Safe Exercise at Every Stage: Youth

SEES-Y

A guideline for managing activity in youth with an eating disorder

Marita Cooper
Danika A. Quesnel
Maria Fernandez-del-Valle

Authors

Marita Cooper, PhD, is a registered Clinical Psychologist at Children's Hospital of Philadelphia. She received her PhD from Australian National University where her dissertation examined muscle dysmorphia and muscularity-oriented body change behaviours. Marita was an Eating Disorders Clinical Research Summer Fellow at Harvard University in 2017. She also serves on the editorial board of both *the International Journal for Eating Disorders* and *Eating Disorders Journal of Treatment and Prevention,* as well as the Board of Directors for the Academy of Eating Disorders. Marita has presented research on exercise and eating disorders at conferences for the Academy for Eating Disorders, Australian and New Zealand Academy for Eating Disorders, and Eating Disorders Research Society. Marita has over 25 peer reviewed publications, with three invited book chapters, and has delivered training in exercise and eating disorders worldwide.

Danika Quesnel, MSc, CSEP-CPT, obtained a Bachelor's degree in Kinesiology / Human Kinetics with a specialty in Health Promotion and a certification in Personal Training for the Canadian Society of Exercise Physiology. Following this, she completed her Masters in Interdisciplinary Studies between Health Sciences and Psychology at the University of British Columbia, in which her research focused on the role of exercise in the treatment of eating disorders. Since the completion of her Masters in Interdisciplinary Studies, Danika has gone on to complete a Masters of Science in Clinical Psychology at Western University. Danika's research has been successfully funded at the national and international level resulting in numerous peer reviewed publications and knowledge translation effort in the field of mental health. Danika has presented as guest speaker, as well as achieved international recognition for her contributions to the field of exercise and eating disorder. She is currently a Ph.D Candidate in Clinical Psychology at the University of Toronto in Canada.

María Fernández-del-Valle, PhD, is an exercise scientist whose career has focused on advancing safe and healthy exercise in eating disorder care. She completed her Licentiate in Physical Activity and Sport Sciences, and PhD in Physical Activity and Health at the European University of Madrid, complemented by clinical training at Hospital Niño Jesús. She later spent nearly a decade in the United States (Texas Tech University and Southern Illinois University), where her work was supported by competitive funding (American Heart Association, National Institutes of Health). On her return to Spain, she was awarded a Margarita Salas Junior Fellowship to support her vision through the DiANa project, which highlights the need for a comprehensive evaluation of the impact of returning to an active lifestyle on the prognosis of anorexia nervosa by integrating clinical, psychological, physiological, and molecular markers. She also served as Co-Investigator on the Canadian Institutes of Health Research initiative to disseminate the SEES guideline. Currently a Professor in the Department of Functional Biology at the University of Oviedo, her research on anorexia nervosa spans more than 15 years. Through randomized controlled trials showing the benefits of supervised resistance training on muscle function, body composition, and quality of life, she has contributed to key studies on physical fitness, metabolic complications, and physical activity patterns in patients with anorexia. An award-winning researcher, Dr. Fernandez has delivered numerous clinical talks and lectures on safe exercise programming, eating disorders, and active lifestyle promotion across Spain, the United States, and Latin America.

Steering Committee

Medical Representatives

Riccardo Dalle Grave, MD, FAED
Director Department of Eating and Weight Disorders, Villa Garda Hospital, Verona

Professor Michael Kohn, MBBS, FRACP, PhD, Chair in Paediatrics Western Sydney University
Director, Centre for Research of Adolescent's Health
Honorary Consultant, AYAM Westmead Hospital

Exercise Science Representative

Fabio Soave, MSc,
Physiotherapist
Department of Eating and Weight Disorders, Villa Garda Hospital, Verona

Patient Lived Experience Representative
Lauren Greenberg

Parents Lived Experience Representative

Dawn Hopkins MSc., Ph.D.
Clinical Associate Professor
Vera Z. Dwyer College of Health Sciences
Indiana University South Bend

Psychology Representative

Daniel Le Grange, Ph.D., FAED
Benioff UCSF Professor in Children's Health
Director, Eating Disorders Program, Department of Psychiatry & Behavioral Sciences
UCSF Weill Institute for Neurosciences
University of California, San Francisco

Dietetics Representative

Marcia Herrin, EdD, MPH, RDN, LD, CD, FAED, Director of Marcia Herrin Nutritional Counselling, Author of "*Nutrition Counseling in the Treatment of Eating Disorders"* and "*The Parent's Guide to Eating Disorders"*

Funding and Conflict of Interest Disclosure

Marita Cooper and Danika Quesnel receive income for delivering workshops and training seminars on behalf of the Safe Exercise at Every Stage group. No other authors, steering committee members, or consultation team members received funding for this project. The authors declare no conflicts of interest.

Danika Quesnel also received the funding from:

MITACS Accelerate International
Social Sciences and Humanities Research Council of Canada
Ontario Women's Health Scholar
LabFront & Gramin Mental Health Research Grant
Canadian Health Research Institute

No funders were involved in the design, data collection, analysis, interpretation, or writing of the Safe Exercise at Every Stage Guidelines. Contents are those of the authors and do not necessarily represent the official views of, nor an endorsement, by any funding bodies.

Table of Contents

Acronyms

ACSM: American College of Sports Medicine
AGREE-II: Appraisal of Guidelines for Research and Evaluation
AAN: Atypical anorexia nervosa
AN: Anorexia nervosa
AN-P: Anorexia nervosa - Purging subtype
AN-R: Anorexia nervosa - Restrictive subtype
ANS: Autonomic nervous system
BED: Binge eating disorder
BF: Body fat
BMD: Bone mineral density
BMI: Body mass index
BN: Bulimia nervosa
BPM: Beats per minute
BUN: Blood urea nitrogen
CBT: Cognitive behavioural therapy
CBT-E: Enhanced cognitive behavioural therapy
CET: Compulsive Exercise Test
CRT: Cognitive remediation therapy
CVD: Cardiovascular disease
DBT: Dialectical behavior therapy
DSM-IV: Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition)
DSM-5: Diagnostic and Statistical Manual of Mental Disorders (Fifth Edition)
EA: Energy adequacy
ECG: Electrocardiogram
ED(s): Eating disorder(s)
EDNOS: Eating Disorder Not Otherwise Specified
FBT: Family-based treatment
FFM: Fat-free mass
FHA: Functional hypothalamic amenorrhea
FSH: Follicle stimulating hormone
FX: Flexibility training
GH: Growth hormone
GnRH: Gonadotropin-releasing hormone
HR: Heart rate
HRQOL: Health Related Quality of Life
IBW: Ideal body weight
IGF-1: Insulin-like growth factor 1
ISCD: International Society for Clinical Densitometry
Kcal/kg: Kilocalories per kilogram
LEA: Low energy availability
LH: Luteinizing hormone
IBW: Ideal body weight
MET: Metabolic equivalent
mL: Millilitre
mg/dL: Milligrams per decilitre
mmHg: Millimetres of mercury
mmol/L: Millimoles per litre
mEq/L: Milliequivalents of solute per litre
N: Number of participants in the sample
OH: Orthostatic hypotension
OSFED: Other Specified Feeding and Eating Disorders
PT: Postural tachycardia
RCT: Randomized controlled trial
RED-S: Relative Energy Deficiency in Sport
RMR: Resting metabolic rate
RT: Resistance training
SEES: Safe Exercise at Every Stage guideline
SMA: Superior mesenteric artery syndrome
USG: Urine specific gravity

Statement of Intent

The Safe Exercise at Every Stage – Youth (SEES-Y) guideline aims to provide evidence-based information to support clinicians in managing maladaptive movement during youth (8-18 years) ED treatment. This guideline serves as a general tool for use under a practitioner's expert judgment, *not* as a standard for medical care. Standards of Medical Care are based on the clinical data of the individual as well as the scientific knowledge available at the time (Yager et al., 2005). Including the SEES–Y guideline as a component within an evidence-based treatment approach does not ensure improved treatment outcomes, nor should it be interpreted as including all methods of integrating movement into the treatment of an ED. All movement may not be healthful or safe for all individuals with an ED. As such, the SEES-Y guideline is intended to be administered by a trained medical or exercise professional (see Glossary, pp. 67) in conjunction with an interdisciplinary team (see Glossary, pp. 67). The SEES-Y guideline was developed in line with the Appraisal of Guidelines for Research and Evaluation guidelines (AGREE Next Steps Consortium, 2017) and recommendations from the National Health and Medical Research Council Guidelines (National Health and Medical Research Council, 2011). In addition to the contribution of our lead investigators, our final guideline has been developed based on a consensus by our steering committee (comprising an international panel of experts in the ED field; see pp.3). The information contained within this document reflects the knowledge and evidence at the time of its publication. Efforts will continue to evolve and these guidelines will be amended as new information and feedback emerges.

Executive Summary

Maladaptive movement is one of the first presenting and last remaining symptoms of EDs (Berkman et al., 2007; Davis et al., 1994; Levallius et al., 2017). As such, it is imperative that movement is addressed throughout all stages of ED treatment and recovery. Addressing movement throughout treatment requires a step-up/step-down approach, tailoring movement recommendations according to the individual's current physical and psychological well-being (Cook & Leininger, 2017; Quesnel et al., 2020a). The SEES-Y guideline provides a framework for assessing an individual's physical and psychological health status to inform movement interventions. These guidelines are intended to augment, not replace, clinical decision-making and judgement. Incorporating the SEES-Y guideline as a component of evidence-based treatment for youth with an ED is anticipated to promote an ethical standard of care and greater consistency in managing maladaptive movement.

Background

Eating disorders (EDs) are complex and multidimensional psychiatric diagnoses. The Diagnostic Statistical Manual of Mental Health – 5th edition (DSM-5; American Psychiatric Association, 2013) classifies ED diagnoses including anorexia nervosa (AN), bulimia nervosa (BN), other specified feeding or eating disorders (OSFED), binge eating disorder (BED), and avoidant/restrictive food intake disorder (ARFID). Their onset and maintenance are multifactorial, including genetic, biological, psychosocial, behavioural, socio-cultural and other factors (NEDC, 2024). ED diagnoses are associated with a high economic burden, poorer quality of life, and increased likelihood of mortality from both medical complications and suicide (Bulik et al., 2005; Crow, 2014; van Hoeken & Hoek, 2020).

