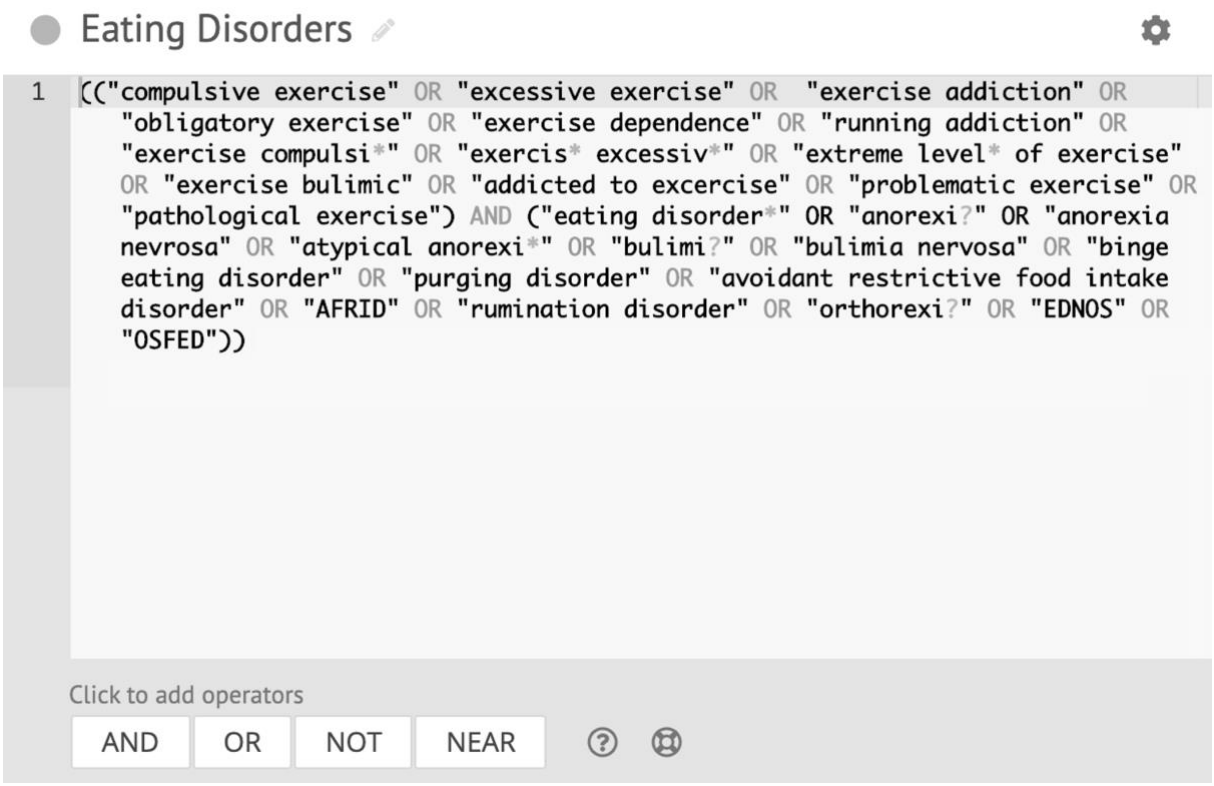
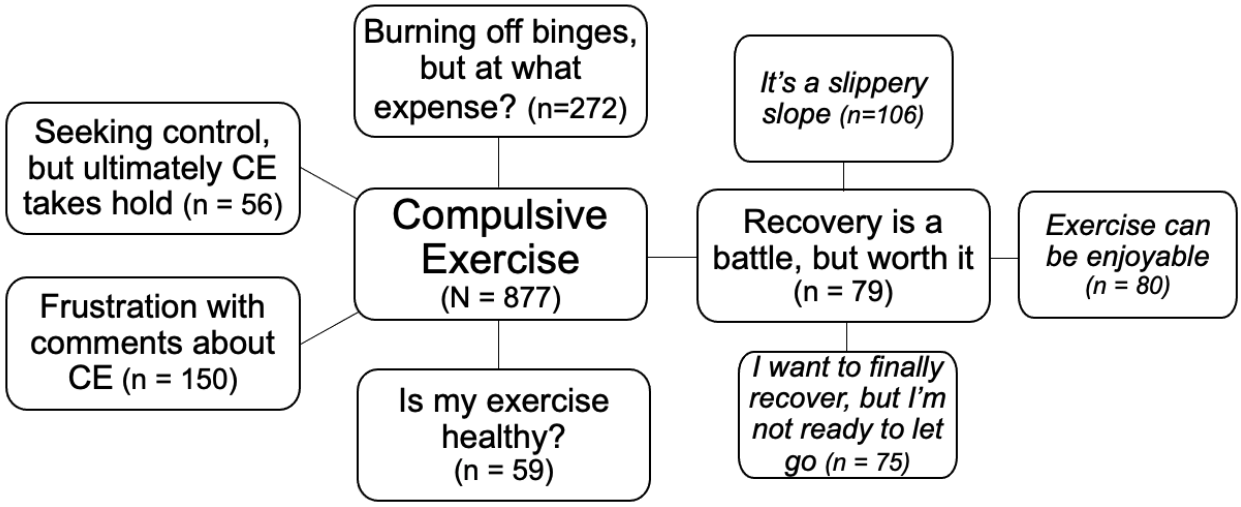


Figure 2

Five themes and three subthemes were identified through a thematic analysis. A total of 887 quotations were identified (i.e., an excerpt from a post; either a sentence or multiple sentences). The number of quotations within each theme and subtheme is indicated.



Bridging Text

Chapter Three described an analysis of 881 social media posts portraying individuals' experiences with CE. The study capitalized on the vastness of social media, leading to a large sample of posts and breadth of experiences, including posts from both men and women and a variety of EDs, addressing a gap in the literature. The findings from this study provided extensive examples of the cognitions and behaviours that characterize the lived experiences of CE for the posters. These characterizations support the proposed definition of CE put forward by Dittmer, Jacobi, and Voderholzer (2018). Individuals identified novel barriers to CE recovery, unique from ED recovery, such as beliefs that gaining weight would erase the hours and hours spent exercising, that should be addressed within CE treatment. It was apparent from the posts that people were uncertain what is considered healthy exercise in recovery, and that they were frustrated by a lack of understanding of CE among friends, family, and even healthcare professionals. Overall, this study helps bridge the research-clinical gap by providing a clearer understanding of CE. Limitations of this social media analysis include a lack of context and specificity at times and the inability to probe on specific components given the observational nature of the study. To address some of the limitations of the study in Chapter Three, and to continue to further develop a clearer understanding of CE, we conducted an additional qualitative study in Chapter Four, seeking depth rather than a breadth of experiences. Chapter Four describes a study that involved exploring lived experiences with CE through a series of in-depth interviews with four women with bulimia nervosa. We also sought to analyze and present the data in a way that would help bridge the research-clinical gap in our understanding of CE. We used creative nonfiction, a novel methodology applied to this topic, to depict our findings in an

engaging yet accessible way for all audiences, including researchers, clinicians, and the general public.

Chapter Four: Study 2

Personal accounts of compulsive exercise and bulimia nervosa: An exploration of psychosocial influences through creative nonfiction storytelling

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Abstract

Compulsive exercise is a common component of eating disorders, characterized by an obsessive need to exercise, often following rigid rules, and using exercise as a maladaptive coping mechanism. However, compulsive exercise is often not well addressed or treated, mainly due to a lack of understanding of how compulsive exercise is developed, experienced, and resolved. Most research, to date, has explored compulsive exercise among individuals with anorexia nervosa and has not considered the social and cultural factors that influence compulsive exercise. Therefore, the purpose of this study was to explore the complex interplay of personal and sociocultural factors that influenced the lived experiences of four individuals with bulimia nervosa and compulsive exercise. A series of four narrative interviews were conducted with each of the participants to allow for an in-depth exploration of lifelong experiences, attitudes, and behaviours around eating, exercise, and body. The analysis involved two phases: a thematic narrative analysis and creative nonfiction. Two creative nonfiction stories were created that depict the tales of Amber and Carley. Both stories are first-person accounts of their personal experiences developing, living with, and (attempting) recovery from compulsive exercise. Woven through the two stories are the personal, situational, and sociocultural influences that shaped their experiences with exercise, eating, and their body. The two stories recount both different and shared experiences, influences, and trajectories with compulsive exercise and bulimia nervosa, presented through emotional and relatable narratives to appeal to a broad audience of readers.

Keywords: creative non-fiction, eating disorders, bulimia nervosa, compulsive exercise, recovery

Highlights

- Compulsive exercise is a result of a complex interplay of psychosocial factors
- Compulsive exercise is uniquely explored among individuals with bulimia nervosa
- Creative nonfiction was used to recount lived experiences with compulsive exercise
- Stories are accessible to create deeper shared understanding of compulsive exercise

Introduction

Eating disorders (EDs) are a severe mental illness that are prevalent worldwide, impacting between 3.5% to 7.8% of the population (Galmiche et al., 2019). From clinical and research perspectives, EDs were previously thought to be a problem of adolescent Caucasian females from high-income western countries, but today there is a more global focus as high rates of EDs are reported among diverse people and in non-Western countries as well (Pike & Dunne, 2015). A common, universal, feature of EDs is compulsive exercise (CE), which impacts as many as 85% of individuals with an ED (Fietz et al., 2014; Moola et al., 2013). Dittmer et al. (2018) define CE as feeling driven to exercise in response to an obsessive need and rigid rules around exercise, and using exercise to prevent or reduce negative emotions, such as feelings of anxiety. CE is also said to be time-consuming, interfering with daily activities, occupation, and social relationships, and is often maintained despite injury, illness, or a lack of enjoyment (Dittmer et al., 2018). At times, individuals may also use exercise as a compensatory mechanism to burn off calories and manage their appearance (Dalle Grave, 2009). Researchers have shown that it is these dysfunctional exercise cognitions, rather than just elevated quantities of exercise, that render CE particularly detrimental (Davies et al., 2008; Scharmer et al., 2020). CE can further exacerbate an ED, and often leads to longer treatment times, is one of the last symptoms to resolve (Davis et al., 1994), and is predictive of shorter periods between relapses (Hay et al., 2018). Although CE is often thought to impact mostly individuals with anorexia nervosa, CE is actually more often reported in individuals with bulimia nervosa (Monell et al., 2018).

Prevention and treatment of CE requires a full understanding of the factors that lead to the development, maintenance, and recovery of CE. Although research on EDs has taken a more global focus, the research on CE has been limited to Westernized countries. Most CE research

has been correlational and has identified potential psychological and sociocultural risk factors (e.g., Homan, 2010; Meyer et al., 2011). The psychological factors that show robust relationships with CE include eating psychopathology, maladaptive affect regulation, obsessive-compulsiveness, and perfectionism (Meyer et al., 2011). There is a growing body of literature investigating the sociocultural factors related to CE, such as internalization of a thin- or athletic-ideal, often due to media exposure or pressure from family and friends (Bell et al., 2016; Homan, 2010; Sumter et al., 2018). Despite advancements investigating potential risk and maintenance factors, there remains a clear lack of shared understanding of CE among health professionals, academics, and individuals with CE, highlighting the need for a deeper understanding of CE.

One approach to developing a clearer conceptualization of CE is through the lens of individuals with lived experience. Researchers (e.g., Scharmer et al., 2020) have called for alternative methodologies (e.g., interviews) to capture the nuanced characteristics that influence CE and provide insight into how healthy exercise develops into CE to further elucidate the nature of CE. To date, a few qualitative studies have explored the role of exercise among individuals with anorexia nervosa (Chubbs-Payne et al., 2021; Kolnes & Rodriguez-morales, 2016; Moola et al., 2015; Young et al., 2015). These studies recount personal experiences with exercise or CE alongside anorexia nervosa, at different stages of life, often with a large emphasis on treatment and a medicalized approach to understanding exercise. The findings from these studies showed (a) that exercise often served as a coping mechanism to control negative affect, (b) how exercise was poorly addressed in treatment, and (c) how to reconcile exercise during recovery from anorexia nervosa. Generally, these studies narrowly focus on the psychological aspects of exercise and CE and include only individuals with anorexia nervosa.

To develop a deeper understanding of CE, the psychological aspects of exercise and CE must be studied in relation to the social and cultural context. For example, an individual solely viewing exercise as a means to manipulate one's appearance is considered dysfunctional, yet this belief can be further compounded by the sociocultural discourses around exercise. Particularly in Western culture, exercise is promoted for weight loss, whereas in Asian cultures, exercise is used as a means to demonstrate focus and discipline, both of which can further reinforce CE. One of the first studies to explore the sociocultural context with exercise and EDs was among women weightlifters and their experience navigating healthy versus dysfunctional exercise in ED recovery (Hockin-Boyers & Warin, 2021). The women described how the culture around weightlifting shifted their mindset, viewing food as fuel, gaining muscle to gain strength, taking rest days to improve performance, and feeling pride around exercise. This study was very specific to the context of weightlifting and focused more so on how weightlifting was a positive experience for ED recovery. More research is needed to investigate sociocultural factors, as well as research specifically on CE and bulimia nervosa. Therefore, the purpose of this study was to explore the personal and sociocultural factors involved in shaping lived experiences with exercise and the development, maintenance, and recovery from CE among four females with bulimia nervosa.

Methods

Philosophical Framework

We situate ourselves within the interpretivist paradigm, meaning we believe that people develop subjective and varied meanings of their life experiences through social interactions and through historical and cultural norms that operate in their lives (Creswell, 2014). Our research was guided by ontological relativism and epistemological social constructionism. Ontological

relativism asserts that reality is subjective, individually created, mind-dependent, and differs from person to person. The epistemological assumption of social constructionism suggests that what we regard as "truth" is not a product of objective observations or discoveries. Rather, knowledge is constructed through daily interactions and social processes, and truth is a consensus that is created by co-constructors (Burr, 2006).

All three authors have personal experiences with eating disorders and disordered eating, and varying degrees of CE. The first and senior authors are both Canadian born and raised, strongly identifying with Western culture. The second author is a first-generation Canadian, whose parents were born in China, and was raised with influences from both Canadian and Chinese cultures. Like many who grow up with immigrant parents, she experienced intergenerational tensions, such as identity conflicts and cultural dissonance, resulting from trying to balance Western and Asian values.

Participants and Procedures

Upon receiving ethical approval from our university research ethics board, we recruited four females from the university. Participants were eligible if they (a) were women between the ages of 18 and 30 years old, (b) were clinically diagnosed with bulimia nervosa by a healthcare professional, (c) were currently living with or recovering from bulimia nervosa, (d) had experienced some form of treatment for their ED, and (e) self-identified as having or had CE. The aim was to recruit participants who did not identify as "recovered", meaning they were still experiencing changes with their relationship with exercise, food, and their body, allowing for new experiences to emerge over time. The need for having received treatment for their ED was to allow for discussions around healthcare professionals' (e.g., dietician, psychologist)

approaches to addressing CE. Given the lack of clear definition or criteria of CE, participants self-identified as having experienced a negative relationship with exercise.

Participants were recruited through an online post within the university's research studies recruitment site. Participants who were interested in the study contacted the first author, and a video call was set up to assess eligibility and to ensure they self-identified as experiencing CE. Discussions around the participants' exercise thoughts and behaviours (i.e., their definition and beliefs around dysfunctional exercise) were saved for the interviews. Given the sensitive nature of the interviews, the first author also ensured the participant felt comfortable speaking openly about their disorder and continued to have support or could access a health professional if needed throughout the interview process. This initial contact also allowed the participants to familiarize themselves with the interviewer prior to the first interview that would involve diving into the topic of their ED. All participants that had a screening/eligibility call were included in the study and provided written consent prior to the first interview.

Data Collection

We conducted four interviews with each participant approximately one month apart, which we chose to do for several reasons. First, several interviews with the participants encouraged flexibility, deep reflection, and promoting effective narrative construction that could not be obtained in one interview (Papathomas & Lavallee, 2014). Second, we could more thoroughly explore participant experiences and aimed to reduce participant burden with shorter interviews as opposed to fewer, longer interviews. Third, conducting interviews one month apart allowed the participants to discuss changes and new experiences that naturally occurred over time between interviews. It also allowed for seasonal changes, holidays, different timepoints in the academic semester, etc. which could all impact exercise and eating cognitions or behaviours.