Eating disorders in children and adolescents

Approximately 5% -18% of young girls and 1-3% of boys will experience an ED by early adulthood, with up to 12% of youth experiencing an ED during their lifetime (Silen et al., 2022). Since the COVID-19 pandemic, inpatient admissions, hospital bed-days, and outpatient care-related inquiries for an ED have all increased (Lin et al., 2021; Otto et al., 2021). For adolescents, ED onset predicts an increased risk of developing depression, anxiety, self-harm, and substance use later in life (Micali et al., 2015). Treatment of these severe and complex disorders typically includes psychotherapy, often in combination with pharmacological/medical treatment and nutrition counselling (Heruc et al., 2020; Kotilahti et al., 2020). Treatment outcomes are favourable for adolescents, with about 80% achieving recovery at long-term follow-up (11 years; Steinhausen et al., 2000).

One factor impacting relapse rates, chronicity and general prognosis in ED populations is engagement in maladaptive movement. Throughout the SEES-Y guideline, we refer to maladaptive movement as a relationship with movement defined by psychological (e.g., driven, rigid, compulsive, compensatory, etc.), physiological (e.g., engaged in despite injury/illness, undermines medical/physiological stability or progress, not adequately nourished, etc.), or functional (e.g., missing out on social/recreational/occupational events to exercise, etc.) aspects of movement. Literature also refers to this construct as excessive exercise (Davis et al., 1993), over-exercise (Smith et al., 2013), exercise addiction (Griffiths et al., 2005; Terry et al., 2004), exercise dependence (De Coverley Veale, 1987; Hausenblas & Downs, 2002; Ogden et al., 1997), exercise abuse (Calogero & Pedrotty-Stump, 2004), dysfunctional exercise (Calogero & Pedrotty, 2010), obligatory exercise (Brehm, 1994; Coen & Ogles, 1993; Pasman & Thompson, 1988) compulsive exercise (Meyer & Taranis 2011), driven exercise (Fairburn et al., 2008), pathological exercise (Cunningham & Pearman, 2016), activity anorexia (Epling et al., 1983), exercise anorexia (Eisler & Grange, 1990) and unhealthy exercise (Lampe et al., 2022; 2023). Maladaptive movement is characterized by qualitative (one's relationship with activity) and quantitative (amount of activity engagement) difficulties with activity that manifest across different types of activity (i.e., incidental, occupational, leisure, sport and exercise) (Barker et al., 2023; Dittmer et al., 2018). Notably, movement is a part of adolescent daily life and includes activities such as walking to the bus, going to gym class, doing sports or simply playing with friends. Unfortunately, maladaptive relationships with movement can begin to permeate across movement types, even for youth (Dittmer et al., 2018; Renz et al., 2019).

Maladaptive movement is reported in between 16-85% of youth with an ED (Fietz et al., 2014; Levallius et al., 2017; Renz et al., 2019). Prevalence data on the gender differences in maladaptive movement is mixed; however, maladaptive movement appears to increase with age. Unlike in adults, maladaptive movement may be more common in EDs not related to significant weight loss (i.e., bulimia nervosa or OSFED) when compared to AN (Levalliuse et al., 2017). Irrespective of diagnosis, however, maladaptive movement is associated with greater ED symptoms such as binge eating, purging, body image disturbance, and food restriction (Holtkamp et al., 2004; Madisun & Ruma, 2003). Indeed, for youth with an ED, engaging in maladaptive movement is linked to overuse injuries, bone fractures, and cardiac complications (Dalle Grave et al., 2008) and is a strong predictor of relapse and illness chronicity, suicidal ideation, anxiety, depression and OCD (Bigregard et al., 2024; Carter et al., 2004; Strober et al., 1997; Stiles-Shields et al., 2011). When maladaptive movement is not addressed during treatment, ED pathology is often exacerbated and anxiety increases (Berends, Boonstra, & Van Elburg, 2018; Cook, Hausenblas, Tuccitto, & Giacobbi, 2011; Stiels-Shields et al., 2011; Fietz et al., 2014).

In contrast, establishing positive movement engagement is associated with remission in youth (Levallius et al., 2017). Evidence over the past two decades suggests that incorporating nutritionally supported, safe, and supervised movement into adolescent ED treatment can improve treatment outcomes without undermining ED treatment and recovery or interfering with weight recovery and maintenance (Hallward et al., 2022; Moola et al., 2013). Interventions range from yoga (Borden & Cook-Cottone, 2020, 2022; Carei et al., 2010; Karlsen et al., 2018; Neumark-Sztainer et al., 2013; Ostermann et al., 2019) to resistance training (Agne et al., 2022; Chantler et al., 2006; Szabo & Green, 2002; Fernandez-del-Valle et al., 2010; 2014), aerobic exercise (Sundgot-Borgen et al., 2002; Tokumura et al., 2003), and other alternative exercise modalities (Catalan-Matamoros et al., 2011; Duesund, & Skarderud, 2003). These global initiatives have resulted in improvements in patients' muscle mass (Agne et al., 2022; Chantler et al., 2006; Szabo & Green, 2002), improved ED outcome markers (Lampe et al., 2022; Ostermann et al., 2019) fitness markers such as VO2max (Tokumura et al., 2013), maladaptive movement symptomatology (Mathisen et al., 2018; 2020; Schlegel et al., 2015), quality of life (Agne et al., 2022; Duesund & Skarderud, 2003), therapeutic alliance (Catalan-Matamoros et al., 2011) reduced drive for thinness (Carie et al., 2010), and shortened time to vital sign stabilization. Further, patients report high satisfaction with exercise programs, with exercise engagement related to improvements in compulsive exercise markers and not detrimental to weight gain.

As Hallward and colleagues (2021) acknowledge, the initiative is no longer “if” exercise should be incorporated into treatment for individuals with an ED but “how.” Indeed, moving beyond the previously standard practice of recommending exercise abstinence, many governing bodies now support return to movement and the inclusion of appropriate movement professionals during treatment for an ED, e.g., The National Eating Disorders Collaboration (2024), the Australian Institute of Sport and National Eating Disorder Collaboration (Wells et al., 2020), Academy of Nutrition and Dietetics (2020) and American Psychiatric Association (Crone et al., 2023). With more than half of all parents recognizing that addressing exercise is an important component of recovery from an ED, there is an urgent need to know how to address maladaptive movement in youth with an ED.

The rationale for youth-specific guidelines

The peak prevalence of EDs is between early adolescence and young adulthood. This period is critical for rapid developmental growth, including pubertal changes, bone formation/accrual, and structural/functional neurological development, all of which can be arrested by malnutrition or undernutrition associated with ED onset (Downey et al., 2023; Katzman, 2005; Misra, 2008; Roze et al., 2007; Saldanha & Fisher, 2023; Sietz et al., 2016) . Indeed, the medical complications of ED in youth are generally more severe than in adults (Dalle Grave et al., 2021). Engaging in maladaptive movement with an ED is linked to serious medical sequelae in youth, and there is understandable concern for return to exercise during this period (Chubbs-Payne et al., 2021; Riva et al., 2022). A further difference in managing maladaptive movement for youth is that family-based approaches are the first-line treatment for youth instead of individual treatment in adults (Dalle Grave et al., 2021). Finally, movement looks different in youth than adults, often encompassing sports, school activities, and planned exercise (van Slujis et al., 2021). These critical differences in the medical presentation of EDs in youth, their treatment, and normative expectations related to movement highlight the need for youth-specific guidance for return to exercise during ED treatment.

Despite demonstrated benefits and organizational support, many treatment protocols do not formally address how to manage return to movement during treatment, particularly for youth. Indeed, there is no standard practice to support how health professionals manage and reintegrate movement into ED treatment (Mathisen et al., 2023). Consequently, many health professionals adopt the practice of recommending abstinence from movement during ED treatment (Davies, 2015; Hechler et al., 2005; Thien et al., 2000; Zunker et al., 2011). Over recent decades, both research and clinical health professionals working in the ED field have questioned recommending that individuals with EDs abstain from movement (Beumont et al., 1994; Ng et al., 2013; Quesnel et al., 2018; 2025). Furthermore, youth with lived experience of ED have advocated for physical activity programming that incorporates education about movement and structured physical activity (Chubbs-Payne et al., 2021).

Following critical research investigating the safety and benefit of exercise interventions of those with an ED (e.g., Beumont et al., 1994; Bratland-Sanda et al., 2010; Calogero & Pedrotty, 2004; Chantler et al., 2006; Fernandez-del-Valle et al., 2010; Schlegel et al., 2012; Sundgot-Borgen et al., 2002; Szabo & Green, 2002; Thien et al., 2000; Touyz et al., 1993 etc.), the Safe Exercise at Every Stage – Youth (SEES-Y) guideline is designed to support clinical decision-making for the assessment and management of movement during ED treatment in child and adolescent populations.

Overview of the SEES-Y guideline

Objective

Maladaptive movement is associated with a range of deleterious outcomes for youth with ED symptomatology, yet safe movement engagement is associated with positive physical and mental health outcomes. As youth with an ED often exhibit an array of medical health complications, it can be challenging for clinicians to determine safe movement engagement. The SEES-Y guideline was developed to address movement management in youth ED populations. This guideline's recommendations are intended to guide clinicians in facilitating better clinical decision-making related to movement recommendations for youth with ED symptomatology. We aim that using this SEES-Y guideline will reduce the likelihood of over-and under-recommending movement relative to the patient's physical and psychological health status. Consequently, this is intended to support youth with ED symptoms to engage in safe levels of movement and psychotherapy throughout their treatment, contributing to improved psychological and physical outcomes.

Target users and population

We developed the SEES-Y guideline for use by trained exercise and medical professionals working with youth with ED symptomatology. This guideline is intended for use across all levels of care, including inpatient and residential settings and outpatient settings. The purpose of the SEES-Y guideline is to augment clinicians' clinical and medical knowledge working with these populations. The application of the guideline should only occur within an individual clinician's scope of practice.