Each of the four interviews had a different purpose and relied on different interview guides unique to each participant. The initial interview was unstructured and involved participants providing a broad overview of their life history as it pertained to experiences around their ED and exercise. The plan for each subsequent interview was to revisit previous experiences, events, or periods in the individual's life to allow for deeper reflection or to explore new experiences. Generally, the second interview focused on childhood and teenage experiences, as well as familial and peer influences, to gain a sense of their sociocultural context. The third interview focused on the time around the ED diagnosis and treatment experiences. The fourth interview explored the time after treatment to current day and involved participants reflecting on their entire journey to date, and some forward-thinking questions about recovery in the future. We (the first and second author) familiarized ourselves with the previous interview(s) for each participant, and then created loosely structured interview guides for interviews two to four that reflected the personal narratives of each participant and built upon what was previously said. At the start of each interview, we asked participants how they were currently doing with their disorder and/or recovery and any changes around thoughts and behaviours since their previous interview. Interviews were conducted using audio and video on Zoom. The audio was recorded and transcribed verbatim. One participant chose not to turn on her camera for all interviews. Another participant withdrew from the study after completing two interviews, stating she no longer felt comfortable discussing such experiences given her current mental state. In the end, we completed 14 interviews which were all used for data analysis.

Data Analysis

Narrative analyses can occur from two different standpoints: that of a story analyst or a storyteller. When narratives are interpreted from a story analyst point of view, the researcher

carries out an analysis *of* the stories. A story analyst focuses on the various "whats" or "hows" of a story, meaning what is involved in the story or how the story is being told (Smith & Sparkes, 2009). As a storyteller, the analysis *is* the story, and the story is portrayed through creative analytical practice, such as creative nonfiction stories where the story is grounded in research findings and created based on techniques of fiction. In line with Smith (2016), we chose to first operate as a story analyst, conducting a thematic narrative analysis (Phase 1) to help build the *what* (i.e., content) and the how (i.e., how the story unfolds) of the story, to then portray the stories from the standpoint of a storyteller via creative nonfiction stories (Phase 2).

Phase 1: Thematic narrative analysis

We analyzed the transcripts using thematic narrative analysis (Reissman, 2008), which focuses on the "what" of a story. A narrative theme is one that is found through a story or a set of stories. A thematic narrative analysis helps keep the story intact while analysing it, retaining the "whole story" and preserving the "wealth of detail contained in long sequences" (Reissman, 2008, p. 74). We engaged in a cyclical and iterative analysis process, guided by Smith (2016). The first few steps involved transcribing and organizing the data. The following step was narrative indwelling, where we immersed ourselves in the data through listening to the audio recordings, familiarization with the transcripts, and beginning to write initial impressions about what was said. Subsequently, to help us identify narrative themes and thematic relationships, we asked ourselves questions such as "what is the common theme(s) in each story?" and "what occurs repeatedly within the whole story?". This involved individually analyzing all transcripts for each participant and identifying narrative themes that occurred throughout. The first two authors were involved in all steps of the analysis and created a final list of narrative themes identified for each participant, which were then reviewed by the senior author.

Phase 2: Creative nonfiction

All participants were currently undergraduate students, in their early twenties, enrolled at two large Canadian universities. Although the participants had many similarities in their experiences, we also identified two distinct storylines based on our participants' experiences that led us to create two nonfiction stories about Amber and Carley. To create the creative nonfiction stories, we again followed a guide of techniques suggested by Smith (2016). First, we conducted the thematic narrative analysis previously described. Second, we acknowledged the purpose of the stories (i.e., to portray the complex interplay of factors involved in the development, maintenance, and recovery from compulsive exercise) and developed a plot (i.e., the chronological order of experiences described by the participants) and characters (i.e., Amber and Carley). Third, we sought verisimilitude through creating stories that were similar to the participants' experiences and emotions, and we included their spoken words as much as possible in telling the stories. Their words appear in italics within the stories. Fourth, we relied on human senses and embodiment to write evocative and engaging stories. We spoke about the characters' bodies in motion and being still and included emotions to engage readers.

Quality Standards

In line with a relativist approach, "quality is both revealed and resides in the research report, placing responsibility for judging quality not only on the researcher but also the reader" (Burke, 2016, p. 337). We were guided by the evaluative criteria proposed by Smith and Caddick (2012) to assess the quality of our study, including impact, coherence, credibility, and transparency. We sought *impact* through creating emotional and intellectual narratives to hopefully lead our audience to generate new research questions and practices, or initiate action. We accomplished *coherence* by creating a meaningful picture of the results and situating these

findings within previous research and theories. We strove for *credibility* by spending a notable amount of time with the participants to help guide our interpretations of the participants' stories and to honour their lived experiences. We achieved *transparency* by including a detailed description of the methods. Additionally, the senior author served as a critical friend throughout the research process to challenge and question assumptions and interpretations of the data.

Results

Amber

I grew up in China, a critically conservative part of the world. My parents emphasized the most important thing for me is my academic excellence. After academics, it's how *I present myself in society. We had a lot of high standards about how we had to dress and look, anything from our weight to how we* carried ourselves and behaved. *There was hardly anyone overweight, let alone obese. All my role models were really slim. They had really smooth and light coloured skin, a flat belly, thin legs, arms, face, and they always looked like they didn't eat much. That was my ideal look, and to be like them, I had to show I had self-control.* My parents put me in ballet to help teach me self-discipline and it was the stereotypical female activity to do. Art, music, dance, those were the activities society expected females to do, and my parents felt the same way, so I just went along with it. *The ballet teachers were all strict about how you looked. I went to an all girl's school too, and even though it wasn't expressed outwardly, I always felt that I was in some sort of a competition with my classmates* to be the best in everything I did. *I was living in such a homogeneous society, everyone pretty much looked and thought the same way. At the time, I didn't have any idea how to think* differently and I didn't see anything wrong with that.

Coming to Canada for university, in the first few weeks, *I made friends from Canada, USA, Europe, Africa, other parts of Asia too. It brought up different opinions and different ways*

of thinking I hadn't thought about. I was no longer living in this conservative place and everyone was free. You could have relationships with people from different parts of the world, the same sex, or even multiple people. You can dye your hair pink, you can get tattoos, you can pierce your tongue. *You could pretty much do anything! It opened up my mind to different body types, larger bodies, different clothing expressions. I started to think about my past, how I grew up, how I acted, the decisions that were made for me, how that affected me, and whether that was good or bad. I started to think maybe my childhood wasn't so great after all. I was controlled a lot of the time. I didn't have the freedom to choose a lot of things*. I wouldn't say it was a bad childhood, but I started to become a bit angry about how little independence I had. *I realized I can't change the past but I can change the future. I can start making decisions for myself.*

I wanted to explore my new freedom and did whatever I could to experience that. I got really tempted hanging out with these newfound friends. I ate so much food and drank so much alcohol. I pretty much gained 10 pounds. It all happened pretty quickly too. *I think I tried to, in a way, make up for all those times that I didn't have control over my own decisions. But then I found myself feeling really, really guilty and ashamed of myself. I was getting fat and I wasn't looking attractive anymore in my own eyes. I realized this isn't what I was brought up to do* or how to look, it was just wrong. Who had I become? I didn't even recognize myself anymore. I needed to present myself better than this. If I was ever going to find a boyfriend, I needed to be slim and pretty for him. *So I felt the need to re-control my life and take some drastic action.* No guy would ever think how I was behaving was appealing or would make for a good girlfriend. *The biggest aspect where I could take back control was to exercise and control what I ate, how I looked and dressed, so that I could feel better about myself,* so that I could actually feel like me.

It started with me just trying to watch my caloric intake and going to the gym occasionally, doing some Zumba classes, back at a time when exercise was fun and enjoyable. I stopped going out with friends as often to avoid extra calories, and it was cold and dark in November. *I lived in a single room so I started to get really lonely not socializing as much.* My friends would be out at restaurants or bars, *but I didn't want to go out with them and feel like I had to eat, but I also didn't want to eat by myself in the cafeteria downstairs. I started just bringing food up to my room from the caf, but I also didn't like the idea of eating alone so I just skipped meals.* Meal time always brought us together as a family back home, even my aunts, uncles, and grandparents. I really missed my family most when eating alone. It felt easier avoiding meals to avoid feeling lonely. *But maybe because my body really craved the food I missed,* or maybe food was comforting and filled that void, *I ended up binging a lot, three or four times a week.* I had zero self-control. *I stuffed myself* to numb out, not feel anything, almost black out. But that feeling, or I guess really a lack of feeling, only lasted so long, until the shame, self-hate, and embarrassment rushed in. *Sometimes I would just vomit it out, but* that never felt like enough. I couldn't just sit with these feelings. I needed to move and to burn calories. *I would exercise for an hour to an hour and half on the treadmill. I always heard cardio is the best way to get rid of weight because it's what all females are doing and I just had the misconception that it's the best way of losing weight and slimming down. I kept telling myself, just keep moving your legs on the treadmill, I knew once I hopped on the treadmill it meant I didn't have to think about anything else, I could just sweat out the feelings*, anything to get rid of them. The treadmill at the gym faced a mirror and I remember looking at myself with tears rolling down my cheeks after my worst binges. I felt horrible in every way possible, and exercise was the only thing that helped me cope. *I never knew that there was such a thing as overexercising. I always thought*

exercise was a good thing, but there was nothing good about what I was doing.

Maybe five or six months of this vicious binge-purge-exercise cycle went by. No one knew, and no one could stop it, not even me. I felt helpless and out of control. *I spent a lot of time thinking about exercise, planning my schedule, trying to squeeze in that extra session. But I wasn't doing well in school and I thought how am I going to explain this to myself later if this ends up having an impact on my schoolwork? I'm seeing friends even less than before and I'm feeling so isolated and lonely. It became clear to me that I was having some issues. I was feeling guilty, even when I was exercising. It was a chore, and almost felt toxic. I had a sense of fear that* the need to exercise *was dominating in my head and also feared what would happen if I binged and didn't exercise. Once something in your life starts to really dominate you and it's in your head, you feel like that voice is winning. It was actually really fearful. That's when I decided that I'm going to do what it takes stop this and decided to visit a psychologist. The admission that I needed help* for a mental disorder *and seeking help was a huge battle on its own. I didn't want to be treated like someone with a problem. I barely had any support from my friends,* not that I ever really saw them anymore. *My parents certainly didn't know because they were the last people I would tell unless I was absolutely dying.* I just knew they wouldn't understand or they'd think I lacked self-control and was a failure. I already felt like I failed myself. *I had lost my sense of pride and questioned my identity. What happened to my self-discipline or self-control? Am I not an independent person? Not resilient enough? Others did fine starting university, why not me?*

I wished there was a magic bullet when I first started seeing a psychologist to feel better. I didn't feel like I had the strength, and when I was just about ready to give up, I found the strength within me. Initially the message that I heard from the psychologist was let's not try to fix it all at once. It's going to be baby steps and that was comforting. I initially started to eat more

regular meals and stopped binging and purging. *My psychologist then used the technique of giving me numbers. Just how many hours did I waste exercising and thinking about it constantly? I used to think the longer I spent at the gym, the better for my body, my weight, and my self-confidence but nobody ever said, "Oh, you look so much better," and I certainly did not feel any more confident about myself or lose more weight.* We made a schedule, where I prioritized school work and social time, then included gym time. *Gradually, we reduced the length and number of my exercise sessions. I followed this schedule as much as possible, and I promised myself that I would stick to the schedule.* It's ironic. When I think back to my childhood, I was told what to do, and my bulimia started because I wanted to be in control. But in the end, *when I got approval from the psychologist to cut down the time and the exercise sessions, I felt free actually. She tried to get me to have that internal reflection as to why do I want to go to the gym. Is it because I feel that I need to or because I want to?*

It's taken about six months of sessions with my psychologist, but I think all in all I've been recovering pretty well, and learned how to take care of myself on my own. I tell myself that regular meals and exercising twice a week is a good frequency and something that I know contributes to my wellbeing. I'm making the decision to exercise just out of my own desire to stay healthy and just to stay emotionally sane, as opposed to stress pushing me in that direction. If I'm starting exercise and within ten minutes I realize I'm not in the right mood, that probably is an indication that I'm doing it just to compensate, for my weight or for my appearance. If after that first ten minutes I'm engaged, then maybe that signals that I'm doing it for fun.

I moved to Canada over a year ago and *I think I've really gained a lot of insight about myself. I have learned to forgive myself and just move on with my life because I just can't look back, it's just not helpful to my life. I will not let it stop me from achieving my future goals. I was*

a proud person. I had great confidence in myself and I took great pride in that, but clearly I stumbled and that was a very humbling experience. My motto now is *everything in moderation. Just because someone says to exercise, it doesn't mean you have to do it like Michael Phelps. It's the virtue of balance I learned.*

Carley

I've had food issues pretty much my entire life, even as like a little kid. I have a few early memories that really stuck with me. *I remember in daycare there was a log book that your parents had to sign in and out and they would record how many servings of lunch you had and if you ate your snacks and stuff like that. And that was very distressing for me.* That idea of logging is probably led to my weight loss diaries. In another memory, *I'm at my friend's house. She was one of those kids that was really small and I just was…normal I guess. I put on her shirt one day and it didn't fit and her little brother was like "She can't fit because she's too fat to wear your shirt."* I also remember *every time I heard about people working out, it was always to reach a goal, never just for fun or because they liked it. My mom always worried about her figure, and the gym for her was to lose weight and go down a jean size. She was always very self-conscious about her body, and even called herself a whale on the beach.* I know these moments all sound pretty random, but I feel like these are the types of memories that explain why I developed the relationships I did with eating, exercise, and my body.

My parents always wanted me to find "my sport". *They tried to put me in ballet, figure skating, and gymnastics*, the sports that normal girls my age did because *I didn't really have a lot of friends either. I just wasn't good at sports and never really fit in. I was always too insecure to wear the leotards. I started running when I was maybe nine and joined cross-country to try it. I liked that it was an individual sport, that no one was relying on me to succeed. Team sports*

makes me nervous, and I wasn't super coordinated. At least running didn't require that much skill. *I ended up doing well and my parents were happy that I found my sport*. I was finally good at something and I was happy that they were proud of me. *I felt like I just had to keep going.*

When I was 10, I got really into these YouTube videos of teenage girls that would post What I Eat in a Day or how to work out to stay fit videos. I started working out, doing ab workouts and whatnot, *nothing too serious*. *I probably shouldn't have been thinking about this at 10 years old, but I thought if the YouTube girls are* eating healthy and exercising, I *should do it too because they look so good. My friends were all naturally thin, and I always compared myself to them, even to girls around me today. I was very self-conscious because I looked different than all of them, I was always a little chubbier,* but these videos were like the solution to fix my body.

I couldn't really control what my parents were making food-wise for me at home. It was a lot of unhealthy food because my parents worked late and needed something easy to whip up like pasta. We would order in probably three nights a week too. I wish they would've made healthier food but I was scared to ask because for some reason I thought in my brain that they were going to think that was weird, that I shouldn't be worrying about how healthy food is. I figured I could at least plan my school lunch. It started off with me packing a really healthy lunch - all fruits and vegetables. Then I slowly progressed into not even bringing lunch. I feel like it starts like that for a lot of people, starting with the mindset of I'm going to eat healthy…but soon that wasn't enough. *I did eat at home because I was really scared that my parents were going to notice. It was my biggest fear. But at school, I could live out my eating disorder life.*

I did running probably up until grade 8. Then I stopped doing cross-country but I got my first gym membership and I started to do different kinds of workouts like the elliptical, biking, and weights. *I noticed I was getting hungrier from working out all of the time, especially from*

lifting. That's when I completely lost control *and I started binging.* I tried to *compensate with purging and exercise compulsion. I found at least with exercise I was partially helping my body at least in some ways. It was healthy and I looked better, but also it was an acceptable thing to do. It didn't bother my parents if I was at the gym for two hours every single night and entire afternoons on the weekend. They were happy to take me to the gym and happy that I enjoyed it.*

My binging, purging, and exercising *continued all throughout high school.* I couldn't escape the vicious cycle. I was stuck in an infinite loop. *I was spinning five times a week and running on the other days. I was exercising so much to the point where my body couldn't keep up. I would go to spin class and my legs wouldn't even turn on the bike because they were so tired. I was so sore and weak all the time but I felt like I had to workout. I did enjoy the mental aspect of working out. I liked how it made me feel. I was taking it to a new extreme but I didn't really* have a choice. *I wanted to lose weight and* exercise was my only solution. My brain had convinced me if I stopped exercising or even took a break I'd gain weight.