We specifically intended that the SEES-Y guideline apply to youth at all stages of their ED and not determine health status based upon an individual's specific diagnosis (for example, bulimia nervosa or anorexia nervosa). Additionally, we actively recommend *against* determining medical risk solely based upon weight or BMI and, thus, developed the guideline to apply to youth with ED symptomatology regardless of weight or BMI. Consequently, this guideline was developed for use with youth under 18 years exhibiting ED symptomatology (e.g. dietary restriction, purging, compensatory behaviours). The SEES-Y guideline may require adaptation by a trained medical team or accredited exercise professional for special populations such as youth with co-occurring conditions such as diabetes, osteopenia/osteoporosis, or other existing metabolic, neurological, cardiovascular/respiratory, psychological, or musculoskeletal conditions. Please use the SEES-2 and SEES-Athlete guidelines for adults and athletes, respectively.

Scope

- The SEES-Y guideline supports clinical decision-making regarding movement recommendations for trained health professionals working with youth with ED symptomatology.
- The SEES-Y guideline is intended for use across all levels of care for youth experiencing an ED or ED symptomatology.
- The SEES-Y guideline applies to youth at every stage of their eating disorder, regardless of their weight, size, or diagnosis.
- The SEES-Y guideline was developed for use in child/adolescent populations and is not suitable for use with adults.
- The SEES-Y guideline is not intended to replace clinical or medical judgment, and recommendations should be made with consideration of the patient's individual needs.
- The SEES-Y guideline may need to be adapted or may not be appropriate for youth with co-occurring conditions or from special populations.

Methodology and Results

The SEES-2 and subsequent SEES-Y guidelines were developed via a thorough review of available research in conjunction with input from experts in the field of ED. We used the AGREE-II instrument (AGREE Next Steps Consortium, 2017) and NHMRC (2011) instrument to support the development of SEES and ensure SEES-2 meets high standards. The authors completed the following procedure to support the development of SEES-Y:

- Review of existing guidelines.
- Focus groups with our steering committees and qualitative feedback.
- Meta-analytic review of exercise interventions in youth ED populations.
- Delphi study with experts in child/adolescent ED treatment and research
- Consultation with steering committee experts.
- Approval of SEES-Y final document by the steering committee

Method of consultation process

Our initial consultation process was undertaken with members of our steering committee (pp.3). Participants provided feedback during online focus groups or via online submission of information. Following the completion of the SEES-Y guideline, the steering committee was again invited to provide feedback related to the guideline.

Results of initial consultation process

Defining safe movement for youth. Our experts discussed that when considering safe movement for youth with ED, it is important to adopt a non-abstinence approach. Movement should be introduced during treatment with a focus on enhancing physical fitness, mental health, social well-being, and overall wellness. The goal should not be to use movement to compensate for calorie intake or engage in "calorie debting."

Given that children and adolescents have limited autonomy but participate in a wide range of activities including play, sports, and training programs, they noted that movement plans should be tailored to youth specific needs. These plans must consider their personal history with movement, the intention behind the movement, and how it fits into their social environment and daily routines.

Consideration for youth compared to adults. Our steering committee noted that the same approach used for adults in returning to movement with an ED can be applied to youth, with some important considerations. First, youth have less autonomy than adults, and individuals like parents, coaches, and gym teachers may play a significant role in managing movement programs. However, youth must be involved in the decision-making process regarding the progression or regression of their activities.

Secondly, youth have unique physical health markers and developmental considerations, such as heart rate, bone formation, menstruation markers, and growth curves. Activities that may be particularly beneficial for youth with ED include weight-bearing exercises like weightlifting and walking. While it may be important for movement progression to align with weight restoration (if applicable), the focus should remain on health factors rather than solely on weight gain or loss.

Lastly, youth should be encouraged to view movement as an opportunity for socialization, fun, and enjoyment rather than to control body shape or weight. A key consideration in youth populations is their involvement in organized sports, unstructured physical activities, or leading generally sedentary lifestyles. In younger age groups (8-12), a simpler and less complex approach is needed, with careful attention to language. While increasing lean muscle mass is important for both age groups, it becomes especially significant for older youth. For younger children, the focus should be on play and sports, steering away from strenuous, individualized activities like those often found in gym settings.

Assessment considerations. As with adults, our experts recommended that a holistic approach to health should be adopted for youth. Collecting information about psychological factors, such as the quality of the relationship with movement, is best done through interviews (e.g., the Eating Disorder Examination) rather than surveys. Given their egosyntonic relationship with movement, this practice may be especially important for youth. It can result in a lack of insight and their tendency to perform better in interviews than in self-report surveys. When insight is limited, real-time self-monitoring of exercise can be useful. It was also suggested that for patients unaware of maladaptive movement patterns, using activity monitoring tools (e.g., Actiheart) and collaboratively reviewing self-monitoring data can help them become more aware of how movement may manifest negatively, especially in less structured contexts. However, preliminary data suggest a link between using external monitors and increased compulsive exercise in youths (Bratland-Sanda et al., 2022).

In youth, instead of focusing on body composition measures (with the exception of bone mass), it may be more appropriate to include measures of functional fitness or health-related fitness. These can be markers of muscle mass restoration, fitness recovery, and body composition. Tests that assess explosive power, balance, upper limb strength, trunk and core strength (e.g., sit-ups), the Stop and Stand test in the MARZIPAN guidelines, and the 6-minute walk test are particularly useful. The Sit-up test is notable for indicating the severity of malnutrition-related damage to the musculoskeletal system and recovery status. ED myopathy in severely underweight patients primarily affects proximal muscles, leading to type 2 muscle fibre atrophy (McLoughlin et al., 2000). While the SUSS test is most significant, adding the Handgrip test allows for a more comprehensive evaluation of physical fitness recovery, as it quantifies a key parameter-grip strength-by measuring kilograms lifted. Both tests should be included in assessments.

That said, fitness testing for youth should be framed in a friendly and considerate manner, presenting it as a way to measure their ability to engage in enjoyable activities and daily life. These tests provide an objective perspective on physical recovery and serve as engagement tools, illustrating to the patient how weight recovery is essential for regaining physical fitness. Furthermore, there has been an emphasis on recovering bone density, which is especially vulnerable during developmental periods. However, functional assessments may be a valuable alternative since many treatment centers lack access to DEXA machines. Considering physiological measures, such as growth curves, rather than focusing solely on weight is important and may provide a more accurate assessment than relying on ideal body weight alone.

Implications for Family Based Treatment. Family-based Treatment (FBT) is considered the first-line intervention for ED in children and adolescents. The treatment involves five core tenets as follows: (1) an agnostic view of the cause of the illness; (2) a non-authoritarian therapist stance; (3) empowering parents to facilitate their child's recovery; (4) the ED is externalized and separated from the patient; and (5) pragmatic approach to treatment. Comprising three phases, FBT begins by guiding parents to manage their adolescent's recovery from the ED before transitioning responsibility back to the adolescent and finally returning to normal adolescent/family functioning.

Movement can be approached in a manner similar to reconciling one's relationship with food. The goal is to cultivate a relationship with movement that is fulfilling, long-lasting, and flexible. An important message for youth in recovery is that developing a healthy, supportive relationship with movement is a crucial part of life and their overall recovery journey. FBT therapists can empower parents to take charge of the youth movement, using SEES-Y as part of their expert consultant role to support parents in their decision-making.

Parents/Guardians. The role of parents/guardians can vary depending on the treatment modality used. Irrespective of the treatment modality, parents or other trained adults must first supervise the intensity and duration of physical activity. This can be achieved by involving parents and other care team members, such as exercise physiologists (for in-hospital activity), coaches, or gym teachers. For younger youth, in particular, individual activities like going to the gym may not be in their best interest unless it was something they previously enjoyed or had as a long-term goal. During movement, parents can assist by cueing healthy behavior and instilling positive, enriching ideologies about exercise. When a child has an urge to exercise that needs management, parents can help by distracting them with alternative activities.

Additionally, parents may need to adjust their own engagement with movement to set a positive example for their child, similar to how they model healthy eating. Lastly, parents must avoid praising their child's body, shape, or fitness level during rehabilitation (and likely afterward). This approach helps the child decouple self-worth from exercise and encourages them to view movement as a neutral behavior rather than praiseworthy.

Youth Contraindication to Exercise. Feedback suggested that contraindications should be the same for youth as for adults, with the addition of the patient remaining catabolic, electrolyte imbalances and cardiovascular abnormalities (bradycardia, postural tachycardia and a prolonged QT interval), etc.; lack of weight gain; noncompliance with treatment guidelines.

Factors that may support increased exercise engagement. These included an increased BMI, treatment compliance, improvements in cardiac health, medical stability, and reduced ED pathology and exercise compulsions. Suggestions were varied regarding how rigid these steps should be and the stage for movement to be safely increased.

Literature search strategy and data extraction

We (DQ, MC, MFD) conducted comprehensive systematic searches of the literature during the period of 1990-2024. We searched for articles published prior to these dates on the following electronic databases: Medline, PubMed and PsychArticles. Search terms included: "eating disorder* OR anorexi* OR bulimi*" AND "exercise OR physical therapy OR physical activity" AND "cardiorespiratory OR mental OR metabolic OR neurological OR musculoskeletal OR mortality OR adverse events OR injury." A supplementary examination of reference sections for additional papers was also conducted. Inclusion criteria were as follows:

1. Be original research reports only;
2. Be from a peer-reviewed journal;
3. Include either a participant/group of participants identified as experiencing an eating disorder;
4. Have physical activity or exercise as a main antecedent or exposure variable;
5. Report on a health outcome variable or risk factor is clearly described and fits into one of our health outcome categories (as described in search terms), and
6. Be written in English.

The authors initially screened all titles, duplications, and publication types to remove articles that could immediately be excluded. A further review of abstracts and full text manuscripts was conducted independently to determine eligibility for inclusion. Any differing opinions between the raters were discussed to reach a consensus decision. MC subsequently extracted data related to study design, setting, patient, diagnosis, sample characteristics, exercise intervention details, reported outcomes, and contraindications. MC subsequently extracted data related to study design, setting, patient, diagnosis, sample characteristics, exercise intervention details, reported outcomes, and contraindications. Initial findings were presented at the 2020 International Conference for Eating Disorders.

Results of Search Process

This review process resulted in a total of 42 studies that were included in resultant systematic reviews and meta-analyses. Core findings were presented at the 2020 International Conference for Eating Disorders and will be published in upcoming meta-analyses.

Monitoring and Audit Process

We intend that the SEES-Y guideline be reviewed for updated information in 2030, although this review may occur earlier should key information become available. The primary investigators will review updates to the literature at this time and, where applicable, update aspects of the guideline based on the latest scientific evidence. Any modifications to the SEES-Y guideline will be conducted under the review of our steering committee. Users of the guideline are encouraged to forward recommendations for adaptations and relevant literature to the SEES-Y guideline through our website (https://www.safeexerciseateverystage.com).