My parents finally started to catch on. I was getting winded in the house even just like walking across the room. The way I looked and the way I acted… they pieced it all together. They never explicitly said the words "eating disorder". Maybe they were uncomfortable confronting me. Maybe they didn't really know what was going on because they never actually caught me doing anything bad. *I really didn't want to talk to them about it*, and they respected that as long as I *started seeing a therapist*. But *I really didn't want to be in therapy, I really did not like* my therapist. *She didn't really know anything about treating a patient with an eating disorder I don't think. We just went in circles every time. She'd tell me, "You have to eat more and try not to purge, and try not to exercise so much, even though it's hard." And I said, "But it's hard," and she said, "But you have to do it."* I felt like she just didn't get me and didn't care.

She recommended that I take the year off school and do inpatient or intensive outpatient or something like that. That also meant she could hand me off, I'd be someone else's problem. *But I didn't want more treatment, I wanted to go to university. I didn't want to get better.*

When I got to university in first year I was living in residence. It's shared bathrooms, so purging wasn't really an option anymore. I just wanted to make friends and fit in, I didn't want to be known as the girl who purged or who was weird around food. *I feared that more than actually gaining weight, so I think I was able to stop because of that. It's embarrassing not being able to eat a meal* without finding a way to compensate for it, *because eating is such a human activity that I can't even do. I tried to relax in some ways around food. I was drinking frequently for the first time.* I knew I had to do it to make friends and fit in, but I had internal battles every time, trying to decide if it was worth it. *In the end, I still ended up gaining weight that year.* With my courses and trying to socialize, I couldn't keep up with my hours of exercise. I had to keep seeing my therapist because my parents made me, but it wasn't productive. To her, she thought I was better because I wasn't purging and had gained weight. But I was actually mentally the worst I'd ever been. My eating disorder was screaming at me constantly, telling me I was fat and worthless. The only thing that got me through that year was knowing it was temporary. *I knew I was going to be able to lose it all* when I left res in April and moved into an apartment.

I lived alone that summer in my apartment. *It was like a free-for-all. I was holding my breath before, and then suddenly, I was like, [exhales].* I started off just restricting, trying to lose the weight – but this time, my body retaliated. *I was binging a few times a week, sometimes every day, and then just some combination of purging and fasting and exercising.* I visited my family a few times throughout the summer. When I was home, I had to be really careful what I could get away with. *My parents thought I was recovered.* I also wanted them to think that. *I'm a people*

pleaser and just wanted to be an easy kid. I was able to exercise pretty regularly because *they thought exercising was healthy and we have a wonderful healthy daughter*. I don't think my parents ever realized exercise was a part of my disorder. *I would purge dinner in the basement bathroom, getting as far away from everyone asleep upstairs so no one could hear me.* By the end of the summer, I had noticeably lost weight. *All my friends were saying, "Oh my God, you look amazing*." The compliments felt good and made it feel like everything I did that summer was worth it. Those feeling were short lived though. My parents told me I wouldn't be returning to school for the next semester. I was being sent to an eating disorder program.

Once I was in an eating disorder day program, I actually committed to recovery for the first time and *felt motivated*. I liked that I wasn't so alone. I stopped all my behaviours and a*ll of the other patients were also going through the same thing. The staff were all specialists, they know what they're doing and they're super helpful. I felt like these were the first health care professionals that actually cared and wanted to help me. I figured I'm going to be here full-time, maybe I will recover, maybe I'll give it a shot, I'll make this worthwhile.* They had a meal plan, with six intakes a day. They locked bathrooms after eating, and kept our movement to a minimum. *They were very strict about stopping exercise while in treatment, so I really did my best to stop. I still wanted to exercise, but it was kind of nice that somebody was forcing me not to do it and I could take a break. We did talk about how exercise can be a beneficial thing and you can exercise in a healthy way in the future. We would have sessions about how exercise should be fun and types of exercise we could incorporate later. If you're exercising to burn calories or punish yourself, if you have to exercise, then that's not a healthy lifestyle.*

I was really nervous about leaving the program. I did try in the beginning to have normal meals and eat my snacks. I tried to only exercise by going on walks, but *I pretty much went back*

to basically what I was doing before treatment. I felt super fat after having gained the prescribed weight. I felt all flabby and soft and horrible about that so I needed to get back in the gym. I never really had a post-treatment exercise plan to follow. They didn't help us figure out *how you get back to exercising in a normal way, the same way they focused on like getting back to eating in a normal way. I don't know what a normal relationship with exercise is. I don't know what amount or type of exercise is good for me. I went from being an inactive kid,* to pretty obsessed with running, to the depths of my disorder. *The specialists were very clear that exercise should never be a punishment or compulsory. That all seemed pretty abstract to me. I wanted to hear like "you can exercise five times a week but no more than that" or something.*

I feel like my options are I either recover, which honestly doesn't really feel like an option at all right now, *or I deal with this for literally the rest of my life, which is not really an appealing thing either. I'm worried I will have to breakdown and be hospitalized to get to that point where I'm like motivated to change. But for now, I'm managing just fine so I'm willing to put up with it, I guess. I feel like it's never going to go away entirely and recovery's an awful lot of work for I don't know how much benefit. I have the inertia of this is what I know how to do and this is what I'm used to doing, so might as well keep going.*

Discussion

The aim of this study was to understand the lived experiences of CE and portray the complex interplay of factors involved in acquiring, living with, and attempting to recover from CE. Through the two stories, we highlighted the emotions and thoughts behind such experiences, and created an engaging yet accessible way to share the experiences of the four participants. Consistent with our philosophical framework, we have made our best efforts to reflect our participants' experiences, but we acknowledge that the stories of Amber and Carley reflect our

interpretation of the personal, social, and cultural factors that shaped their experiences. We also invite readers to reflect on their perceptions and interpretations when reading the two stories.

Throughout our analyses, we were struck by the many similarities in lived experiences across our participants, despite coming from distinct cultural backgrounds. A common experience among Amber and Carley was their internalization of the thin ideal (i.e., 'buying into' the cultural ideal of attractiveness). Both Western and Asian societies perpetuate and emphasize the thin ideal (Culbert et al., 2015; Pike & Dunne, 2015), whereby these unrealistic appearance ideals are often associated with high levels of eating psychopathology, body dissatisfaction, dieting, and bulimic symptoms (Culbert et al., 2015). The two characters' thin idealizations were differentially impacted by their societal contexts. In Asian cultures, a women's appearance, more so than her skill or ability, is a crucial aspect of her success in marriage and career, further adding pressure to be thin (Pike & Dunne, 2015). As Amber recounted, when she was growing up she only saw pretty, slim female figures, setting a standard and precedent for her to achieve the same. Furthermore, she recounted being motivated to lose weight to be desirable for men and find a romantic partner. Carley strongly internalized the thin ideal, but also the athletic ideal (i.e., appearing toned and fit). Athletic-ideal internalization has been shown to predict CE and is associated with dieting and bulimic symptoms (Bell et al., 2016; Homan, 2010). As a result, Carley not only faces the deleterious effects from the thin-ideal, but additionally the athletic-ideal. From a young age, she engaged in social comparison with her thinner friends and fit women on social media. Women often strive to achieve a thin physique as portrayed in the media as they believe it is associated with increased confidence, happiness, more romantic attention, and generally a positive, successful life (Evans, 2003). It is clear from both Amber and Carley's

upbringing that internalizing the thin ideal and the unhealthy values perpetuated in their cultures had a big influence on the development and maintenance of their EDs and CE.

The manifestation of CE in both of the characters can also be attributed to their foundational development in sport and exercise during childhood and adolescence. The role of sport and exercise varies considerably between Asian and Western societies. In Asian societies, academic achievement is highly valued, often at the expense of the child's sport or exercise participation (Ha et al., 2010). Children and adolescents are also aware and acknowledge that academic achievement is their number one priority, over and above physical activity (Ha et al., 2010). Amber's parents placed her in ballet from a young age, an activity that taught her about control and self-discipline. However, ballet is also an activity associated with a high risk of EDs, body dissatisfaction, low self-esteem, and intense pressure on weight and body shape (Liu et al., 2016). From years of ballet, Amber made associations between exercise, self-discipline, and manipulating the body, later developing into CE as means to change her appearance. When Amber's academics began to suffer in university as a result of CE, her strong academic values led her to seek help for CE to ensure her grades would not deteriorate further, demonstrating the pressure of maintaining high academic success over her compulsive need to exercise.

In North America, Carley, from a young age, noted how the discourse around sport and exercise was related to appearance goals. Carley noted how her mother always spoke about exercise as a means to lose weight. Previous research has shown that when mothers make negative comments about their own appearance and weight, daughters are indirectly influenced by their mother's comments to go on diets and experience greater body dissatisfaction than daughters not exposed to such comments (Diaz de Leon Vazquez & Unikel, 2018). Furthermore, negative maternal comments directed towards their daughters' weight, eating habits, or health

has been associated with their daughter experiencing weight and shape concerns, higher exercise frequency, and CE (Lease, 2016). Research conducted through the lens of several feminist theories has noted that fitness has become an important means for women to achieve the thin ideal, and that toned and thin bodies are also celebrated as healthy bodies (Markula & Kennedy, 2011). With the association that thin and toned equals health, Carley goes to such extremes with exercise to achieve that physique, ultimately creating a compulsive and unhealthy relationship with exercise. The discourse around women and exercise needs to broaden in scope to focus on the many positive physical, mental, and even social benefits that can be incurred from exercise.

Through the course of both characters' lifetimes, there is palpable tension between seeking control, taking control, and lacking control that manifests with both their EDs and CE. In 1979, Lawrence coined the term the "control paradox" in anorexia nervosa, which is also applicable to bulimia nervosa, and even CE. The paradox refers to the fact that individuals attempt to control their body weight, food, and exercise with the illusion they are controlling their life, but in reality they are not addressing the real issues. Often these initial feelings of being in control are short-lived, as the ED and CE becomes all-consuming and controlling in its own right. CE has also been recognized as a means to control negative affect, or in other words, an ineffective coping mechanism to manage difficult emotions (Meyer et al., 2011). Both Amber and Carley used exercise to control and to cope with the negative emotions they felt about their bodies and even cope with life's challenges. For example, both girls reported exercising as a means to cope with feelings of loneliness, but this led to further negative emotions as they faced the challenges of CE and an ED. Amber grew up doing ballet, a form of exercise she associated with control and self-discipline, then repeating a similar pattern turning to exercise in adulthood to gain a sense of control. For Carley, exercise was one aspect of her ED experience that she

could control at all times and did not have to hide from her parents. One participant from a qualitative study stated: “Compulsive exercise is a socially acceptable prison cell” (Hallward & Duncan, 2021, p. 1668), expressing the sentiment that people can often “get away with” CE and are praised for their dedication to exercise, further exacerbating the situation. In the end, both Amber and Carley were controlled by CE, describing exercise as toxic. The two characters spoke about feeling intense guilt and shame when unable to exercise and feeling compelled to workout, despite not wanting to. They also feared that ceasing exercise would lead to weight gain or leave them without a means to cope with negative emotions. This negative reinforcement (i.e., fearing the consequence of ceasing exercise) is a common characteristic of CE (Meyer et al., 2011)

The treatment and recovery journey for EDs and CE is a unique and personal experience for each individual, with notable differences between Amber’s and Carley’s experiences. Currently, there is no recognized standard treatment for CE (Calogero & Pedrotty-Stump, 2010). Most clinicians fear allowing exercise during ED treatment and often prescribe exercise abstinence (Davies et al., 2008) despite research demonstrating that exercise can be safely prescribed and beneficial on a number of physical and psychological outcomes (e.g., Moola et al., 2013). We can see that allowing Amber to exercise, in moderation and with the support of her psychologist, during treatment had a more positive outcome in the end. Carley was prescribed exercise abstinence and struggled to develop a healthier relationship with exercise after treatment. Although Carley had some education about exercise during treatment, she felt it was too abstract and struggled to apply it to her routine post-treatment. Carley’s experience is in line with previous research reporting patients feeling lost with exercise after leaving treatment (Moola et al., 2015). ED treatment should include exercise psychoeducation to help individuals address motives for engaging in CE, develop a positive and healthy relationship with exercise,

and have individuals engage in exercise during treatment to allow them to experience a healthy model of exercise (e.g., Calogero & Pedrotty-Stump, 2010; Hallward et al., 2020). The stories of both Amber and Carley provide support for the importance and need to address CE in treatment, and more education for health professionals treating EDs and CE. Unfortunately, these women are left trying to navigate recovery in a society and culture that continues to promote the thin- and athletic-ideal and places an unnecessary amount of pressure on women's appearance.

Limitations

Our small sample size and narrative analyses allowed us to honour the lived experiences through an emotional and evocative representation of their stories, but this approach is not without limitations. First, we had one participant who decided to withdrawal from the study after completing two interviews to protect her mental health and recovery progression. Given the sensitive nature of the interviews and this topic of study, early withdrawal from some participants is to be expected. Fortunately, we completed two interviews and were able to use her experiences to help create the narratives. Second, we must acknowledge the experiences we did capture reflected experiences with EDs and CE from women who were university educated, from middle- to upper-class families, had received diagnoses and had access to treatment, and had thin privilege while navigating recovery. EDs and CE can affect people from all genders, sexualities, races, ethnicities, socioeconomic statuses, etc., and future research is needed to highlight how these factors influence lived experiences. Third, each individual has a unique story, and we were only able to capture that of four participants. Additionally, a challenge of creative nonfiction is having to be selective in what experiences we could present, knowing it would not be feasible to include them all; therefore, some aspects of the participants' experiences were excluded. However, we feel that multiple interviews with a small sample encouraged rapport building with

our participants to allow for more emotional, detailed experiences, rather than attempting to capture a breadth of experiences without much depth. Fourth, we chose to reflect the stories from the participants' perspectives to portray the thoughts and emotions the characters experienced, and we reflected a timeline that covered most of the character's life to present the interplay of factors from childhood to present day that impact EDs and CE. Rather, we could have included dialogue with other characters, such as parents, friends, or health professionals, demonstrating multiple perspectives in the narratives, which could have enhanced relatability for our readers.

Implications and Conclusions

There are some practical benefits to presenting lived experiences with EDs and CE through two creative nonfiction stories. There is a lack of shared understanding around CE among academics, health professionals, and those who experienced CE. This misunderstanding also extends to a lack of awareness among friends, family, the media, and other professionals working in health-related fields. The goal of these creative nonfiction narratives is to paint a picture of the number of subtle and overt messages from many different sources overtime that build up and can cause disordered thoughts around food, body, and exercise. These environmental factors, taken together with biological and genetic factors, can lead to the development of an ED and CE. We hope the raw, honest, and emotional portrayal of these two characters also highlights for everyone the impact of brief comments on the individual and brings a level of awareness around CE and EDs. Family and friends should be cautious how they speak about their own bodies, and how they comment on others' appearance, eating and exercise habits. Dieticians, kinesiologists, personal trainers, coaches, and others working in health-related fields should be aware of such disorders, be able to recognize symptoms, and ensure some education in prevention and treatment strategies for these individuals.

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Bridging Text

Chapter Four explored the experiences of four women with CE and bulimia nervosa, illustrated through two creative nonfiction stories. The two stories reflected the evolving relationship with exercise, eating, and the body from childhood to early adulthood, and how these relationships were influenced by life events, psychological, and sociocultural factors such as the media and cultural expectations. This study addressed some of the complexity and interplay of factors that can lead to the development of CE, and further describes experiences living with, being treated for, and recovering—or attempting recovery from—CE. The results section of this study includes two stories that are emotional and evocative, but also accessible and sufficiently detailed that they can be used to bring further awareness to CE for a broad audience. Together, Chapters Three and Four employed qualitative methodologies that captured both a breadth and depth of experiences with CE, with implications for advancing the understanding of CE for academics, clinicians, and even those with lived experiences. Across both chapters, participants frequently referred to a lack of treatment or poor experiences with treatment for CE, which aligns with previous findings in the literature (e.g., Chubbs-Payne et al., 2021; Moola et al., 2015). There is a growing amount of research focused on treatment approaches for CE, with evidence supporting that exercise can be safely and effectively integrated within ED treatment, and may even be more beneficial for treatment outcomes than exercise abstinence (e.g., Hausenblas et al., 2008; Moola et al., 2013; Ng et al., 2013). However, there are currently no guidelines for the "best" treatment for CE, and very little is known about the specific treatment components or efficacy of CE treatment. Chapter Five addresses this need and includes a systematic review of treatment approaches for CE, and provides a brief summary of the state of the literature. Chapters Three and Four (Studies 1 and 2) also demonstrated there

are strategies to help with CE recovery, such as developing positive exercise motives, finding more enjoyable forms of exercise, and appreciating what the body can do. We conducted the review to also examine whether current treatment approaches in the literature employ some of the strategies described by participants. As a result, the overall purpose of Chapter Five was to assess the content and examine the efficacy of current CE treatment.

Chapter Five: Study 3

A systematic review of treatment approaches for compulsive exercise among individuals with eating disorders

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Abstract

Individuals with eating disorders often experience compulsive exercise which, if left untreated, can lead to longer treatment and worsened symptoms. Compulsive exercise must be addressed within eating disorder treatment to help individuals establish a healthy relationship with exercise. However, there are currently no standardized guidelines for treating compulsive exercise or a consensus on which forms of treatment are most effective. Therefore, the purpose of this review was to examine interventions that address compulsive exercise and their impact on treating compulsive exercise among individuals with eating disorders. A systematic review of the literature was conducted. Eleven studies testing treatments for compulsive exercise were included in this review. Participants were diagnosed with anorexia nervosa, bulimia nervosa, or EDNOS, and a small portion had BED. Improvements in compulsive exercise and eating psychopathology were observed across all studies. The interventions focused on exercise psychoeducation and often incorporated exercise sessions. The findings highlight the positive impact of treating compulsive exercise, suggesting it should be a standard component of eating disorder treatment. Future studies should examine differences in treatment approaches and outcomes specific to each eating disorder, and specific to males. More consistency across studies in the conceptualization and measurement of compulsive exercises is also needed.

Keywords: Feeding and eating disorders, compulsive exercise, treatment, interventions, systematic review

Clinical Implications

- Treatment addressing compulsive exercise can improve exercise-related outcomes
- Compulsive exercise treatment can improve eating psychopathology
- Psychoeducation and exercise sessions can reduce negative exercise attitudes
- All types of eating disorders can benefit from compulsive exercise treatment
- All eating disorder treatment should address exercise cognitions and behaviours

Introduction

Individuals with eating disorders often experience maladaptive exercise cognitions and behaviours, which has been identified in as many as 85% of individuals with eating disorders (Fietz et al., 2014; Meyer et al., 2011; Moola et al., 2013). The etiology of maladaptive exercise is unknown (Costa et al., 2016), which has led researchers to conceptualize it in various ways. For example, maladaptive exercise has been described as an addiction and conceptualized based on theories of behavioural addiction (Brown, 1993), such as gambling addiction. The terms exercise abuse or exercise dependence have been used, based on criteria for diagnosing substance dependence (De Coverley Veale, 1987). Other researchers have explained that the term addiction encompasses both compulsion and dependence (i.e., addiction = compulsion + dependence; Berczik et al., 2012; Szabo, 2010). Regardless of the term used, conceptualizations of maladaptive exercise include either a quantitative component (i.e., frequency, volume, duration) or a qualitative dimension associated with exercise cognitions (i.e., obsession, compulsivity, rigidity; Meyer & Taranis, 2011). However, there is strong evidence indicating quantities of exercise (i.e., hours of exercise each week) are unrelated to eating psychopathology in both clinical and non-clinical samples (Meyer & Taranis, 2011). The qualitative or psychological aspects of maladaptive exercise, such as distress with ceasing exercise, obsessive thoughts, and exercising despite negative outcomes are more telling of pathological exercise (Noetel et al., 2017).

There is a movement towards using the term compulsive exercise, as it has been shown to be the most clinically- and theoretically-appropriate term among eating disordered and non-clinical samples (R. R. Davies, 2015; Mond & Calogero, 2009; Noetel et al., 2017). Compulsive exercise is often described as a rigid and highly-driven urge to exercise, associated with a

perceived inability to cease exercising regardless of the risk of harmful consequences (Noetel et al., 2017). The severity of compulsive exercise can vary considerably, and is often associated with higher eating psychopathology, dietary restraint, and lower BMI (Dalle Grave, 2009). Compulsive exercise can lead to an increased risk of overuse injuries, bone fractures, cardiac complications, and hinders weight restoration for underweight individuals, mainly those with anorexia nervosa (Dalle Grave, 2009). Compulsive exercise is often used for weight control reasons, but can also serve to regulate negative affect (Meyer & Taranis, 2011). Although more commonly documented in anorexia nervosa, bulimia nervosa, and eating disorders not otherwise specified (EDNOS; e.g., Monell, Levallius, Mantilla, & Birgegård, 2018), compulsive exercise can also be problematic among individuals with binge eating disorder (BED; American Psychiatric Association, 2013; Mathisen et al., 2018). Compulsive exercise among individuals with eating disorders is of particular concern given it is associated with longer treatment times, shorter periods between relapses, exacerbation of eating disorder symptomology, and is often one of the last symptoms to subside (Calogero & Pedrotty-Stump, 2010; Davis et al., 1994). Compulsive exercise has been identified to play a significant role in the etiology, development, and maintenance of eating disorders (e.g., Davis et al., 1994), highlighting the importance of addressing and treating the issue.

Clinicians have commonly prescribed exercise abstinence during treatment to prevent exercise serving as an obstacle for weight restoration (Calogero & Pedrotty, 2004). However, ceasing exercise completely during treatment has been proposed as unrealistic and potentially detrimental to health outcomes in the long run (R. R. Davies, 2015). Removing the opportunity to exercise might exacerbate the lack of control patients already feel during treatment (Moola et al., 2015) and it can be difficult for health professionals to supervise or enforce exercise policies,

leaving individuals engaging in covert activity (R. R. Davies, 2015; Moola et al., 2015). Individuals in treatment are left confused about what are considered "normal" or healthy levels of exercise, and fear that engaging in movement after treatment might lead to relapse (Moola et al., 2015). Exercise should be addressed in treatment, focusing on reducing the negative cognitions and behaviours that maintain compulsive exercise.

There is growing empirically-based evidence that challenges the notion of exercise abstinence and supports positive benefits of addressing exercise cognitions and behaviours, and including exercise training during treatment (Cook et al., 2016; Meyer et al., 2008; Scott & Blyderveen, 2014). Several reviews have examined positive outcomes of implementing exercise (that is deemed medically safe for patients and is nutritionally supported) during treatment among patients with various types of eating disorders (e.g., Hausenblas, Cook, & Chittester, 2008; Moola et al., 2013; Ng, Ng, & Wong, 2013). Across studies, exercise type, intensity, frequency, and duration varied considerably, with anything from aerobic and resistance training to yoga, sessions ranging from 30 to 60 minutes, and occurring two to five times a week. Exercise during treatment has been shown to decrease the drive for thinness, body dissatisfaction, and eating disorder symptoms; increase weight gain, strength, well-being, quality of life, and mood; and improve cardiac abnormalities (Hausenblas et al., 2008; Moola et al., 2013; Ng et al., 2013). These promising research findings provide support for the integration of safe and healthy exercise in treatment settings.

The goal of treatment for compulsive exercise should be to help individuals recognize and reduce their maladaptive behaviours, but additionally their maladaptive exercise cognitions. Individuals should learn how to (re)establish a healthy relationship with exercise to gain lifelong positive benefits from exercise (Hausenblas et al., 2017). However, healthcare professionals lack

a common conceptualization of healthy exercise and clear evidence-based guidelines for best practices, which makes it difficult to determine how to safely and effectively treat compulsive exercise (S. Davies et al., 2008). Current approaches to treating compulsive exercise often include exercise counselling and exercise sessions. The fundamental goal of the programs are to address and challenge negative beliefs about exercise through education, and have individuals engage in exercise during treatment to expose themselves to a healthy exercise model (e.g., Calogero & Pedrotty-Stump, 2010; Calogero & Pedrotty, 2004). Treatment approaches are often implemented across eating disorder types, with considerable variability across methodologies with regard to the types of exercises, the psychoeducational approach, measures of success, and rationale for including exercise in treatment, among others.

There is currently a lack of general guidelines for incorporating exercise into eating disorder treatment and for effectively treating compulsive exercise. Researchers are calling for standardized guidelines, but researchers and clinicians have yet to come to an agreement as to what constitutes best practices, which has hindered the development of formal guidelines (Touyz et al., 2017). In order to determine the effectiveness of current interventions and move forward towards establishing standardized protocols for treating compulsive exercise, a systematic evaluation of current compulsive exercise interventions is needed. Therefore, the aim of this review was to examine the current compulsive exercise interventions and their impact on reducing or treating compulsive exercise, considering both qualitative and quantitative dimensions of exercise, among eating-disordered populations.

Methods

A systematic review of the literature was conducted using the preferred reporting items for systematic reviews and meta-analyses (PRISMA) checklist (Moher et al., 2009). This

systematic review is registered with PROSPERO (CRD42020156492). A narrative synthesis of the quantitative data was performed (Popay et al., 2006), in consultation with the Synthesis Without Meta-analysis (SWiM) guidelines (Campbell et al., 2020).

Search Strategy and Data Collection

Seven databases were systematically searched including MEDLINE (OVID 1946-), Web of Science, EMBASE (1946-), CINAHL (EBSCO), PsycINFO (1987-), ERIC (ProQuest), and PubMed. These databases were selected given they cover a range of educational, medical, psychological, and social science topics relevant for this review. The initial search was developed in MEDLINE (OVID) using MeSH terms (shown in Supplemental Material 1) and was adapted for the remaining databases. The key search terms related to (a) eating disorders, and (b) exercise (e.g., compulsive exercise, exercise dependence, excessive exercise, etc.). The articles from the database searches were downloaded into EndNote X9 reference management system and duplicates were removed. The articles were subsequently managed in Rayyan, a free mobile and web application developed for screening abstracts and titles of systematic reviews (Ouzzani et al., 2016). Titles were reviewed by one author, and abstracts and full-text articles were reviewed independently by two authors to determine which articles were included in the review.

Inclusion Criteria

Types of studies

Eligible articles were published in English or French, in peer-reviewed journals, and between January 1, 1946 and September 30, 2019 (based on the time frame of the databases and when the search was conducted). Study designs included randomized controlled trials, quasi-

experimental studies, pre-experimental studies, case studies, and mixed methods (as long as quantitative measures were reported).

Types of participants

The population included individuals diagnosed with eating disorders according to the DSM-3 to DSM-5 (depending on the time the study was conducted). These eating disorders include anorexia nervosa, bulimia nervosa, BED, and other specified feeding or eating disorder (OSFED) as described in the DSM-5, formerly EDNOS in previous DSM versions. Studies with participants of all ages and both males and/or females were included. Studies were eligible if the control or comparison group included clinical and/or non-clinical samples. There was also no restriction for participant eligibility based on baseline scores of compulsive or excessive exercise. The authors were not only interested in improvements for participants classified as compulsive exercisers, but also for improvements among sub-clinical cases as these improvements can also be informative of treatment effectiveness.

Types of interventions

Studies were included if they implemented an intervention with the goal of, in part or as the main focus, treating or reducing compulsive exercise for individuals with eating disorders. The interventions must have included a treatment component that was designed to target and address issues around exercise. Interventions that did not incorporate a component addressing exercise (i.e., were exclusively focused on treating eating psychopathology) were excluded. Eligibility of interventions was not limited by program characteristics such as setting, duration, delivery, frequency, etc.

Types of outcomes

The main outcomes were exercise-related outcomes, including exercise quantities or exercise cognitions (i.e., attitudes and beliefs toward exercise) to indicate whether the intervention was able to reduce or treat compulsive exercise. Therefore, eligible articles must have reported at least one exercise-related outcome. Although the quantity of exercise is not directly associated with maladaptive exercise among individuals with eating disorders (Meyer & Taranis, 2011), some researchers continue to believe it is worth assessing; therefore, exercise quantities were included in this review. The secondary outcome examined was eating psychopathology to determine the effect of the interventions on eating disorder symptoms or severity. Given the primary diagnosis of these individuals is an eating disorder, noting how the interventions impacted eating psychopathology is an important outcome to observe, particularly to assure eating psychopathology does not worsen while focused on treating compulsive exercise.

Data Extraction

Two authors independently extracted data from the articles following the checklist from the Cochrane Handbook for Systematic Reviews (Higgins et al., 2019). The data extracted included: authors, year of publication, country, study design, number of participants, participant characteristics, intervention description, study duration, setting, attrition (i.e., dropout), adherence (i.e. participant compliance to the intervention and complete data), measurement tools, and outcomes. A third author was responsible for comparing the extracted data from both authors, discussing any discrepancies, and referring back to the research articles to help all three authors come to an agreement.

Data Synthesis

A narrative synthesis of the quantitative data was performed, relying mainly on the use of words and text to summarize and explain the findings (Popay et al., 2006), both in paragraph form and in note form in Table 1. A meta-analysis was not performed because statistical pooling of the results would not have been appropriate given the high levels of heterogeneity across studies in terms of study designs, intervention characteristics, and outcomes (Campbell et al., 2019). A thorough description of the study designs, participants, and intervention characteristics was provided to outline the variability across the studies as described in the results section and Table 1.

Studies were grouped for the main analysis based on the type of exercise outcome(s) reported (i.e., exercise quantity outcomes, exercise cognition outcomes, or studies that reported a combination of both). Exercise quantities (e.g., number of compulsive exercise sessions per week) were reported with objective measures (i.e., accelerometry data) or self-report measures of physical activity or compulsive exercise. Exercise cognitions (e.g., feeling guilty for missing an exercise session) were reported using questionnaires, where higher scores indicated more maladaptive beliefs around exercise. Observing a reduction in the total or subscale score is considered an improvement, whereby the individual has less maladaptive beliefs around exercise.

For the exercise outcomes, between and within-group differences were reported (whether no changes or significant changes were observed). Effect size (Cohen's d) was used as a standardized metric to assess the magnitude of change across studies. Effect sizes were reported for all significant changes among exercise outcomes when sufficient data were available for it to be calculated or it was reported within the research article. For the secondary outcome of eating

psychopathology, pre- to post-intervention changes were reported for each study, indicating whether a significant change or no change was observed.

Quality Assessment

The methodological quality and risk of bias were assessed for each article using the Quality Assessment Tool For Quantitative Studies (Effective Public Health Practice Project, 1998). The tool assesses: (a) selection bias, (b), study design, (c) confounders, (d) blinding, (e) data collection methods, and (f) withdrawals and dropouts. Each criterion is given a score of 1 = strong, 2 = moderate, and 3 = weak. An overall score for the article is then given where 1 = strong (no weak ratings), 2 = moderate (one weak rating), or 3 = weak (two or more weak ratings). Two authors independently evaluated each article. Any discrepancies were discussed between the two authors, referring back to the article and the evaluation tool dictionary, and a final rating was determined by consensus.