Limitations

It is important to highlight the following limitations to the SEES-Y guideline:

- This guideline was developed based on clinical and research understanding of exercise intervention and ED treatment at the time it was written. We identified highly divergent opinions in the research and clinical fields throughout this development process. To rectify these contrasting opinions within our guidelines, we relied on the current research evidence and the expert opinions of our steering committee.
- We recognise that there is currently limited evidence to support the safe use of exercise in ED populations, particularly in outpatient settings. Consequently, the SEES-Y guideline will require updating as research into this area evolves.
- This guideline is not a manual for exercise intervention. It is a review of current literature and exercise interventions in samples of youth with an ED. Consequently, it is intended that the SEES-Y guideline will support clinicians in their decision-making regarding safe movement and exercise education adjunctive to implementing an evidence-based treatment approach.
- This guideline is not intended to train clinicians in the physiology and psychology of exercise in individuals with ED symptomatology. Instead, it provides recommendations for clinicians already trained in these areas to support clinical decision-making. We also recognise that there are situations where access to specialised ED clinicians is not possible, often due to geographic or economic resources. Consequently, we aim for the SEES-Y guideline to support trained medical and exercise professionals (pp.68) in these situations to augment their current clinical judgement and knowledge.
- The SEES-Y guideline was not developed to address the specific needs of diverse cultural or special populations, however, we have prioritised the inclusion of current evidence-based recommendations throughout. We recommend that clinicians applying the SEES-Y guideline should tailor interventions to each individual's needs.

Key Principles

The authors identified five key principles underpinning the development of the initial SEES guideline. These principles have guided the development of this guideline and should be employed when applying its recommendations. The key principles include non-abstinence, safety, holistic, intuitive and mindful movement, and collaboration.

1. Non-abstinence

This principle was central to our motivation for developing the SEES guidelines. The clinical practice of recommending exercise abstinence for those with an ED is common and understandable, considering the high rates of complex medical complications associated with ED and exercise (Davies, 2015; Hechler et al., 2005; Quesnel et al., 2023; Thien et al., 2000; Zunker et al., 2011). However, exercise abstinence is associated with an increased risk of relapse (Carter et al., 2004), secretive exercise, poorer treatment outcomes (Bratland-Sanda & Vrabel, 2018), more severe psychopathology, worsened illness chronicity (Dalle Grave et al., 2008; Davis et al., 1994), and does not align with the evidence-based 2024 Eating Disorder Safe Guidelines or other standards of care (NEDC, 2024; SAMHSA, 2023; Kezelman & Stavropoulus, 2019; NADA, 2022, Victorian Government, 2022).

Conversely, engagement in safe, tailored, and life-enhancing exercise and psychoeducation during treatment is linked to improvements in quality of life, body composition (e.g., bone and muscle mass), central health markers of the illnesses (e.g., drive for thinness, weight/shape concerns and eating restraint), and co-occurring physical and psychological symptomatology (e.g., anxiety, depression, muscle degradation, body esteem issues, sleep disturbances, perceived stress and osteoporosis) in those with ED (Hausenblas et al., 2008; Moola et al., 2013; Ng et al., 2013; Vancampfort et al., 2014). Thus, there is a clear need to determine how to address movement at all stages of ED treatment and recovery to prevent deleterious outcomes associated with exercise abstinence and obtain the physical and psychological benefits of a fulfilling relationship with mo. Movement. After all, we don't simply suggest that individuals with an ED 'just eat'; we provide interventions to guide renourishment and support patients in establishing a life-enhancing relationship with food. Including safe movement interventions "from the earliest opportunity" is encouraged (NEDC, 2024).

2. Safe and Healthful

EDs affect every major organ system in the body (Mehler & Brown, 2015), with both medical and psychological risks exacerbated by maladaptive movement (exercise engagement) (Quesnel et al., 2023). Therefore, movement recommendations in ED treatment must promote the safety of patients (Cook et al., 2016). Health professionals currently report limited knowledge of how to facilitate safe return to movement during ED treatment, likely contributing to uncertainty and confusion related to patients' safety in any exercise during ED (Quesnel et al., 2017). The SEES and subsequent SEES-Y guidelines were developed to summarize existing evidence on the medical complications and relevant contraindications to exercise and describe how this knowledge can inform movement recommendations. We intend that this guidance will help address clinical concerns related to patient safety and improve clinical knowledge of movement engagement during ED treatment. Therefore, a second key principle of the SEES-Y guidelines is to promote physical and psychological safety as paramount for any exercise intervention.

3. Holistic

An individual's relationship with movement is multifaceted, comprising physical, emotional, social, cognitive, and sociocultural components (Calogero & Pedrotty, 2007; NEDC, 2024). Consequently, each component influences engagement in movement (Calogero & Pedrotty, 2003). While clinical management of movement in ED treatment commonly considers the physical risk/safety of exercise engagement, it is critical also to consider other facets of exercise engagement, such as how movement is related to psychological processes (e.g., how exercise impacts one's emotional wellbeing, what helpful/unhelpful cognitions about movement an individual holds, rigid rules related to movement) as well as how exercise impacts an individual's functioning (e.g., missing school/work obligations, impacting social relationships). As highlighted above, safe and healthful movement has been paramount in developing the SEES guidelines; therefore, we must consider how this is achieved via a multifaceted and holistic approach. Addressing these dimensions through a holistic lens is integral to supporting individuals in developing a healthy relationship with all types of movement. Our prioritisation of a holistic approach underpins the combination of medical, cognitive, emotional, and behavioural benchmarks in the SEES guideline. This decision-making process aims to guide clinicians in supporting their patients to begin and continue safe movement engagement, contributing to this multifaceted construct of well-being.

4. Mindful and Attuned Movement

A maladaptive relationship with movement can be characterised by rigid inflexibility, punitive attitudes, and guilt (Meyer et al., 2011). To address this relationship with movement, clinicians must support patients to cultivate a more safe, positive and healthful relationship with movement in a tailored and collaborative way for the person (NEDC, 2024). Building mindful and attuned movement skills can be a key strategy to facilitate this transition. According to Calogero and colleagues (2019), mindful and attuned movement initially prioritises physical and psychological safety before promoting engagement in process-oriented movement, facilitating life-enhancing outcomes (Calogero et al., 2019). Attuned movement "reflects mindful attention, self-compassion, self-acceptance, joyful moments, and becoming more connected and present in the body (Calogero et al., 2019, p.84).

Attuned movement builds on the original concept of intuitive movement, which is defined as "movement that is done with attention, purpose, self-compassion, acceptance, awareness, and joy… focused on the process of becoming more connected, healthier, and stronger" (Calogero & Pedrotty, 2010 p.434). Clinicians can support their patients to begin mindful movement by providing opportunities to connect with their physiological and psychological cues before, during, and after exercise engagement and use these internal signals to choose and adjust health-enhancing movement (Calogero and Pedrotty, 2007). This process aims to support individuals to foster trust in their bodies' preferences. It needs to be related to exercise, contributing to the likelihood of positive, rather than destructive, health outcomes over time (Calogero & Pedrotty, 2003). According to Calogero and Pedrotty (2007, p.184), mindful and intuitive movement should:

1. Rejuvenate the body, not exhaust or deplete it.
2. Enhance mind-body connection, but do not allow or induce disconnection.
3. Alleviate mental and physical stress, not produce more.
4. Provide genuine enjoyment and pleasure, not pain and dread.

For further details on encouraging mindful and intuitive processes during return to movement, please see pp.39.

5. Collaborative

Establishing a collaborative relationship with patients/care takers, parents, clinical team members, peer supports, and others includes supporting patient autonomy, listening to and incorporating the person's valuable experience and insights, providing options/choices, and demonstrating empathy for patient wellbeing, irrespective of treatment adherence (Geller et al., 2023; Cobbaert & Rose, 2023). Developing a positive therapeutic alliance in treatment is a well-established predictor of positive treatment outcomes (Graves et al., 2017), and collaborative patient-practitioner relationships are linked to lower rates of dropout, reduced ambivalence to change, and increased treatment acceptability by both patients and clinicians (Geller et al., 2003). The SEES-Y guideline was designed to promote collaboration to help guide safe engagement in movement and psychotherapeutic intervention at all stages of ED treatment and recovery. This approach differs from a directive, prescriptive, or expert-type approaches, where clinicians may prescribe a specific movement amount/type/frequency for their patients (Cobbaert &

Rose, 2023; Geller et al., 2023; NEDC, 2024; Kezelman & Stavropoulus, 2019; NADA, 2022; SAMHSA, 2023; Victorian Government, 2022).

Instead, we encourage the use of a collaborative approach involving the patient throughout the return to movement decision-making processes. This process requires a thorough collection of patient information (see Assessment Form in Appendix 1) and working with patients as an active member in clinical decision-making. We note that these decisions are still made within the context of clinicians prioritising the patient's safety and health and are not solely patient-directed. This approach aims to facilitate open and honest conversations with patients about exercise while supporting individuals in building autonomy in movement-related decisions throughout their recovery.

The Foundations of SEES-Y

Similar to the adult Safe Exercise at Every Stage, this simple and graded process aims to support clinicians in determining the level of movement and psychotherapeutic interventions appropriate for each individual based on their current level of physical and psychological well-being. The guideline was based upon results from systematic reviews of the literature, focus groups with professionals in the field, and feedback from relevant stakeholders worldwide (including clinicians, researchers and individuals with lived experience). A key mission of the SEES team is to provide guidance in the safe return to movement for individuals with an ED based on a high standard of evidence. We have freely disseminated the SEES guidelines online (www.safeexerciseateverystage.com/access-sees-guideline/). The upcoming section summarizes key advancements in the field of activity and ED that have informed adaptations in the SEES-Y guideline.

Terminology and Conceptualization

We use the term maladaptive movement throughout SEES-Y as an umbrella term for unhelpful cognitive, behavioral, and emotional patterns that manifest in relation to movement during an ED. There continues to be a vast number of terms used within the literature that are often not operationalized or interpreted incorrectly, perpetuating unnecessary complexity within the research and clinical ED field. Here, we will review advancements in our understanding of maladaptive movement and review how our definition of the term maladaptive movement aims to do justice to the multiple facets of one's relationship with movement.