Results

A total of 5,386 articles were identified from the search, and resulted in 3,442 unique titles after duplicates were removed. After screening titles and abstracts, 66 full-text articles were read in full and assessed for eligibility. In total, 11 articles met the inclusion criteria and were retained for this review. The flow of the articles is presented in Supplemental Material 2. A thorough description of the eleven eligible studies, including study characteristics, participant characteristics, intervention descriptions, measurement tools, and exercise outcomes, is provided in Table 1.

Conceptualizations of Maladaptive Exercise

Across the studies, several different conceptualizations of maladaptive exercise were described, using various terms like compulsive exercise, exercise dependence or abuse, excessive

exercise, and over-exercise. All studies mentioned a cognitive component to maladaptive exercise, meaning it was not exclusively viewed as an issue of large quantities of exercise.

The classification criteria for compulsive exercise differed considerably between studies. In Bratland-Sanda et al. (2010) and Bratland-Sanda and Vrabel (2018), 29% and 23% of the patients were classified as excessive exercisers at baseline, respectively. Individuals were classified as excessive if they met the following three criteria: >6 hours of moderate to vigorous physical activity measured by an accelerometer at admission, reported persistence of this amount of exercise for >1 month before admission, and were classified as exercise dependent symptomatic based on a questionnaire. In Calogero and Pedrotty (2004), the average hours of exercise per week for all patients was classified as clinically excessive (i.e., >6 hours per week), although based on the range of hours provided, it was evident not all individuals met the threshold. In four studies, all participants were classified as compulsive exercisers at baseline (Bratland-Sanda et al., 2018; Dittmer et al., 2018; Long, 1995; Long & Smith, 1990), based on various criteria such as excessive hours of exercise, if exercise was compulsively performed, if participants displayed ‘negative addiction’ to exercise, and cut-off scores on questionnaires. In the remaining four studies (Danielsen et al., 2016; Hay et al., 2018; Mathisen et al., 2018; Schlegel et al., 2015), average baseline scores for compulsive exercise were reported, but the number of individuals that fell below or above the clinical threshold was not specifically indicated.

Intervention Characteristics

Most studies included a combination of individuals with anorexia nervosa, bulimia nervosa, or EDNOS, where four studies focused only on individuals with anorexia nervosa. Mathisen et al. (2018) was the only study to include individuals with BED. Interventions were

delivered as a form of inpatient, residential, or outpatient treatment. Refer to Table 1 for specific details about eating disorder diagnoses and intervention settings for each study. The treatment sessions were delivered by a variety of professionals or specialists, including clinical exercise physiologists and psychologists (Bratland-Sanda et al., 2010, 2018; Bratland-Sanda & Vrabel, 2018), a clinical psychologist (Dittmer et al., 2018), a sports therapist (Schlegel et al., 2015), exercise coordinators (Calogero & Pedrotty, 2004), or multidisciplinary teams with specialties in areas like dietetics, psychology, body-oriented therapy, cognitive behavioural therapy (CBT), and exercise (Danielsen et al., 2016; Hay et al., 2018; Long, 1995; Long & Smith, 1990; Mathisen et al., 2018).

Treatment programs

Inpatient treatment addressed eating psychopathology, and additionally incorporated strategies aimed at improving compulsive exercise. For outpatient settings, the treatment mainly focused on compulsive exercise, with the premise that eating psychopathology had previously been addressed or was addressed through additional treatment elsewhere. The two main approaches used to treat compulsive exercise were psychoeducation and exercise sessions. However, many studies lacked a theoretical framework underpinning the interventions as researchers relied on previous research or empirical data from patients in their treatment centers to create novel programs. Some interventions were developed based on principles of CBT. For example, Danielsen et al. (2016) mentioned using principles from psychodynamic theory, CBT, and motivational interviewing within their intervention. Rather, many interventions focused on targeting the known or hypothesized mechanisms that maintain eating psychopathology and compulsive exercise, such as affect regulation and compulsivity. For example, in Bratland-Sanda

and Vrabel (2018), the treatment approach was to create a "formula" of the unique mechanisms maintaining each patient's psychopathology to be addressed throughout treatment.

All studies used psychoeducation to address participants' attitudes, beliefs, and thoughts around exercise. The overall goal of the psychoeducation was to challenge motives for engaging in compulsive exercise and to develop positive and healthy associations with exercise. Within the psychoeducation sessions themselves, individuals discussed differences between healthy and unhealthy exercise amongst other patients or with health professionals. Participants were taught through body-oriented therapy how to better recognize bodily signals around movement, such as fatigue or soreness. They also learnt how to (re)establish a flexible exercise regimen through challenging previous assumptions around exercise and engaging in exercise in new ways. Participants discussed how to (re)experience joy with exercise to encourage lifelong positive engagement with exercise. The individuals focused on the social components of exercise and finding new forms of exercise that were often different from what they were doing previously in a compulsive way. Towards the end of the interventions, the content focused on emotional regulation and alternative coping mechanisms to teach participants not to always rely on exercise to regulate negative affect, and relapse prevention strategies. Although each intervention included slightly different content, they shared the same underlying principles and approach to treatment. Sessions were delivered in both group and individual formats. Only two interventions (Danielsen et al., 2016; Hay et al., 2018) relied exclusively on psychoeducation as the treatment approach.

The majority of studies supplemented psychoeducation with participants engaging in exercise throughout the program. The goal of having participants engage in exercise during treatment was to expose them to a healthy model of exercise, and allow participants the

opportunity to process emotions that occur before, during, and after exercise (Calogero & Pedrotty, 2004). The number of exercise sessions ranged from once a week (e.g., Schlegel et al., 2015) up to four times a week (e.g., Mathisen et al., 2018). The exercises varied from walking, outdoor activities, sports, or recreational games (Bratland-Sanda et al., 2010; Bratland-Sanda & Vrabel, 2018; Schlegel et al., 2015) to more structured exercise programs with aerobic and resistance training sessions (Bratland-Sanda et al., 2018; Calogero & Pedrotty, 2004; Dittmer et al., 2018; Mathisen et al., 2018). Exercise sessions were often no more than an hour, graded in terms of intensity and types of exercise, and often supervised. To ensure safety for engaging in exercise, studies often had eligibility criteria for a minimum BMI, included weight restored patients, monitored weight throughout the program, or had participants medically cleared to participate in exercise. In the two studies by Long and Smith (1990) and Long (1995), the participants applied the principles they were learning through the intervention to their own exercise sessions, which were not prescribed nor supervised by the program providers.

Outcomes

Exercise

Generally, the participants noted a reduction in negative exercise cognitions and exercise quantities. An improvement in exercise cognitions (i.e., less maladaptive attitudes towards exercise) were noted in nine of the ten studies that assessed it, with no change observed among the one participant in Bratland-Sanda et al. (2018). Decreases in exercise quantities were noted in three studies (Bratland-Sanda et al., 2018; Bratland-Sanda & Vrabel, 2018; Long & Smith, 1990), no change observed in two studies (Mathisen et al., 2018; Schlegel et al., 2015; Swenne, 2018), and mixed findings in Bratland-Sanda et al. (2010).

Cognitions. Among the five studies that exclusively assessed exercise cognitions (Calogero & Pedrotty, 2004; Danielsen et al., 2016; Dittmer et al., 2018; Hay et al., 2018; Long, 1995), all of them noted improvements whereby participants reported having less negative beliefs towards exercise, such as feeling less guilt for missing exercise, feeling more exercise enjoyment, and not using exercise solely as a means to reduce negative affect. Calogero and Pedrotty (2004) reported significant within- and between-group improvements in exercise cognitions. Hay et al. (2018) compared one group receiving a specialized intervention to treat compulsive exercise to a group receiving standard CBT for eating disorders. No significant group differences were reported, and both groups showed significant improvements pre- to post-intervention, although the degree of change was larger in the specialized compulsive exercise treatment group compared to the CBT group. Significant increases (with large effect sizes) were noted from baseline to post-intervention (4 weeks later) in Dittmer, Voderholzer, et al. (2018) and from baseline to follow-up (~26 months after discharge) in Danielsen et al. (2016). Long (1995) had six participants, where four participants reported improved exercise cognitions, and two participants did not report notable improvements; however, no changes were observed for any of the six participants on the Commitment to Exercise Scale.

Quantities. Only one study (Bratland-Sanda & Vrabel, 2018) exclusively measured exercise quantities and reported a significant decrease in the number of compulsive exercise sessions from pre- to post-intervention.

Cognitions and quantities. Five studies assessed both exercise cognitions and exercise quantities (Bratland-Sanda et al., 2010, 2018; Long & Smith, 1990; Mathisen et al., 2018; Schlegel et al., 2015). Long and Smith (1990) was the only study that noted improvements in exercise cognitions, and decreases in exercise quantity. The remaining studies had misaligned

findings between cognitions versus quantities. Two studies (Mathisen et al., 2018; Schlegel et al., 2015) demonstrated significant improvements in exercise cognitions, but found no changes in exercise frequency. In Bratland-Sanda et al. (2010), participants were classified, at baseline, as either excessive exercisers or non-excessive exercisers. Excessive exercisers had significant improvements in exercise cognitions, but did not have a significant reduction in exercise frequency, where there was even a significant increase in quantity from mid-treatment to discharge. There was no change in cognitions for the non-excessive exercisers, and a significant decrease in exercise quantity. In the case study by Bratland-Sanda et al. (2018), there was no change for exercise cognitions, but there was a reduction in the amount of exercise.

Eating psychopathology

In the nine studies that assessed eating psychopathology, a decrease in eating psychopathology from before to after the intervention was noted, except the case study of the individual in a strength training intervention where no notable changes were observed (Bratland-Sanda et al., 2018).

Quality of Studies

Overall, five studies were rated as strong, two studies were rated as moderate, and four studies were rated as weak using the Quality Assessment Tool For Quantitative Studies (Effective Public Health Practice Project, 1998). One trend was the presence of selection bias, where participants may not have been representative of the target population as individuals were referred from an affiliated clinic or inpatient treatment center, or chosen in a systematic manner and not randomized. Some studies also reported high dropout or withdrawal rates. The majority of studies had moderate study designs and strong data collection methods. The overall quality

rating of each study can be found in Table 1, and a more detailed description of the ratings for each category can be found in Supplemental Material 3.

Discussion

This review assessed interventions designed to treat compulsive exercise among individuals with eating disorders. All studies approached and treated compulsive exercise in a similar manner, mainly through exercise psychoeducation and exercise sessions, and did not differ depending on eating disorder type or intervention setting. The findings were overall positive with reductions in negative exercise cognitions noted across 10 of 11 studies. Additionally, eating psychopathology was reduced or unchanged, providing promising evidence that treatment for compulsive exercise can be successfully incorporated alongside or in addition to eating disorder treatment to help individuals recover from both an eating disorder and compulsive exercise. The similar approach across studies treating compulsive exercise is a somewhat surprising finding, given the inconsistencies in terms and measurement tools used. These findings allude to the fact that nuances between the various conceptualizations of these constructs are so minor they did not meaningfully impact the treatment approach.

All programs fundamentally acknowledged that to treat compulsive exercise, the goal is to help individuals recognize and reduce negative attitudes and beliefs, establish a positive relationship with exercise and their bodies, and engage in healthy exercise. However, there is a lack of a clear understanding among clinicians and healthcare professionals about what constitutes healthy exercise for individuals recovering from an eating disorder (S. Davies et al., 2008). In a survey of 43 inpatient eating disorder units in the United Kingdom, only four units had a written definition of healthy exercise, whereas other units provided some descriptions of how they viewed healthy exercise. The most common response was healthy exercise was

"individually defined", with only five units suggesting healthy exercise should be enjoyable (S. Davies et al., 2008). Individuals leaving inpatient treatment have expressed being confused about what constitutes healthy versus unhealthy activity for them (Moola et al., 2015). Moola et al. (2015) suggested people can engage in exercise for a multitude of reasons, some detrimental and beneficial for health, and may lie along a continuum from healthy to unhealthy. Perhaps treatment should define and explore what healthy exercise means for each individual patient to provide them a clear treatment end goal and what healthy exercise means to them post-treatment. Although this may be beneficial in practice for the patients, advancements in the field may be hindered without an operational definition of healthy exercise, as demonstrated by the inconsistencies in terminology for compulsive exercise. As healthcare professionals and researchers have done previously to come to an agreement for the term compulsive exercise (Noetel et al., 2017), a similar process should occur to define healthy exercise among the eating disorder population. A consensus definition would facilitate advancements in future research and provide, at minimum, a goal for patients to achieve when discharged from treatment.

To further advance research for the treatment of compulsive exercise, clinicians have to continue to adapt their practices to address exercise within eating disorder treatment. Often healthcare professionals have expressed that exercise goes "untouched" during the treatment of eating disorders; however, failing to acknowledge and address compulsive exercise in treatment, as its own distinct issue, can lead to longer treatment times, worsened eating disorder symptoms, and shorter periods between relapses (Calogero & Pedrotty-Stump, 2010). Notably, in the study by Calogero and Pedrotty (2004), patients in the control group receiving inpatient treatment, with no attention to compulsive exercise, reported an increase in maladaptive exercise beliefs at discharge compared to admission, highlighting the importance of targeting compulsive exercise

during treatment to avoid worsened outcomes. More healthcare professionals may feel comfortable addressing compulsive exercise with a set of standardized guidelines for treatment. However, more research focused on the design and efficacy of compulsive exercise interventions is needed to inform the development of standardized guidelines.

Compulsive exercise impacts individuals across the eating disorder spectrum (Boyd et al., 2007) and is more often linked to higher levels of eating psychopathology, dietary restraint, and lower BMI, which can lead to serious detrimental health consequences (Dalle Grave, 2009; Davis et al., 1994). There are mixed findings for the prevalence of compulsive exercise among each type of eating disorder (Dalle Grave et al., 2008; Monell et al., 2018). The lowest rates of compulsive exercise are often reported in BED, but has been reported in as many 22% of individuals with that diagnosis (e.g., Monell et al., 2018). Regardless of eating disorder type, compulsive exercise is prevalent across diagnoses and should be addressed as part of treatment for all different types of eating disorders. In this review, the majority of studies had a population consisting of individuals with anorexia nervosa, bulimia nervosa, and EDNOS, and the remaining studies often had mixed samples of diagnoses as well. The outcomes were not reported for each eating disorder, meaning sub-analyses examining the impact of treatment for each type of eating disorder was not possible. Future research should examine outcomes specific to each eating disorder, as there are perhaps nuances to treating compulsive exercise. For example, the relationship between quantity and quality of exercise may be worthy of exploring depending on the type of eating disorder or individual characteristics of the patient, such as BMI, level of malnourishment, and medical history. Mathisen et al. (2018) also alluded to the notion of an ‘exercise paradox’ where individuals report high scores for compulsive exercise, yet engage in low levels of exercise, often among those with bulimia nervosa and BED (Mathisen et al.,

2018). Both the idea of large quantities of exercise among emaciated patients, and the 'exercise paradox' speak to issues that may differ from one eating disorder to another, worthy of considering and investigating with future research.

The sample in this review was almost only compromised of females, with males comprising around 1% of the total sample. Eating disorders are less common among males, but they also have been severely neglected in diagnoses and treatment, which are often based on characteristics and paradigms intended for females. As a result, males with eating disorders are often overlooked, misunderstood, and underdiagnosed (Strother et al., 2012), resulting in a lack of understanding around males with eating disorders and compulsive exercise (Monell et al., 2018). Rates of compulsive exercise in males are inconclusive, and findings are mixed regarding whether males face higher, equivalent, or lower rates of compulsive exercise compared to females (Adkins & Keel, 2005; Monell et al., 2018). Measurement tools may not be validated or designed to assess criteria for compulsive exercise among males, as criteria may differ. For example, females may engage in compulsive exercise for a drive for thinness, whereas men may be driven by the desire for an athletic, lean, and muscular body (Danielsen et al., 2018). As noted in Danielsen et al. (2016), males were excluded from the study because the questionnaire for compulsive exercise had not been validated in men with eating disorders at the time. Given the small sample of males, the conclusions drawn from this review in terms of effective treatment approaches should not be generalized to males. More research is needed around eating disorders and compulsive exercise that is applicable to the male population.