Overarchingly, maladaptive movement is defined by both quantitative and qualitative features. Although the quantity of movement may be considered in characterising maladaptive movement, there is no consensus on the specific quantity (i.e., cut off) of movement (whether by frequency, duration, type, or intensity) that defines movement as "maladaptive" or not (Bratland-Sanda et al., 2019; Glazer, 2008; Harris et al., 2022; Mond & Gorrell, 2021; Scharmer et al., 2020; Sundgot-Borgen & Torstveit, 2004). A recent Delphi study (Harris et al., 2022) highlighted specific qualitative components of one's relationship with activity that may be problematic, including movement that is perfectionistic, rigid, for the purpose of affect regulation, driven by shape or weight motivations, or is compulsive. We emphasise that although maladaptive movement can be experienced at an individual level, aspects of this relationship with movement (e.g., weight-related motivation, punitive) may be promoted and sustained at the societal level, highlighting the need for a sociocultural shift toward a more holistic relationship with movement and health (NEDC, 2024; Cobbaert and Rose, 2023; NEDC, 2023). A prominent definition of maladaptive movement by Dittmer et al. (2018) is based on diagnostic criteria for obsessive-compulsive disorder and proposes that maladaptive movement is defined by a) feeling driven to perform exercise in response to an obsession or according to rules that must be applied rigidly and that the exercise is aimed at preventing some dreaded consequences or at preventing or reducing distress, often based on distorted beliefs about exercise, b) exercise is engaged with in a time-consuming way (>1hour per day) that significantly interferes with one's daily routine, occupational functioning or social relationship, or is continued despite medical injury, illness, or lack of enjoyment, c) exercise is engaged with in a way that is excessive or unreasonable, and that d) these qualities are noted across the individual's engagement in vigorous exercise (i.e. gym sessions, sports engagement), marked increase in daily movement or incidental physical activity (i.e. chores, walking to the mailbox), and motor restlessness (pacing, overall agitation). This definition highlights that maladaptive movement is not limited to exercise but may also include daily movement, incidental physical activity, or motor restlessness.

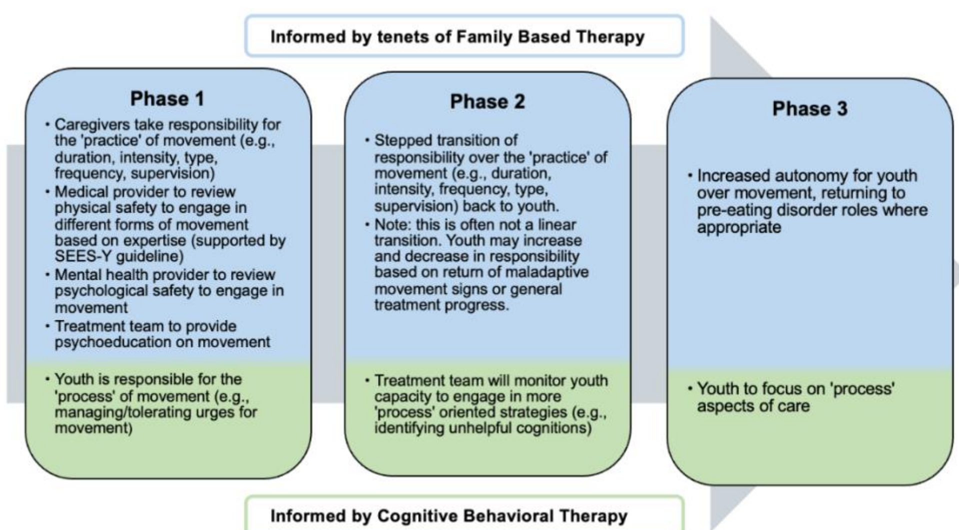
Bratland-Sanda et al. (2019) extended this model, proposing that obsessional cognitions related to movement, irrespective of engagement, further characterize maladaptive movement. A key part of this clarification is that individuals whose movement is restricted (e.g., those hospitalized or abstaining from movement) may have a maladaptive relationship with movement. Calls have also been made to consider how occupational physical activity may be implicated in our understanding of maladaptive movement and return to movement within ED treatment (Baker et al., 2024; Rizk et al., 2020). One final aspect important to our conceptualization of maladaptive movement stems from data by Lampe and colleagues (2023), who used ecological momentary assessment to observe that individuals can engage in adaptive and maladaptive movement even within a single day. In sum, we use maladaptive movement throughout the SEES-Y guideline to refer to bouts of movement that are maladaptive in nature, as indicated by psychological (e.g., driven, rigid, compulsive, compensatory etc.), physiological (e.g., engaged in despite injury/illness, undermines medical/physiological stability or progress, not adequately nourished, etc.), or functional (e.g., missing out on social/recreational/occupational events to exercise, etc.) aspects of movement.

Multicomponent Management of Maladaptive Movement

Evidence continues to reinforce the need for patients to both *"practice"* and *"process"* movement during treatment (Calogero & Pedrotty, 2003). Interventions that focus solely on an individual's relationship with movement (process) without permitting active engagement in movement (practice) have shown to be less impactful. For example, the Loughborough Eating Disorders Activity Program (LEAP) is the only manualized initiative of its kind, offering a CBT-based intervention to address symptoms of maladaptive movement, such as compulsivity, exercise myths, rigidity, and weight- and shape-motivated exercise (Hay et al., 2018; 2023). Findings on LEAP are mixed with some data demonstrating improvements in maladaptive movement-related cognitions above treatment as usual (Hay et al., 2018; 2023). Similarly, studies implementing an exercise protocol without addressing the “processing” piece have been unsuccessful in impacting psychological outcomes such as quality of life (Thien et al., 2000), markers of depression (Chantler et al., 2006), and overall maladaptive movement symptoms (Thien et al., 2000).

Therefore, it appears crucial to the rehabilitation process for patients with an ED to both engage in movement in a therapeutic setting and address their relationship with movement via psychotherapeutic intervention. These findings have led to a shift toward research and development of interventions that include both in vivo exercise and psychological components in treatment. For example, the Freiburg Sports Therapy Program includes exercise engagement and psychotherapy, including psychoeducation, identifying exercise motivations, reducing perfectionism, and preventing relapse (Schlegel et al., 2015). Similarly, the Healthy Exercise Behavior intervention (Dittmer et al., 2018) integrates cognitive-behavioral therapy (CBT) approaches such as psychoeducation, coping strategies, and behavioral analysis alongside exercise.

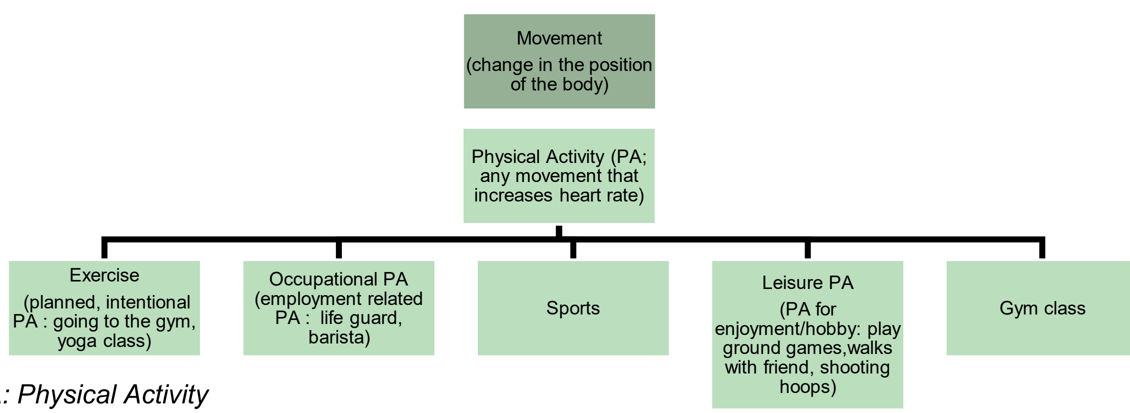
The efficacy of these treatments has been evaluated via randomized controlled trials in both outpatient (Schlegel et al., 2015; Zeeck et al., 2020) and inpatient settings (Dittmer et al., 2018; 2020), with preliminary data suggesting greater reductions in maladaptive movement from pre- to post-treatment compared to treatment as usual. Although the SEES-Y guideline does not endorse any specific interventions, these early findings highlight the potential of integrated programming to enhance psychological and physical readiness for a return to movement. Based on these insights, we have added further details on adjunctive psychological and exercise processing interventions on pages 42-45. Overarchingly, we have framed these guidelines via the following model:



Youth-Focused Movement

Maladaptive movement is commonly thought of as manifesting through intense, solitary cardiovascular exercise, e.g., running or cycling (Quesnel et al., 2018). Articles such as "I am not physically active, I only go for walks" (Bratland-Sanda et al., 2015) pay homage to other types of movement that impact ED outcomes and may indicate a maladaptive relationship with movement. In fact, incidental physical activity (i.e., walking to the bus or from one class to another) is strongly linked with exercise addiction and relapse in patients with AN (Dalle Grave et al., 2008; Strober et al., 1997). Moreover, occupationally related physical activity (i.e., manual labor but also daily work requirements in non-manual labor work such as lifting, carrying, moving, etc.) are also forms of movement in which a maladaptive relationship can occur and must be considered when determining overall energy expenditure for an individual during ED treatment (Barker et al., 2024). Yet, both are commonly overlooked during the assessment and management of maladaptive movement. Regardless of being discharged from an outpatient or inpatient setting, youth must navigate real-life demands, including engagement in recess, gym class, sports, and incidental and occupational physical activity (Figure 1). For youth, many activities differ from adults, as they participate in sports and/or school programs that entangle movement with their daily lives (Ardundell et al., 2016; Coatsworth & Conroy, 2007; Lydecker et al., 2021). All youth have recess and gym classes, which introduce different opportunities for movement across age groups (Wallhead & Buckworth, 2004). Thus, a thorough assessment of all types of movement relevant to youth should occur continuously throughout treatment to manage patient misconceptions of what movement 'looks like", prevent detrimental treatment outcomes, and promote patient safety.