Limitations and Future Directions

Many limitations of this review stem from limitations of the broader field of research on compulsive exercise. The field is plagued by inconsistencies for the terms and conceptualization

used to describe compulsive exercise, and measurement tools used. Across the 11 studies, several different terms were used to describe compulsive exercise, including excessive exercise, exercise dependence, exercise abuse, driven exercise, over-exercising, among other similar terms. With regard to assessments, seven different validated questionnaires were used to measure exercise cognitions. Although the terms and questionnaires are similar, there are slight differences in their meaning and questionnaire items which can lead to confusion and difficulty when trying to compare studies (e.g., R. R. Davies, 2015). The field is moving towards a consensus on the term compulsive exercise (Noetel et al., 2017), so future studies should be consistent in using this term. With regard to assessments, the Compulsive Exercise Test has been developed and validated among clinical and non-clinical samples (Meyer et al., 2016; Taranis et al., 2011), and is the first measure to assess the multi-dimensional components of compulsive exercise that have shown to play a role in the etiology and maintenance of eating disorders. Although most changes in compulsive exercise were a result of improved exercise cognitions as measured by questionnaires, researchers should be cautious relying on self-reported exercise levels. Individuals with anorexia nervosa have been known to hide or underestimate their levels of physical activity (Alberti et al., 2013; Bezzina et al., 2019), leading patients to be discharged prematurely and increases the likelihood of relapse (Calogero & Pedrotty-Stump, 2010). Using consistent language and measurements allow researchers to make accurate comparisons and conclusions to help inform the development of standardized guidelines for managing exercise within eating disorder treatment.

Along with the inconsistencies across studies with regard to terms and assessments, there is also considerable heterogeneity across interventions whereby, compulsive exercise was treated both within inpatient and outpatient settings, across eating disorder diagnoses, and with various

intervention characteristics. The lack of homogeneity across certain variables is a major factor limiting the ability to conduct further analyses to draw more nuanced conclusions around compulsive exercise treatment. The findings from this review reveal psychoeducation and exercise sessions were the common approaches to treating compulsive exercise and were successful. However, more research is needed that examines treatment approaches specific to each eating disorder. Future research should examine the potentially unique presentation of compulsive exercise within males to develop appropriate diagnostic tools and treatment approaches for males with eating disorders.

Several of the studies included in this review came from the same research groups. Replication of findings from these research groups would support the validity of their results and research conducted by other research groups would enhance the generalizability of the findings to other treatment settings and/or cultural contexts. When designing future studies, researchers should also use higher quality methods, such as having larger sample sizes, validated questionnaires, and conducting randomized controlled trials. Future studies should include long term follow-up measures to track compulsive exercise and eating psychopathology to further demonstrate the efficacy of interventions given the detrimental impact of compulsive exercise on eating disorder recovery and relapse. Four studies in this review were rated as weak, and the majority of studies lacked a control or comparison group, and some studies had small sample sizes. As a result of the limitations of the current literature and the studies in this review, such as the heterogeneity across intervention characteristics, measurement tools, and outcomes, alongside weak study designs and small sample sizes, a meta-analysis of the reviewed articles was not appropriate. Conducting a meta-analysis of weak and considerably-varied study designs as well as underpowered results could cause misleading and incorrect results (Campbell et al.,

2019; Eysenck, 1995; Hoffman, 2015). This systematic review was also limited to only peer-reviewed articles, which excluded grey literature, and any articles not written in English or French.

Conclusion

The 11 studies included in this review focused on psychoeducation to help individuals recognize and reduce negative attitudes and beliefs around exercise and develop a positive relationship with exercise. Most studies had participants engage in exercise throughout treatment to encourage healthy exercise experiences. Findings were generally positive, with improvements in compulsive exercise and eating psychopathology, mainly among females with anorexia nervosa and bulimia nervosa. There continues to be considerable variability across studies with regard to conceptualizations of compulsive exercise, measurement tools, outcomes reported, and intervention characteristics. Future research is needed with more consistency across studies, stronger study designs, and larger sample sizes. There is sufficient literature supporting the fact that exercise can be safely incorporated into treatment and is beneficial, which should encourage healthcare professionals to adapt their treatment practices. Specifically targeting the issue of compulsive exercise in treatment can help to improve negative beliefs around exercise, and in turn, help improve patient outcomes and recovery from an eating disorder.

Data Availability Statement

Data sharing is not applicable to this article as no new datasets were generated or analysed for this review.

Declaration of Conflicting Interest

The authors have no conflict of interest to declare.

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Table 1. Study characteristics

Study	Sample Characteristics	Intervention Description (includes Treatment [T] and Control [C] conditions)	Exercise Measures	Key Exercise Outcomes
Bratland-Sanda et al. (2010) Norway Cohort (one group pre and post) **Quality:** Strong	*N* = 38 women Mean age (*SD*) = 30.9 (8.9) years *n* = 11 EE[†] (AN = 2, BN = 1, and EDNOS =8) *n* = 27 NEE	**T**: Multi-component treatment: eating disorder treatment (reducing symptoms and normalizing eating, individual and group psychotherapy, psychoeducation, and art therapy sessions) + 2 weekly exercise group sessions led by exercise physiologist (moderate intensity, sports, walking, strengthening exercises) + 1 exercise psychoeducation session by exercise physiologist **C**: N/A **Duration**: 12 weeks for AN and 20 weeks for BN, Exercise training occurred 2x/week, 60 mins each **Setting**: Inpatient treatment	Exercise Dependence Scale – Revised (EDS-R) Reasons for Exercise Inventory (REI) Quantity of physical activity measured with accelerometer	Pre > post for exercise dependence for EE (significant change; raw data not available to calculate effect size) Pre = Post for exercise dependence for NEE Pre = Post for reasons for exercise for EE and NEE Trend toward reduction in PA from admission to mid-treatment, then significant increase towards discharge for EE (*d* = 0.313) Mid-treatment > discharge for PA for NEE (*d* = 0.7) **Attrition**: 36% **Adherence**: Not reported
Bratland-Sanda & Vrabel (2018) Norway	*N* = 84 adults (21 AN, 43 BN, 20 EDNOS) Mean age (*SD*) = 28.1 (7.7) years	**T**: Manual, individualized cognitive behavioral therapy (CBT) for eating disorders (including daily group sessions, psychoeducation, individual goal setting and evaluation, in-vivo exposure to meals) + two weekly group exercise sessions. For the EE, 1 extra session with clinical exercise	Eating Disorder Examination Questionnaire (EDE-Q) version 6.0 (measured frequency of compulsive exercise sessions)	Pre > post in frequency of compulsive exercise for EE and NEE (*d* = 1.03) Significant interaction effect between week

Cohort (one group pre and post) **Quality:** Weak	*n* = 19 EE‡ (9 AN, 5 BN, 5 EDNOS) *n* = 65 NEE (12 AN, 38 BN, 15 EDNOs)	physiologist to make a plan to reduce excessive exercise **C**: N/A **Duration**: 12 weeks **Setting**: Inpatient treatment		number and episodes of compulsive exercise (*d* = 0.84) **Attrition**: Not reported **Adherence**: Not reported
Bratland-Sanda et al. (2018) Norway Cohort (one group pre and post) **Quality:** Weak	*N* = 1 woman (AN-R) Age = 25 years	**T**: Maximal strength training supervised by instructor competent in clinical exercise physiology and AN psychopathology (warm-up on treadmill or cycle ergometer then deadlifts, squats, bench presses, and pull-downs) + exercise psychoeducation **C**: N/A **Duration**: 16 weeks, 3x/week, 60 mins each **Setting**: Outpatient treatment	Muscle strength assessed with 1RM tests in lower (half squats) and upper body (bench press). Compulsive Exercise Test (CET) Self-reported habitual exercise (minutes per week)	Pre < post for muscular strength Post > FU for muscular strength (7% decrease) Pre = post for CET Pre > post for volume of habitual exercise and intensity **Attrition**: 0% **Adherence**: 100% to training sessions
Calogero & Pedrotty (2004) United States Cohort analytic (two groups pre and post) **Quality:** Moderate	*N* = 254 girls and women (114 AN, 89 BN, 50 EDNOS) Mean age (*SD*) = 23 (8.5) years	**T**: Exercise group sessions led by exercise coordinators, 4x/week, 60 minutes (warm-up, exercise activities including stretching, yoga, pilates, partner exercises, strength training, aerobic activity, recreational games, and other activities, cool-down, and time to process the experience). Graded program with progressively more activity as patients move through + residential ED treatment **C**: Residential ED treatment	Obligatory Exercise Questionnaire (OEQ)	T < C for obligatory exercise scores on all three subscales: emotional commitment to exercise (*d* = 0.19), exercise involvement (*d*= 0.13), and exercise rigidity (*d*= 0.98), **Attrition**: Not reported **Adherence**: Not reported

		Duration: Mean length of stay in treatment was 27.23 days (*SD* = 10.46) **Setting**: Residential ED treatment facility		
Danielsen et al. (2016) Norway Cohort (one group pre and post) **Quality:** Strong	*N* = 78 girls (16 years ≥) and women (46 AN, 16 BN, 16 EDNOS) Mean age (*SD*) = 21.1 (3.9) years	**T**: Multidimensional treatment: psychodynamic theory, with elements of cognitive behavioural therapy and motivational interviewing in group and individual therapy sessions. Body oriented therapy, adjusted outdoor activity, regular exercise groups (strength training and aerobic activity) + exercise psychoeducation. **C**: N/A **Duration**: Mean treatment time for patients with AN = 149 days (*SD* = 61), BN 115 days (*SD* = 36), and EDNOS 111 days (*SD* = 48). FU was 26 months after discharge **Setting**: Inpatient treatment	Exercise and Eating Disorder (EED) questionnaire (assessed attitudes toward compulsive exercise with four subscales: compulsive exercise, positive and healthy exercise, awareness of body signals, exercise for weight and shape reasons)	Pre > FU for positive attitudes towards compulsive exercise (*d* = 0.93) and across subscales: compulsive exercise (*d* = 0.84), positive and healthy exercise (*d* = 0.49), awareness of body signals (*d* = 0.82) and weight and shape (*d* = 0.69) **Attrition**: 33% **Adherence**: 78 %
Dittmer et al. (2018) Germany Cohort (one group pre and post) **Quality:** Strong	*N* = 32 girls and women (26 AN, 2 BN, 4 EDNOS) Mean age (*SD*) = 22.7 (8.3) years	**T:** Routine inpatient ED treatment + healthy exercise behaviour (HEB) intervention to target compulsive exercise through psychoeducation and movement. Manual-based cognitive-behavioural and exercise-based treatment elements, + engaging in different forms of exercise (yoga, walking, playful movement, etc.). Delivered by clinical psychologist and sports therapist. **C**: N/A **Duration**: 4 weeks, 2x/week, 100 mins each **Setting**: Inpatient treatment	Commitment to Exercise Scale (CES) Compulsive Exercise Test (CET)	Pre > post for commitment to exercise (*d* = 1.44) Pre > post for compulsive exercise total score (*d* = 0.93), and for 4 of 5 subscales: avoidance and rule-driven behaviour (*d* = 1.04), weight and control (*d* = 0.52), mood improvement (*d* = 1.23), and exercise rigidity (*d* = 0.95) **Attrition**: 28%

				Adherence: 88% to 100% of sessions
Hay et al. (2018) Australia, UK, & USA Randomized controlled trial **Quality:** Weak	*N* = 78 adults (*n* = 4 men) (100% AN) Mean age = 27.4 years	**T** (*n* = 38): LEAP (exercise psychoeducation intervention) sessions embedded in standard CBT-AN, delivered by CBT-AN trained specialists also trained in LEAP LEAP: behavioral experiments to reduce driven exercise, challenge views on the maintenance of excessive exercise; education about what constitutes "healthy" exercise; cognitive skills and strategies necessary to challenge maladaptive attitudes, beliefs, and behaviors toward exercise; alternative (adaptive) emotion coping strategies; and relapse prevention. **C** (*n* = 40): standard CBT-AN alone **Duration for T**: 4 weeks, 2x/week, then weekly, with 3- and 6-month FU sessions. 2 sessions of CBT-AN, 8 sessions of LEAP treatment embedded within 50 min CBT-AN sessions, and then 24 further sessions of CBT-AN. **Duration for C:** 34 individual sessions over 8–10 months of CBT-AN **Setting**: Outpatient treatment	Compulsive Exercise Test (CET) Commitment to Exercise Scale (CES) Exercise Beliefs Questionnaire (EBQ)	Pre > post > FU for T for compulsive exercise (*d* = 0.62), commitment to exercise (*d* = 1.13), and exercise beliefs (*d* = 0.78) Pre > post > FU for C for compulsive exercise (*d* = 0.65), commitment to exercise (*d* = 0.61), and exercise beliefs (*d* = 0.08) No significant group x time interaction for the 3 measures. **Attrition**: 53% for T and 38% for C **Adherence**: 55% completed 75% of therapy sessions
Long & Smith (1990) UK Cohort (one group pre and post)	*N* = 1 woman (AN & BN) Age = 27 years	**T**: Focus on eliminating compulsive exercise, reduce amount of exercise, and engage in exercise for joy. Small group sessions + individual sessions with exposure and response prevention, reducing activity level, stimulus control, and cognitive techniques. **C**: N/A	Commitment to Exercise Scale (CES) Self-monitoring of exercise	Pre > post for commitment to exercise and exercise quantity **Attrition**: 0% **Adherence**: 100%

Quality: Weak		**Duration**: 14 weeks with 12 sessions (of which 4 were group sessions). FU was at 3 and 6 months **Setting**: Outpatient treatment		
Long (1995) UK Cohort (one group pre and post) **Quality:** Moderate	*N* = 6 adults (1 man) (100% AN) Mean age = 26 years (range of 14-35 years)	**T**: Focus on eliminating compulsive exercise, reduce amount of exercise, and engage in exercise for joy. Small group sessions + individual sessions with exposure and response prevention, reducing activity level, stimulus control, and cognitive techniques. **C**: N/A **Duration**: Average length of sessions was 12 days (range 8-14 days), with an average of 8.3 sessions of exposure and response prevention (range 4-12 sessions). FU was at 4 years **Setting**: Outpatient treatment	Commitment to Exercise Scale (CES) Purpose-designed questionnaire that assessed exercise, behaviour and cognitions	At 4 year FU: 4 patients classified as "good group" and 2 as "poor group" based on recovery outcomes. Good group: positive changes in exercise motivation Poor group: patients continued to exercise for reasons concerned with body shape, and increasingly to regulate affect. No difference between groups on commitment to exercise **Attrition**: 0% **Adherence**: 100%
Mathisen et al. (2018) Norway Randomized controlled trial	*N* = 172 women (117 BN, 55 BED) Mean age = 27.3 years	**T1** (*n* = 76)**:** Physical exercise and dietary therapy (PED-t); Theoretical sessions on exercise physiology and exercise principles + dietary therapy + 1-2 weekly supervised exercise sessions (resistance training) + 2 weekly unsupervised exercise sessions (one resistance and one high intensity interval training session). Therapists had	Compulsive Exercise Test (CET) Quantity of overall physical activity and MVPA measured with accelerometer	No between group differences on CET. Pre > post > FU for compulsive exercise for T1 (*d* = 0.63) and T2 (*d* = 0.61)

Quality: Strong		a bachelor or master degree in exercise physiology + dietician for dietary sessions. **T2** (*n* = 73): CBT for EDs, manual based, 1-2 weekly group therapy sessions run by CBT-therapists. **C** (*n* = 23): Wait-list control **Duration**: 16 weeks with 20 sessions **Setting**: Outpatient treatment		No change for C. No between or within group differences for level of physical activity or MVPA. **Attrition**: 21.8% for T1, 50% for T2, and 21.7% for C **Adherence**: 80.6% for T1 and 82.1% for T2.
Schlegel et al. (2015) Germany Controlled clinical trial **Quality:** Strong	*N* = 36 adults (*n* = 3 men) (12 AN, 20 BN, 4 EDNOS) Mean age = 25.5 years	**T** (*n* = 18): Sport therapy: warm-up, exercise psychoeducational component, physical activity and sport plays, and reflection and prescription of homework. Led by sports therapist. **C** (*n* = 18): Control group was matched on age, gender, diagnosis and body mass index. **Duration**: 13 weeks, 12 weekly group sessions + 1 introductory meeting, 120 mins each **Setting**: Outpatient treatment	Commitment to Exercise Scale (CES) Quantity of exercise assessed with a questionnaire of sports behavior (type of sports activity, frequency per month and duration of each episode)	Pre > post for commitment to exercise (*d* = 0.95) Time x group: T > C (*d* = 0.57) No changes within or between groups for exercise quantity **Attrition**: 34.4% **Adherence**: Not reported