Figure 1. Types of Movement



Note. PA: Physical Activity

Appropriate Framing of Movement

Movement should not be framed as a reward or a punishment. Indeed, the NEDC (2024) recommends people be "*supported to experience movement and exercise in ways that promote their overall wellbeing, including their emotions, social connections, and physical and mental health*" (pp. 10). For example, if a patient is unable to meet their agreed-upon weight progression, the resulting changes in their levels of movement should not be framed as a "punishment." Conversely, following a nutritional plan or weight gain should not be "rewarded" with movement, nor should it be dangled as a "carrot" for patients to "earn." Indeed, doing so perpetuates unhelpful relationships with movement that can be long-lasting (Aasland et al., 2017; Rosenthal et al., 2010). Instead, clinicians, loved ones, peers and other support people should convey the message that movement is a normal part of life but that the frequency, intensity, time, and type of movement must be adjusted where possible based on each individual's physical and psychological safety and health status, among other factors. Consistent with sociocultural norms promoting weight stigma, diet culture and a "health ideal," people with an ED may frame movement as a requirement to earn or "reward" themselves with food, as a punishment for certain food choices, or other considerations such as coping, perfectionism, etc. Perpetuating these messages within treatment does not allow patients to develop a relationship with movement that is fulfilling and distinct from their nutritional consumption/weight/shape/size, nor does it facilitate mindful, intuitive movement that is engaged in response to their body's needs or wellbeing. The clinician's role in working with patients to engage in safe, modified movement offers a new perspective on exercise while aiming to attenuate previously held ideologies around movement and eating.

Lifelong Movement

Childhood and adolescent engagement in physical activity predicts adult physical activity participation and is crucial to long-term health (Landry & Driscoll, 2012). As such, ED treatment centers have a unique opportunity to help youth develop lifelong, fulfilling relationships with movement. Sociocultural messages about movement are pervasive. Youth encounter a wide range of messages from various sources, including social media, television, school health programs, gym classes, governing bodies (e.g., the American College of Sports Medicine, the Canadian Society of Exercise Physiology), parents, and peers (Cusumano & Thompson, 1997; Deighton-Smith & Bell, 2018). Navigating what constitutes an optimal relationship with movement is complex, particularly when compounded by the challenges of an ED.

Regarding maladaptive movement in youth, unfavorable comparisons to body image ideals, pressures to conform to societal standards, and body-related messages from significant others (such as peers and parents) often play a significant role (Reynolds et al., 2023). The SEES-Y guideline, therefore, focuses on fostering health-affirming relationships with movement by collaborating with each patient to develop individualized programs. These programs encourage movement that is enjoyable, attuned to the body's needs, and sustainable. Additionally, they provide education on health-promoting activities and tools to help youth critically navigate sociocultural messaging around movement.

Weight-Inclusive Approach

More than one in three adolescents presenting for treatment with a restrictive ED have a history of higher weight (i.e., >85%ile age and sex-adjusted BMI) (Lebow et al., 2015). Children and adolescents with a history of higher weight report significantly longer duration of illness and greater weight loss prior to seeking ED treatment, often despite exhibiting similar levels of medical risk and ED severity (Lebow et al., 2015). This may, in part, due to weight biases held by providers, delaying recognition of an ED and referrals for care, alongside internalized weight stigma in youth themselves underlying the common thought of not being 'sick enough' to necessitate treatment-seeking (Kramer et al., 2025; Silbiger, 2024). Existing guidelines for the management of ED for people in higher weight bodies recommend 1) Exercise interventions should focus on positive physical and mental health benefits of physical activity, not exercise for weight/shape change 2) Referral to an exercise professional with experience in working with people with higher weight where necessary and 3) Psychoeducation for family members regarding the impact of weight and eating-related talk, modeling body image acceptance (Ralph et al., 2022). We would additionally add 1) Acknowledgement of experiencing prior (and unfortunately probably future) provider recommendations to engage in exercise for weight loss and the harm that this can cause 2) Exercise spaces may not be 'safe' spaces for those in larger bodies (e.g., harmful weight-centric messages; Ashdown-Franks et al., 2021; McEntee et al., 2023; Thedinga et al., 2021).

Application of the Guideline

The SEES-Y guideline is a summary of current evidence and clinical practices for managing maladaptive movement during ED treatment. It is a tool to augment clinical judgment and aims to provide a standard of practice for movement recommendations. In creating this clinical tool, we will review evidence-based strategies to support the implementation of the SEES-Y guideline and recognise potential barriers in the application.

Facilitating SEES-Y Implementation

The following are encouraged strategies for supporting the implementation of the SEES-Y guideline when working with youth with an ED.

1. Involving Parental/Guardian Support

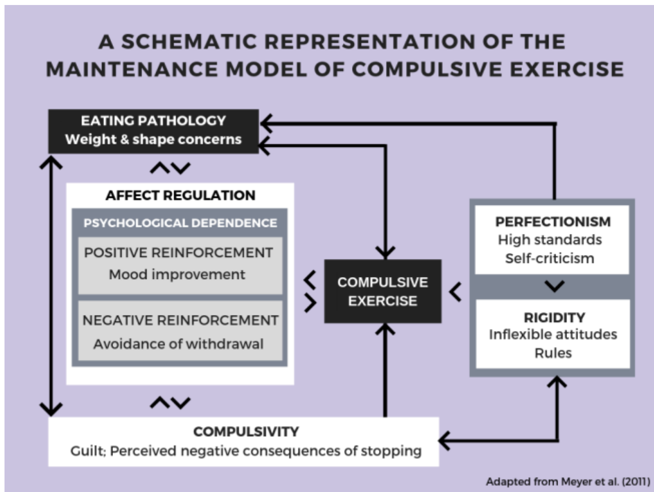
Family-based treatment (FBT) is the first-line approach for children/adolescents with an ED. FBT provides support to parents to enable them to return their child's weight to within their premorbid healthy weight range trajectory while also help normalizing eating behaviors during the first phase of treatment for youth with an ED (Datta et al., 2022; Rienecke & Le Grange, 2022). In line with this approach, parents/carers may be well equipped to manage maladaptive movement and return to exercise in youth. Indeed, youth undergoing FBT report significant reductions in compulsive exercise during and at the end of treatment (Datta et al., 2024). From an FBT standpoint, parents monitor exercise behaviour and determine the safe intensity, frequency, and type of movement when an adolescent is ready to return to exercise (Datta et al., 2024)

Additionally, youth are more likely to underreport or minimize symptoms of ED, including exercise (Couturier et al., 2006; Levallius et al., 2017; Vanzhula et al., 2024). Critically, there is poor reliability between parent and child reports of maladaptive movement (Mariano et al., 2013). Collecting information from multiple informants may be critical in gathering an accurate picture of a youth's ED and relationship with the movement.

2. Patient Awareness of Exercise Function

Conceptualising the role of movement within the ED is helpful for both the clinician aiming to address maladaptive movement and for the patient wishing to gain a further understanding of their relationship with exercise. Meyer and colleagues (2011) presented an evidence-based model that clinicians may find helpful in supporting the development of this conceptualization (Box 1). They postulate that eating pathology (including weight and shape concerns) is a core aspect in the development and maintenance of compulsive exercise; with compulsive exercise subsequently serving to reinforce eating pathology. The authors also build upon Fairburn's transdiagnostic theory of ED (Fairburn, Cooper, & Safran, 2003) and addiction models, highlighting the important role of exercise in not only managing negative affect but also increasing positive affect and possessing negative withdrawal symptoms (Meyer et al., 2011). Meyer and colleagues (2011) draw further similarities to obsessive-compulsive symptomatology, noting the reinforcing roles of perfectionism (including self-criticism), compulsivity (and fear/guilt of ceasing exercise) and rigidity. Recent research supports compulsive aspects of maladaptive movement as being more closely linked to ED psychopathology, in particular, exercising to manage negative affect and control weight (Scharmer et al., 2020).

Box 1. A schematic representation of the maintenance model of compulsive exercise.



A more recent model of maladaptive movement suggests combining positive and negative reinforcement of movement alongside the role of habit in maintaining movement in individuals with AN in particular (Coniglio, Cooper, & Selby, 2021). Although there is no one-size-fits-all model, aspects of any of these models may help patients understand how their relationship with movement develops and is maintained.

3. Behavioral Contracting

Cook et al. (2016) recommend developing a collaboratively written behavior contract may be useful in ED treatment. Contracts should be developed collaboratively with patients and other treatment team members, and it should be an ongoing, flexible process throughout treatment (Yeager, 1992; Cobbaert and Rose, 2023). They may include goals, outcomes, expectations, and contingencies related to movement engagement to facilitate transparency and clarity in treatment (Cook et al., 2016). Key components of behavioural contracting highlighted are collaboration, relevant goal setting, clear monitoring of exercise within the parameters of the guidelines and setting appropriate consequences. Efforts should be made to ensure that the contract increases collaboration, improves transparency and outlines clear expectations rather

4. Interdisciplinary Team

Collaboration from an interdisciplinary treatment team is a key component for recovery from an ED (NEDC, 2024; Wonderlich et al., 2012). Clinical ED guidelines recommend that the team should minimally include professionals administering medical, dietetic, and psychological interventions (Hay et al., 2014). Trained exercise professionals may also be helpful in the presence of maladaptive movement. Exercise professionals are often cited as key personnel in conducting group and individual exercise programs (Bergmeier et al., 2021; Danielsen et al., 2018; Vrabel & Bratland-Sanda, 2023). Studies suggest that exercise professionals working in the mental health field may be uniquely poised to identify contraindications/barriers to engaging in movement, conduct fitness/functional capacity assessments, provide exercise-related education, and develop or monitor the safety of exercise programs given patient limitations/co-occurring conditions (Bergmeier et al., 2021; Lederman et al., 2016; NEDC, 2016). Further, as part of the rehabilitative team, physical therapists can help assist with heightened fall risk (during ambulation and standing from lying or sitting) and, later, complement nutritional rehabilitation during the medical stabilisation process (Laging et al., 2017).

5. Motivational and Collaborative

A collaborative approach in treatment emphasizes patient autonomy, providing patients with options/choices and demonstrating empathy for patient wellbeing, irrespective of treatment compliance or adherence (Geller et al., 2023). The importance of a motivational/collaborative approach in ED treatment is recognised by both patients and clinicians alike (Geller et al., 2003). This approach is linked to lower dropout rates, reduced ambivalence toward change, and increased patient and clinician treatment acceptability (Geller et al., 2003). Geller and Srikameswaran (2006) recommend that a collaborative patient-practitioner relationship may help establish treatment non-negotiables and uphold the values of patient safety, autonomy, and respect. Clear therapeutic boundaries remain paramount in collaborative settings to ensure medical and psychiatric safety, efficient use of treatment resources, and a level of patient and clinician responsibilities (Geller et al., 2012). This collaborative approach differs from directive, prescriptive, or expert-type approaches, where clinicians may prescribe a specific exercise amount/type/frequency for their patients. See Geller & Srikameswaran (2006) for more details on developing non-negotiable treatment components.