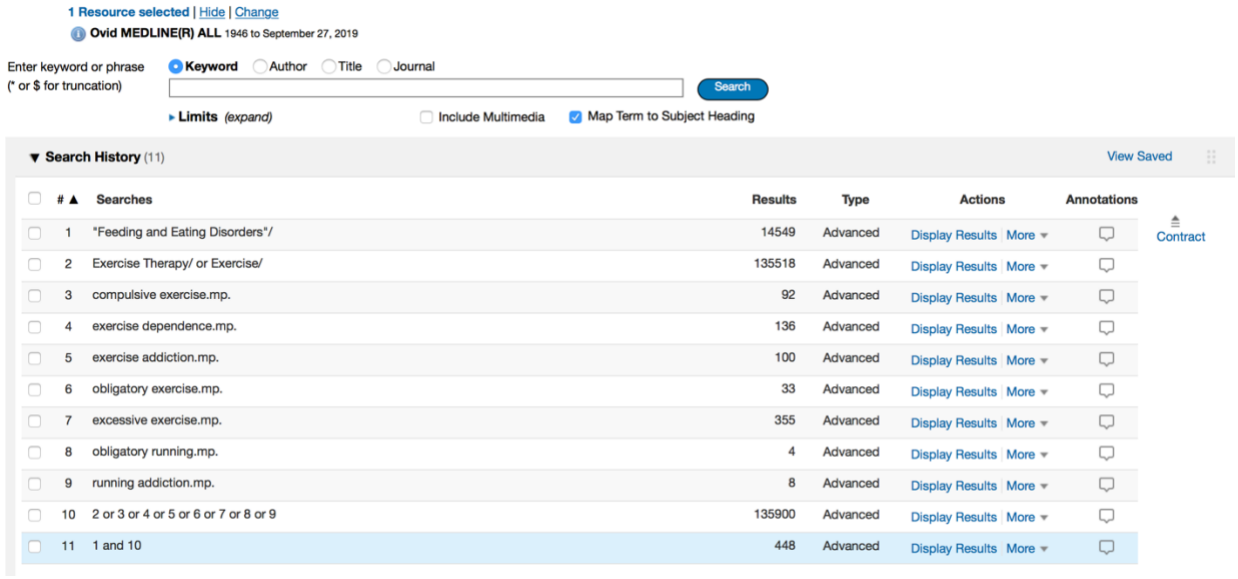
Note. Effect sizes were reported for significant findings only.

AN = anorexia nervosa, BN = bulimia nervosa, BED = binge eating disorder, EDNOS = eating disorder not otherwise specified, ED = eating disorder, EE = excessive exerciser, NEE= non-excessive exerciser, CBT = cognitive behavioural therapy, MVPA = moderate to vigorous physical activity, T = treatment condition, C = control group. T > C = treatment group did significantly superior to control group, T = C indicates no significant differences between groups, Pre = baseline scores, Post = post-intervention scores, Pre > post = baseline scores were higher than post-intervention, Pre < post = baseline scores were lower than post-intervention scores, FU = follow-up,.

[†]EE: ≥ 6 hours/week of ActiGraph assessed MVPA upon admission, reported persistence of this amount for ≥ 1 month before admission, and classification as exercise dependent symptomatic.

[‡]EE: six or more episodes of driven exercise within the past 7 days

Supplemental Material 1. Terms used for MEDLINE database search



1 Resource selected | Hide | Change

Ovid MEDLINE(R) ALL 1946 to September 27, 2019

Enter keyword or phrase (* or $ for truncation) — Keyword | Author | Title | Journal — Search

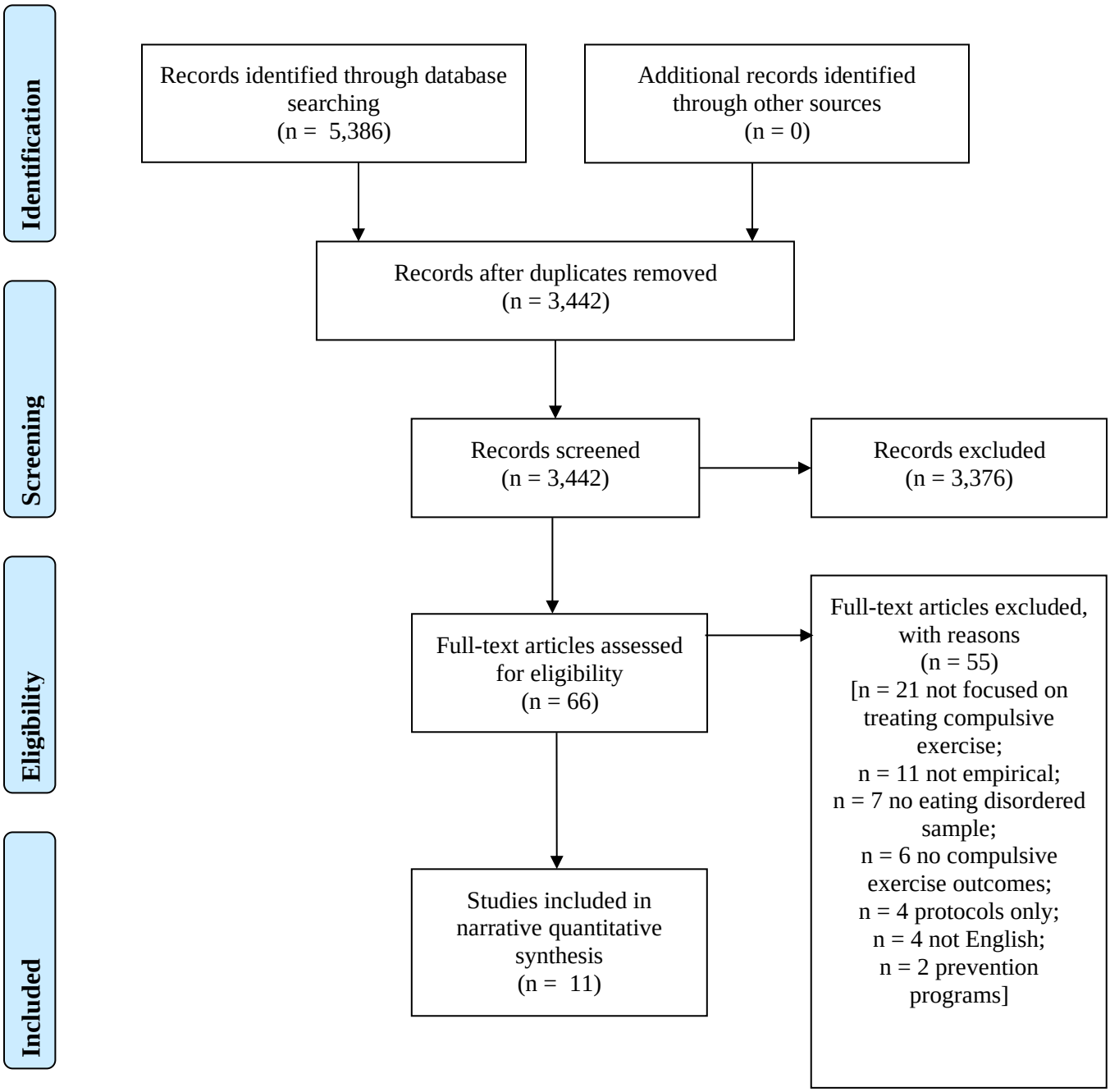
▸ Limits (expand) — Include Multimedia — Map Term to Subject Heading

▼ Search History (11) — View Saved

# ▲	Searches	Results	Type	Actions	Annotations
1	"Feeding and Eating Disorders"/	14549	Advanced	Display Results | More	
2	Exercise Therapy/ or Exercise/	135518	Advanced	Display Results | More	
3	compulsive exercise.mp.	92	Advanced	Display Results | More	
4	exercise dependence.mp.	136	Advanced	Display Results | More	
5	exercise addiction.mp.	100	Advanced	Display Results | More	
6	obligatory exercise.mp.	33	Advanced	Display Results | More	
7	excessive exercise.mp.	355	Advanced	Display Results | More	
8	obligatory running.mp.	4	Advanced	Display Results | More	
9	running addiction.mp.	8	Advanced	Display Results | More	
10	2 or 3 or 4 or 5 or 6 or 7 or 8 or 9	135900	Advanced	Display Results | More	
11	1 and 10	448	Advanced	Display Results | More	

Contract

Supplemental Material 2. PRISMA 2009 flow diagram



Supplemental Material 3. Quality rating scores

Authors	Selection bias	Study design	Confounders	Blinding	Data collection methods	Withdrawals and dropouts	Total Score
Bratland-Sanda et al., 2010	Strong	Moderate	Strong	Moderate	Strong	Moderate	Strong
Bratland-Sanda & Vrabel, 2018	Strong	Moderate	Strong	Weak	Strong	Weak	Weak
Bratland-Sanda et al., 2018	Weak	Moderate	Weak	Moderate	Strong	N/A	Weak
Calogero & Pedrotty, 2004	Moderate	Moderate	Strong	Moderate	Strong	Weak	Moderate
Danielsen et al., 2016a	Moderate	Moderate	Strong	Moderate	Strong	Moderate	Strong
Dittmer et al., 2018	Strong	Moderate	Strong	Moderate	Strong	Strong	Strong
Hay et al., 2018	Weak	Strong	Strong	Strong	Strong	Weak	Weak
Long & Smith, 1990	Weak	Moderate	Weak	Moderate	Weak	N/A	Weak
Long, 1995	Strong	Moderate	Strong	Moderate	Weak	N/A	Moderate
Mathisen et al., 2018	Strong	Strong	Strong	Moderate	Strong	Moderate	Strong
Schlegel et al., 2015	Strong	Strong	Strong	Moderate	Strong	Moderate	Strong

Chapter Six: General Discussion

Summary of Findings

The overall goal of my dissertation was to explore experiences living with, being treated for, and recovering from CE among individuals with EDs. To accomplish this goal, we first sought to explore a breadth of experiences with CE and EDs as documented on social media. Previous qualitative studies investigating CE have been limited to small, homogenous samples of females with anorexia nervosa. With over 800 posts gathered from across various social media sites, this study included the voices of women and men with various EDs, and referred to all phases of CE from development to recovery. Individuals described a range of CE cognitions and behaviours, aligning with the current proposed definition of CE (Dittmer, Jacobi, & Voderholzer, 2018). People were ambivalent about wanting to recover from CE and were unclear about what constitutes healthy exercise in recovery. Individuals reported being fearful to exercise at all, as it can be a slippery slope back to CE. People also vented about misconceptions and harmful personal comments they received about their exercise habits, highlighting the importance of CE awareness among those who are not experiencing it. Although the findings provided a number of new experiences and insight into CE, the study had some limitations we aimed to address in Chapter Four (Study 2). The social media posts in Chapter Three (Study 1) were often short, provided limited context to the individuals' experiences, and did not allow for further probing given the observational nature of the data collection. We gained insight into the various phases of the development, maintenance, and recovery of CE, but could not capture the antecedents or aftereffects of each phase.

My second study (Chapter Four) aimed to further extend our understanding of CE and address some of the limitations from Chapter Three (Study 1), such as achieving greater depth,

speaking directly to individuals with lived experience, and exploring individuals' journeys through all phases of CE. My second study (Chapter Four) included multiple interviews with four women to gain deeper insight into the psychological and sociocultural factors that influence all phases of CE. We sought out four women with bulimia nervosa, as this ED is underrepresented in the literature in the context of CE. Using thematic narrative analysis and creative nonfiction, we identified the roles of personality, familial or peer pressure, and cultural expectations on developing CE, as well as the continued influence of these factors during treatment and recovery. Taken together, the participants in Chapters Three and Four (Studies 1 and 2) were often frustrated with the lack of effective CE treatment. CE treatment was often inadequate or neglected altogether. Only a few individuals had positive experiences with exercise in recovery, or reported recovering from CE at all.

In Chapter Five (Study 3), we conducted a literature review of current CE treatment interventions. My systematic review demonstrated that CE treatment includes psychoeducation to address the beliefs and attitudes that maintain CE and to help develop a healthier mindset around exercise. Most CE treatment programs also included exercise sessions to allow individuals to experience a healthy model of exercise with the support of professionals. All CE treatment programs included psychoeducation and they were all found to be efficacious at reducing and treating CE. However, there continues to be a research-clinical gap as these approaches do not seem to be implemented within most treatment settings, as highlighted by participants in Chapters Three and Four (Studies 1 and 2).

Contributions to the Literature

Together, the findings from all three of my studies have contributed to advancements in understanding all phases of CE, from development, to living with CE, to treatment and recovery experiences.

A number of studies have outlined definitions, features, or criteria of CE (e.g., Bratland-Sanda et al., 2019; Dalle Grave, 2009; Noetel et al., 2017), but these conceptual papers do not capture how CE behaviours, attitudes, and beliefs are personally experienced. Chapters Three and Four (Studies 1 and 2) provide descriptions of both a breadth and depth of experiences from people living with CE. People described having rigid rules and beliefs about *needing* to or *having* to exercise, such as achieving anywhere from 10 to 60 thousands steps a day, exercising for hours on treadmills and ellipticals, engaging in multiple workouts a day, and not allowing themselves to sit for longer than 20 minutes at a time. Although these behaviours relate to quantities of exercise, which is not always a critical factor in determining CE (Adkins & Keel, 2005; Meyer & Taranis, 2011), the emphasis is on the belief that they *must* accomplish those behaviours and follow their self-determined rules. What was most striking from my studies is the emotional, evocative, and impactful first-hand accounts of the mental toll and burden people experienced from CE, which has not been described in conceptual papers. People described feeling out of control, isolated, lonely, embarrassed, anxious, and depressed. Individuals further described prioritizing exercise over and above everything, such as their academic, occupational, romantic, and social lives. Individuals worried about reducing their exercise levels, fearing they would gain weight instantly, unsuccessfully manage or cope with life's stressors, and lose their identity. The current proposed definition of CE describes individuals feeling driven to exercise in response to an obsession or according to rigid exercise rules (Dittmer, Jacobi, & Voderholzer,

2018), but further understanding how this specifically manifests within an individual, and may vary considerably across individuals could provide invaluable insight into understanding CE. The contributions from my studies can provide a strong foundation on which to build a shared understanding of CE among healthcare professionals, academics, and those with lived experience.

Chapter Four (Study 2) demonstrated the complex interplay of a number of sociocultural factors that were involved, at least in part, in the development of CE and bulimia nervosa. The sociocultural factors discussed included influences from family and friends, media, and cultural and societal expectations like the thin- and athletic-ideal. My qualitative findings align with previous quantitative studies showing associations between these sociocultural factors and CE (e.g., Bell et al., 2016; Goodwin et al., 2014; Homan, 2010; Lease et al., 2016). My findings further extend previous research by demonstrating how these sociocultural factors interact and can lead to and maintain CE. Previous qualitative papers have described how people often had positive sport and exercise experiences during childhood, but eventually they developed CE without describing what led to the shift from positive to pathological exercise (Moola et al., 2015; Young et al., 2015). My studies indicated that there are a number of psychological, social, and cultural factors that can lead to lifelong challenges with exercise. Future research is needed to continue to explore these factors as a better understanding of the development of CE is critical for prevention efforts.

Chapters Three and Four (Studies 1 and 2) contribute to understanding current challenges and needs for CE recovery. The goal of CE recovery is for participants to develop a positive relationship with exercise, to encourage sustainable, safe, and healthy lifelong exercise. Participants in both Chapters Three and Four (Studies 1 and 2) lacked knowledge, resources, or

support to recover from CE. Many individuals questioned what is considered "normal" or "healthy" exercise. These findings align with previous qualitative studies among adolescent girls and women with EDs calling for more support for CE treatment and recovery (Brunet et al., 2021; Chubbs-Payne et al., 2021; Moola et al., 2015). Individuals in the depths of their disorder asking for support and resources to recover should be the ultimate incentive for researchers and health professionals to establish CE treatment protocols. One considerable aspect hindering CE recovery is the lack of understanding and awareness from healthcare professionals, friends and family, and the general public. Participants in Chapters Three and Four (Studies 1 and 2) spoke about the lack of sufficient knowledge from healthcare professionals trying to treat CE and ED, which further created distrust with health professionals and a perceived exacerbation of symptoms. The lack of awareness from friends, family, and the public, resulted in comments that reinforced CE, providing further hurdles to recovery. ED information and training should include a component on identifying and treating CE for health professionals (e.g., clinicians, psychologists, dieticians, physiotherapists, etc.). More resources on CE and healthy exercise should be included on ED organizations' websites and more widely on the internet for the general public.

One make-it-or-break-it factor for successful recovery can be the efficacy of CE treatment. There are currently no treatment guidelines for CE, or for integrating exercise within ED treatment. Despite the lack of guidelines, there are published studies that describe the development and testing of CE treatment programs (e.g., Dittmer, Voderholzer, et al., 2018; Hay et al., 2018; Schlegel et al., 2015). My systematic review revealed that current CE treatment programs are efficacious at reducing CE as well as eating psychopathology. The two main components of efficacious CE programs included psychoeducation and exercise sessions, which

aligned with previous treatment recommendations (Cook et al., 2016; Danielsen et al., 2018). The psychoeducational components of the studies included in the systematic review align with some of the recovery experiences participants' communicated in Chapters Three and Four (Studies 1 and 2). Individuals described that the mindset shift around exercise was instrumental in recovery. Recovery from CE meant finding joy in movement again, working out for health reasons rather than as a punishment, and listening to the body. Together, all three of my studies highlight the importance of psychoeducation in treatment. However, only 20% of patients with an ED actually seek treatment (Swanson et al., 2011), which leaves the majority of those in need of support without health professionals. My studies contribute to bridging the gap between understanding CE among healthcare professionals, academics, and those with lived experience, but the gap remains present as effective CE treatment, as identified in the literature, does not yet appear across treatment settings.

Future Directions

As previously discussed at length in Chapter Two, and further highlighted in my systematic review in Chapter Five, there remains inconsistencies in terms, conceptualizations, and assessments of CE. Coming to a consensus among researchers and clinicians is important for diagnostic criteria and consistency across research studies to allow for meta-analyses. Despite efforts towards reaching a consensus on the appropriate term and definition (Bratland-Sanda et al., 2019; Dittmer, Jacobi, & Voderholzer, 2018; Noetel et al., 2017), new research is being published that continues to use different conceptualizations. However, as Chapters Three and Four (Studies 1 and 2) highlight, those with lived experience are more concerned about defining healthy exercise in the context of CE and ED recovery. Individuals were not preoccupied with labelling or defining their relationship with exercise, using terms like addiction, obsessive,

dependence, compulsivity, among others. Rather, they were seeking ways to recover by striving for a healthier, positive relationship with exercise and questioning what constitutes healthy exercise in recovery. In my first study (Chapter Three), there was an entire theme entitled, “Is my exercise healthy?” reflecting individuals’ uncertainty and desire for answers. In my second study (Chapter Four), Carley struggled to recover from CE, recounting that clinicians in treatment did not address how to exercise in a normal or healthy way. She was looking for concrete advice such as the amount and type of exercise that would be considered healthy for her, stating that what she had learned in treatment was very abstract. My review (Chapter Five) showed that the effective way to treat CE includes exercise psychoeducation and exercise sessions. However, there remains uncertainty whether these approaches specifically promote healthy exercise, and whether people are discharged from treatment with a healthy relationship with exercise or instead, a reduction in CE cognitions and behaviours.

The lack of clarity around healthy exercise and CE among healthcare professionals, family, friends, and the general public can unintentionally lead to harm among those with CE. Findings from Chapters Three and Four (Studies 1 and 2) together alluded to the lack of education, understanding, and expertise of healthcare professionals in addressing CE, and the associated consequences for individuals with CE. People reported not being heard or feeling understood, which led to trouble trusting healthcare professionals. Harmful comments from family and friends also reinforced CE and additionally provided barriers to recovery. For example, skipping a social event to exercise (due to obsessive and rigid rules around exercise), may be viewed by friends and family as having strong willpower and being dedicated to one’s health, but praising the individual encourages CE. My systematic review (Chapter Five) highlighted that clinicians, with the appropriate expertise and knowledge of CE, can successfully

address it and treat it, leading to a reduction in CE. A small portion of studies in my review also included family-based therapy or integrated family within CE treatment, indicating that family members with the appropriate knowledge and tools, can support CE treatment and recovery. While healthcare professionals will require professional and regulated training on CE and EDs, educating the general public proves to be a much more difficult task. One possible avenue that has a significant influence on the general population is social media. Despite the ability of social media, often Instagram, to perpetuate EDs and unrealistic thin- and athletic-ideals (e.g., G. Holland & Tiggemann, 2017), it also has the ability to promote encouraging messages (e.g., Herrick et al., 2020). For example, the body positivity movement which rejects unattainable and narrowly-defined beauty ideals and promotes acceptance of diverse body sizes and appearances has gained considerable momentum on Instagram (Cohen et al., 2019). As such, more individuals impacted by EDs and CE should promote healthy exercise and raise awareness via social media.

In order to provide effective training for healthcare professionals, and to share a broad, but consistent message across social media, a clear understanding of healthy exercise is needed. One of the largest studies investigating the definition of healthy exercise in the context of ED recovery involved surveying 43 inpatient ED units in the United Kingdom (S. Davies et al., 2008). Only four units had clearly defined healthy exercise at the time of the survey, whereas the remaining units provided ad hoc descriptions to complete the survey. The most commonly reported definition of healthy exercise was that it should be “individually defined.” Other definitions of healthy exercise included: reasonable given dietary intake; related to some measure of weight; not excessive in time, duration or amount; not harmful to the patient’s physical health; enjoyable; part of a normal daily or weekly routine; not driven by weight or calorie burning; and

should promote health (S. Davies et al., 2008). Each of these definitions are subjective, vague, and may vary from individual to individual. From a clinical perspective, a definition of healthy exercise can provide a clear benchmark for treatment discharge. From an academic perspective, a clear definition provides consistency and allows for improved comparison across interventions. From a practical perspective, people can use a definition of healthy exercise to evaluate and regulate their exercise cognitions and behaviours. As such, a definition of healthy exercise can benefit clinicians, academics, those with lived experience, and even the general public.

In the Delphi study where Noetel and colleagues (2017) sought a consensus to define CE, there were two criteria that experts agreed upon for defining healthy exercise among adolescents with anorexia nervosa (Noetel et al., 2017). The panel of experts stated that healthy exercise is exercise that can be modified, reduced, or ceased without distress and there is flexibility with the exercise routine (Noetel et al., 2017). These two criteria may provide a foundation on which to build a more comprehensive definition of healthy exercise and one that can apply to adults and other EDs. The Canadian ED strategy emphasizes the importance of drawing from individuals' lived experience to inform research (Canadian Eating Disorders Alliance, 2019); therefore, developing a definition of healthy exercise should include the voices of those with lived experience of CE. My first two studies (Chapters Three and Four), particularly Study 1, included individuals' descriptions of positive exercise experiences in recovery which could be used to inform a definition of healthy exercise. Participants described exercise as enjoyable and freeing. They chose to exercise for their health (including mental health) rather than being compelled to for appearance-based reasons. Although those in treatment should have exercise psychoeducation and supervised exercise sessions to be exposed to a healthy model of exercise, this is not feasible for everyone. Either clinicians fail to incorporate CE treatment strategies, or

people do not have access to treatment. For those who don't have access to treatment, there is a need for resources and information accessible online through ED or health organizations that have definitions of healthy exercise and strategies to achieve and maintain healthy exercise.

Although the literature examining healthy exercise in the context of CE is limited, there is a growing body of literature examining exercise concepts in ED prevention that could be described as healthy exercise, including embodied movement (Menzel & Levine, 2011), attunement with exercise (Calogero et al., 2019), and intuitive exercise (McGilley, 2014). Embodied movement, adapted from the concept of embodiment, refers to engaging in physical activity that is both physically and psychologically safe, process-oriented, and focused on self-care, enjoyment, and bodily attunement. Embodied movement encourages awareness and attentiveness to the body, a sense of physical competence and empowerment, and being deeply immersed in the activity (Menzel & Levine, 2011). Based on this conceptualization, any physical activity can be embodied if it is founded in enjoyment, is accessible to all body shapes, sizes, and abilities, and allows people to connect to their body (Piran, 2015). Calogero et al. (2019) drew on theories of embodiment and mindfulness, and their past clinical work with women with EDs, to develop the concept of attunement with exercise. Attuned exercise reflects exercise that involves mindfulness, self-compassion, self-acceptance, enjoyment, pleasure, being connected and present in the body, and alleviating mental and physical stress. Attunement with exercise, like embodied movement, can and *should* be applied to all forms of exercise. Intuitive exercise refers to exercising in response to physical cues, rather than feeling obligated to and following rigid routines (Reel & Miyairi, 2012). McGilley (2014) summarized a number of guidelines for engaging in intuitive exercise from various published research articles, including: (a) listening to your mind, heart, and body and approaching exercise accordingly; (b) respecting and responding

to your inner needs and body, especially those messages of pain and fatigue; (c) examining your motives for exercise, and if needed, developing healthier ones; (d) finding exercise and physical activities which are enjoyable; (e) removing concepts of fat, calories, and size from exercise thoughts and language; and (f) ensuring adequate nourishment. These three exercise concepts share underlying principles that could be used to inform a definition of healthy exercise within the context of CE, in addition to past research (e.g., S. Davies et al., 2008; Noetel et al., 2017) and relying on those with lived experience from my research and future research. Additionally, these healthy exercise concepts could be used for CE prevention, just as they are for ED prevention, given the scarcity of research investigating CE prevention efforts.

Limitations

The limitations of each individual study have been described within their associated chapters. Throughout my doctoral studies, the lack of diversity among ED and CE research was glaring. EDs have mainly been studied among skinny, white, affluent girls (deemed SWAG; Sonneville & Lipson, 2018), whereby individuals of different genders, weights, races, ethnicities, and socioeconomic backgrounds are often overlooked (Sonneville & Lipson, 2018). Although we acknowledge the gross need for research in this area, we had limited success with including more diversity in this area of research when considering my thesis as a whole. In Chapter Three (Study 1), we do not have the sociodemographic background of the individuals behind the posts, which prevented us from addressing the need for more diversity. However, it was evident there were men and women in the sample and people with various EDs. The hope is that by gathering a sample from social media, from English speaking individuals, we were able to access a heterogenous sample, though we do acknowledge that SWAG voices' are prioritized in ED spaces on social media. My second study (Chapter Four) included two Asian participants,

whereby the experience of Asian identity and culture intersecting with CE and an ED was reflected within the creative nonfiction story of Amber. We did seek women who were able to access treatment which inherently implies some level of privilege; however, for the study's purpose of examining how CE was addressed in treatment, this was mostly unavoidable. Additionally, we sought women with bulimia nervosa given that CE alongside bulimia nervosa has been largely absent from the literature. Finally, my third study (Chapter Five), although the samples were not in my control, predominantly consisted of females with access to inpatient treatment from Western countries, which unfortunately met the SWAG stereotype. There is a shift toward a global approach and understanding of EDs, with researchers studying samples of people from non-Westernized countries and marginalized communities (e.g., Austin et al., 2013; Beccia et al., 2019; Pike & Dunne, 2015), but the same cannot be said about CE yet. My dissertation does contribute to some diversity in the context of CE, and we will seek to explore more diverse populations in future research.

Conclusion

CE is a considerable problem among individuals with EDs, but several gaps in the literature have hindered a clear understanding of CE. The field has been plagued by inconsistent terminology and assessments, a lack of consensus for a definition, an unclear understanding of the condition, and a lack of standardized guidelines for effectively treating CE. To address these gaps in the literature, researchers, clinicians, and those with lived experience need to have a clear and shared understanding of CE. As such, the overall goal of my dissertation was to explore lived experiences with CE, including CE treatment and recovery experiences among individuals with EDs. We conducted a series of three studies, each with a specific research question, that together contribute to addressing my dissertation purpose. My findings revealed a number of

novel experiences regarding developing, living with, being treated for, and recovering from CE. More research is needed to bridge the research-clinical gap, develop clear definitions of CE and healthy exercise in the context of CE and EDs, and address CE prevention efforts. Stay tuned for what is next in my postdoc!

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Figures

Figure 1

Cognitive behavioural development and maintenance model of compulsive exercise from Meyer et al. (2011)

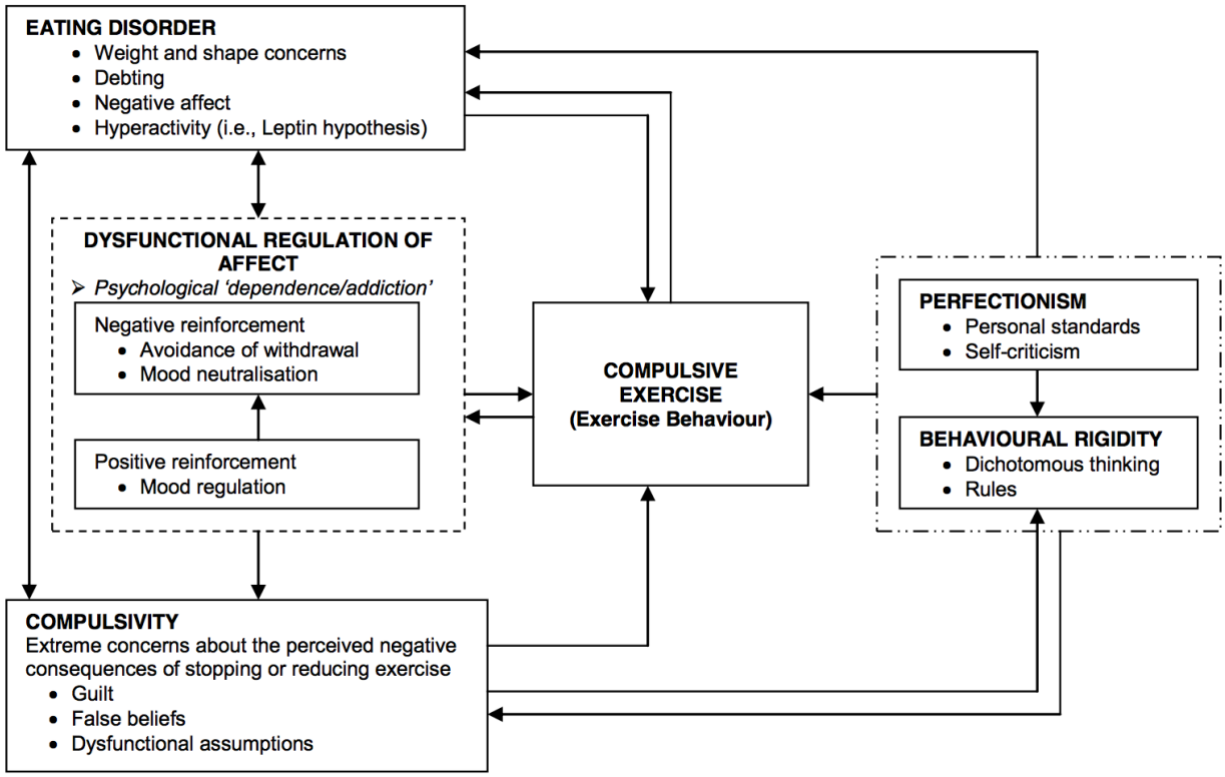

Figure 2

Sociocultural model of excessive exercise, proposed by White and Halliwell (2010)