Barriers to Implementing SEES-Y

We recognise several potential barriers to implementing the SEES-Y guideline as well as those related to exercise engagement during treatment for ED symptomatology.

1. Access to Specialist ED Teams

Geographic and financial factors are recognised as a barrier to treatment access. In particular, public healthcare systems may be limited by funding and resources, including specialised staff to facilitate movement interventions and program resources such as equipment and program development (Bergmeier et al., 2021; Quesnel et al., 2018). The credentials/background of training of exercise professionals are linked to patient opinions of movement interventions (Bakland et al., 2019).

2. Clinician Scope of Practice

The SEES-Y guideline is not intended to replace clinical training/education. Thus, its effective implementation is limited by each clinician's skills and knowledge. The SEES-Y guideline should only be used by trained medical and accredited exercise professionals with expert knowledge in the physiology of ED.

3. Professional Attitudes and Perceptions

Health professionals' attitudes and perceptions regarding including exercise during ED treatment are among the most prominent barriers to incorporating exercise in ED treatment (Quesnel et al., 2018; 2025). Hesitancy around incorporating exercise into ED treatment may stem from historical perceptions of exercise as a *"pathological calorie-wasting mechanism employed to limit energy reserves*" (Davis et al., 1998, pp.3). This notion has been perpetuated by an absence of clear guidance and fear of negative consequences resulting from the patient's engagement in movement during treatment. As Hallward and colleagues (2021) acknowledge, the initiative is no longer "if" movement should be incorporated into treatment for individuals with an ED but "how." The SEES-Y guideline aims to alleviate some of these historical tensions and help facilitate the process of formalising safe movement recommendations in ED treatment.

Historically, ED clinicians have inadvertently perpetuated the ED mentality that exercise net-burns calories and induces weight loss when declining permission for a patient to engage in movement. While, of course, extreme exercise along with inadequate energy intake can contribute to some weight loss, clear research has shown that activity in the absence of adequate nourishment will slow the basal metabolic rate (through the same physiologic changes seen in RED-S and in restrictive ED, such as bradycardia, intestinal dysmotility, and reduced perfusion of extremities) before it will cause weight loss (Pontzer et al., 2012). Although the laws of thermodynamics dictate that moving one's body takes energy, underfueled exercise will shunt energy intake toward the activity and reduce overall caloric requirements for essential bodily functions. Clinicians can advise patients to fuel their movement properly, or their metabolism will slow to protect them. Additionally, countless studies have affirmed that activity, on the whole, does *not* result in weight loss but rather that (properly fueled) those who improve their cardiorespiratory fitness and muscle strength derive meaningful health, function, and mortality benefits entirely independent of BMI.

Finally, the ED field has often overlooked the needs of those who are neurodiverse. As a result, it has often interpreted rocking, bouncing, or jiggling movements as pathological attempts to burn calories. While this can be the case, for those who are neurodiverse, such movements can be soothing and help with focus and comfort. Improving recognition and responsiveness to such needs will improve patient experiences and outcomes.

4. Resistance to Change

We recognise that movement in ED serves a function for many individuals. Proposing change can understandably contribute to resistance to the idea of reducing or modifying their movement engagement (Meyer et al., 2011). Developing collaborative patient-practitioner relationship (Geller et al., 2003) and psychoeducational interventions highlighted above (Calegoro & Pedrotty, 2004; Schlegel et al., 2015; Taranis et al., 2011) may help address resistance to change.

Instructions for Use

The SEES-Y guideline was developed to facilitate clinical decision-making related to safe movement for youth with ED symptomatology. This step-up/-down model involves two key components:

1. Risk assessment: Reviews key psychological and physical health markers requiring assessment to facilitate the incorporation of safe movement.
2. Movement recommendations: Describes movement levels related to the level of risk identified in the risk assessment.
3. Psychotherapeutic recommendation: Outlines adjunct psychotherapeutic interventions useful to facilitate safe movement engagement and remediation of one's relationship with movement.

This guideline does not replace clinical judgment but rather augments the ethical and clinical decision-making processes related to maladaptive movement. It is expected that clinicians review patients' medical and psychological progress in accordance with the guideline's risk levels regularly (i.e. weekly in Level A – highest risk, decreasing in relation to risk). We also recommend that psychological intervention occurs concurrent to exercise and nutrition interventions to best support patients. These should include addressing factors contributing to developing and maintaining maladaptive movement behaviours and building healthy coping strategies.

Importance of Safe Exercise at Every Stage

Graded exercise can be safely undertaken during ED treatment to achieve positive outcomes such as improved ED symptomatology, general psychological wellbeing, cardiac functioning and musculoskeletal health, and increased completion of meal plans and treatment. However, the exact movement recommendation for each patient will differ depending on their level of physical and mental health risk, as well as their individual preferences and recovery goals in relation to movement.

Using the SEES-Y guideline

This guideline was developed to support clinicians in making evidence-based decisions when determining safe movement with their patients. Movement sessions should be supervised in the initial stages, with increasing autonomy permitted as treatment and recovery progresses. Please note that supervision is not a requirement, nor is it always possible for a treatment team member to conduct it. As such, we recommend that a trusted family member or appropriate adult with knowledge of the individual's movement plan and limitations be present for these sessions. Regular medical and psychological reviews are required to decide whether the current exercise levels should be maintained, progressed, or reduced, depending on patient symptomatology and assessment results.

1. **Assessment:** Collect psychological and physical information (as pp. 43) to determine your patient's level of risk when engaging in movement. Always begin the assessment using the markers from the highest-risk category, Level A (as outlined on page 43). If no risk factors from Level A are identified, assess the measures in Level B, and so on. Note the risk category your patient falls within.

2. **Recommendations:** Once the level of risk has been identified (e.g. Level A), match with the corresponding movement and adjunctive recommendations on page 46. Please note that even once an individual progresses past Level A (highest risk), clinicians are still recommended to continue interventions from this level as they include important education and support regardless of health status. This continues to apply at Level D (lowest risk), whereby interventions from Level A, B and C should continue to be implemented.

3. **Step up/step down:** Individuals may step up (into the lower risk categories) and down (higher risk) on the guideline throughout treatment due to the non-linear nature of recovery. For this reason, reviewing patient progress/risk (e.g., weekly, monthly) is recommended at each level. Stepping up requires not only the clearance of all risk markers up to and including their current level but also requires individuals to adhere to treatment, consume adequate nutrition, and exhibit improvements in health status. Conversely, an individual will step down level/s if they exhibit any of the higher risk markers or if they are not able to engage with their treatment/meal plan as recommended, experience a return to maladaptive movement, or experience increases in ED behaviours/cognitions.

Intensity, Duration and Type of Movement

The SEES-Y guideline provides recommendations regarding the intensity, duration, and type of movement; however, it deliberately does not specify the frequency of movement sessions per week. The clinician, patient, and carers must collaboratively determine this to prioritise safety, minimize harm, and support life-enhancing treatment outcomes.

Movement is a positively indicated treatment component but is not compulsory, and boundaries are important to reduce the risk of returning to maladaptive movement. Clinicians should work with patients to help them listen to their body signals prior to, during and after movement sessions. This knowledge can then be incorporated into learning to match movement type, intensity, and amount to their energy levels, helping to support exercise autonomy and life-enhancing outcomes. Supervising professionals must be aware of each individual's limitations and any changes in energy and/or symptomatology to adjust movement accordingly. This includes incidental physical activity (such as walking to class, cleaning, playing, carrying groceries), occupational-related physical activity (e.g., working as a barista, lifeguard, or gardener), and motor restlessness, which the clinician must collaboratively discuss with their patient and consider in addition to recommended movement to determine an individual's total daily movement.

Limitations

This guideline does not replace clinical judgment by the treatment team. It was developed for the use of trained medical and exercise professionals with expert knowledge in the physiology of ED when working with the general youth population. Some groups of individuals may benefit from additional support and must be assessed by a medical team and, where accessible, an accredited exercise professional (see Glossary pp.67) before recommending an appropriate supervised movement and psychoeducation plan. Please note this does not preclude such groups from engaging in movement; however, we encourage adaptations to the SEES-Y guideline for these individuals to be conducted under the supervision of medical professionals with expertise specific to their individual requirements. These groups may include (but are not limited to) individuals living with diabetes, osteopenia/osteoporosis, or other existing cardiovascular/respiratory, metabolic, neurological, psychological or musculoskeletal complications. Please refer to the SEES-2 and SEES-Athlete guidelines for adults and athletes, respectively. Finally, whilst purging as a behaviour is not included in the literature as a contraindication to movement, we encourage practitioners to ensure a thorough and frequent assessment for individuals engaged in vomiting, laxative, or diuretic use and movement due to the compromising nature of these behaviours (see *Purging and Hypovolemia*).

Application Components

1. Assessment Form

There is no clear consensus on the best approaches to assessing or defining maladaptive movement (Gümmer et al., 2015). However, the SEES-Y guideline is complemented by an updated Assessment Form that can be used in conjunction with the SEES-Y guideline to help the treatment team determine return-to-activity plans collaboratively. The Assessment Form (see Appendix 1) offers a step-by-step guide to conducting a comprehensive assessment of an individual's movement history, goals, current movement, and risk levels. This form is intended to facilitate the comprehensive implementation of the SEES-Y guideline, including gathering the required information to use the guideline and develop individualized movement intervention.

Compulsive Exercise Test. There are many existing measures to assess maladaptive movement with varying conceptualizations (Harris et al., 2022; Lampe et al., 2024). Although all measures have pros and cons to their use, we elected to use the Compulsive Exercise Test (CET; Taranis et al., 2011) as it has been validated in youth ED populations (Harris et al., 2024; Sweene et al., 2018). Despite being a well-validated measure, there are shortcomings in relying solely on CET scores to understand an individual's relationship with movement and inform appropriate intervention. For example, the CET does not account for incidental physical activity or motor restlessness and does not consider how an individual's relationship with exercise may vary across bouts. Beyond this, in youth populations, there can be a lack of insight and display tendencies for secretive movement. Thus, we recommend using the CET alongside clinical information gathering via a semi-structured interview and discussion with parents/caregivers (Harris et al., 2022). As such, we have added a semi-structured interview to complement the CET in the assessment form.

The Youth Physical Activity Questionnaire (Kowalski et al., 2004) is a valid measure used to capture child and adolescent activity engagement through sport, school, and day-to-day activity. (Kowalski et al., 1997). Within the context of the SEES-Y, it has been used in the assessment form to effectively understand the types of movement youth patients engage in (see Appendix 1).

2. Activity Engagement

Engaging in movement during sessions may occur via individual or group programming (Danielsen et al., 2018; Vrabel & Bratland-Sanda, 2023). In vivo exercise may support patients to address their relationship with movement, such as rigid routines, inflexibility, and compulsivity, be an opportunity for introducing new movement modalities, and facilitate developing one's mind-body connection during exercise (Calogero & Pedrotty, 2007; Cook et al., 2016; Meyer et al., 2011). Debriefing involves practicing mindful awareness of sensations, emotions, and cognitions induced by exercise engagement (Calogero & Pedrotty, 2007; Cook et al., 2016). This may occur before, during, and after exercise sessions or as part of a homework task via an exercise log or journal. For further in-session activities, see Calogero and Pedrotty (2010) or Taranis et al. (2011).

3. Psychological Intervention

Youth with EDs need to practice (in vivo movement) and process (psychotherapeutic intervention) movement (Calogero & Pedrotty-Stump, 2010; Kern et al., 2020; Mathiesen et al., 2023). As such, SEES-Y has combined the psychotherapeutic components of published protocols to recommend steps for determining the psychological interventions that may be used as adjuncts to the movement recommendations. The following section describes how to determine the adjunct psychological interventions that could be recommended for patients managing their relationship with movement during ED treatment.

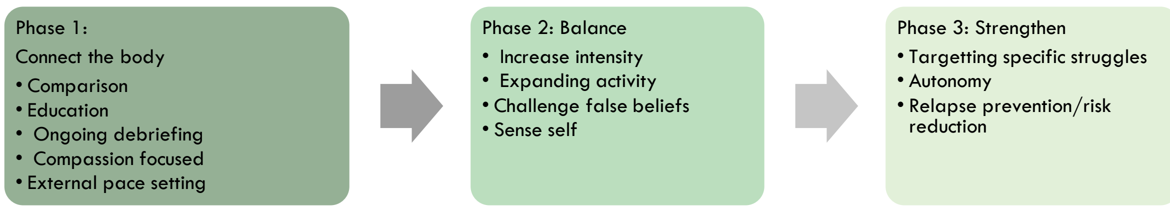
Assessment. The results of the CET and the semi-structured interview will offer the baseline information used to determine the "Phases of Return to Movement" and the "Psychological Interventions" that can be utilized with your patients.

Phases of Return to Movement. Calogero and Pedrotty (2004) describe three overarching phases of return to movement. Phase 1, "connection to the body," focuses on developing skills to foster awareness of the body and its needs during movement (Calogero & Pedrotty, 2004; Duesund & Skarderud, 2003). The goal of this phase is to manage physical and psychological risks as patients develop a process-oriented, rather than goal-oriented, relationship with movement that promotes life-enhancing outcomes such as enjoyment, mind-body connection, and rejuvenation. Similarly, compassion-forward intervention improves emotion regulation capacities (Vrabel & Bratland-Sanda, 20121). Activities in Phase 1 include psychoeducation about movement in EDs, reducing comparison to others, introducing debriefing, and promoting joyful and life-enhancing movement (Calogero & Pedrotty, 2004; Calogero & Pedrotty-Stump, 2007; Long, 1995; Long & Smith, 1990).

Phase 2 builds on Phase 1 to promote balance in movement. This phase supports patients in engaging in mindful movement by providing opportunities to observe their physiological and psychological cues related to exercise and use these internal signals to choose/adapt movement where possible (Calogero & Pedrotty, 2007). The range and intensity of movement can be expanded, e.g., by modifying the duration, intensity, modality, and environment of physical movement. During this phase, other interventions may include challenging false beliefs about movement, expanding an individual's repertoire of activities and environments, and trying new activities.

Phase 3 aims to foster independence and strengthen the individual's ability to implement learning in real-world settings. Independent selection of movement and engagement is gradually encouraged. Targeting patient-specific difficulties with return to movement is a core goal and developing a relapse prevention/risk reduction plan (Figure 2).

Figure 2. Phases of Return to Movement



These return-to-movement phases are loosely reflected in the psychological interventions' recommendation section of SEES-2. Although not strictly applied, they may inform return to movement and adjunct psychological interventions for youth.

Psychological strategies for managing maladaptive movement. Within the overarching "Phase of Return to Movement," specific psychological interventions can be implemented. Clinicians may use the CET to identify elevated scores in the following areas - lack of joy, rigidity, compulsivity, affect regulation, and weight and shape motivation and, subsequently, relevant targets for psychological interventions. Table 1 (below) outlines the interventions that can be incorporated within the three phases of returning to movement. The interventions described in Table 1 correspond to each of the CET subscales. These initiatives are depicted in the assessment form (see Appendix 1) and follow the subscales of the CET. Largely, the Phases of Return to Movement should guide the chosen psychological interventions and progress accordingly.

Table 1. Psychological Interventions

Rigidity	• Introduce flexibility into the routine • Distress tolerance • Behavioural experiments
Compulsivity	• Habit-based approaches • Increase awareness of movement • Urge surfing or exposure-responsive prevention
Affect regulation	• Expand coping skills (e.g., DBT, CBT, mindfulness) • Behaviour analysis
Weight and Shape Motivation	• Values-based intervention • Cognitive restructuring
Lack of Enjoyment	• Identify exercise goals • Foster joy in exercise

Note. Adapted from Martenstyn et al. 2022, interventions can cross subscale targets.

Increasing progression with meal plan

SEES-Y Table 1. Risk Assessment

Level A Review weekly	Level B Review Biweekly	Level C Review monthly	Level D Review as required
Cardiovascular profile: HR<50bpm or >100bpm Acute postural tachycardia >20bpm* Orthostatic hypotension >20mmHg systole (independent of symptoms) Systolic BP <90mmHg Prolonged QT/c interval >450msec Arrhythmias **Biochemical profile:** Hypokalemia Hypophosphatemia Hypomagnesemia Hypercarbia Hyponatremia Hypoglycaemia **Psychological profile:** *Higher score on CET indicates greater dysfunction* **Other:** Temperature <35°	*Individual has cleared all prior risk markers and is also adhering to:* **Individuals with AN:** Continue weight gain trajectory in line with treatment goals **Individuals who have weight-restored** Weight stabilisation/mobilisation in line with treatment goals **Recommended to assess BMD if:** (i) underweight for > 6mths (ii) amenorrhea for > 6mths (iii) low testosterone in males (iv) history of stress or fragility fractures **Psychological profile:** Stable or improved trajectory of CET scores and other relevant markers	*Individual has cleared all prior risk markers and is also adhering to:* Weight stabilisation or increasing trajectory if still required Level A markers related to ED are normalised as per medical Managing ED behaviours (e.g., self-induced vomiting, restriction/ bingeing, fear of becoming fat, & laxative use) Normalised sex hormones without exogenous replacement including oral contraceptive use (e.g., return to menses & normalized oestrogen for females; testosterone for males) **Psychological profile:** Positive trajectory of CET scores and other relevant markers	*Individual has cleared all prior risk markers and is also adhering to:* Weight progression >90% of target body weight (considering BMI z-score or percentiles, any stunting of linear growth & family characteristics) **Psychological profile:** Stable CET score and other relevant markers

* Many people continue to experience postural tachycardia beyond weight restoration and reduction of other symptoms, etc. Consider that postural tachycardia may be a benign persisting symptom when medical stability is otherwise present.

Symptom regression, treatment/meal plan non-adherence, return to maladaptive movement

Increasing progression with meal plan

SEES-Y Table 2. Movement Recommendations

	Level A	Level B	Level C	Level D
Movement goals	Staying safe, preventing injury, being kind to our body	Increasing social interactions, rebuilding balance/flexibility	Finding movement I enjoy and getting stronger	Building movement habits for life
Gym Class	No	No	Yes, considered part of movement plan	Yes, no longer considered part of movement plan
Sport	No	No	Yes, low impact sport (no game play or contact): golfing, baseball, rock climbing soccer, basketball, volleyball, hockey, dance etc.	Yes, return to all sport (including contact and games): rugby, football, martial arts, basketball, hockey, soccer, gymnastics etc.
Play/Leisure Activity	Sedentary play: board games, cards, video games, reading, puzzles, sewing etc.	Low intensity play without impact (social/games focus): table tennis, walking pets with family, swimming (playing in the water), throwing ball, bowling, free play interactive games etc.	Moderate intensity play: roller blading, ultimate frisbee, biking, dodgeball, freeze tag, Capture the flag, jump rope, tag, trampoline, hiking, free play (hoop, climbing, ladder), scootering, etc.	High intensity play: kickball, skiing/snowboarding etc.
Daily movement	Minimize movement at home and any school-related movement (e.g., stairs, carrying books)	Home and school-related movement is considered part of movement plan	Return to normal levels of daily activity (monitored)	Self-driven daily activity

Symptom regression, treatment/meal plan non-adherence, return to maladaptive movement

SEES-Y Table 2. Movement Recommendations

Exercise Components:	Level A	Level B	Level C	Level D
Intensity	Max Talk Test level: 2 METS: <3	Max Talk Test level: 5 METS: 3-5	Max Talk Test level: 8 METS: 6-8	Individualised
Duration	30min max	30min max	60min max (30min max cardio; 30min max resistance)	Individualised
Stretching	Static (without orthostatic compromise)	Dynamic warm up; static cool down		
Cardiovascular/ respiratory exercise	As above	Low intensity activity without impact (social/games focus): table tennis, walking pets with family, swimming (playing in the water), throwing ball, bowling, free play interactive games etc.	Moderate intensity activity with low impact permitted: rollerblading, biking, jump rope, dodgeball, freeze tag, tag, trampoline, free play (climbing, ladder), biking etc. Including low impact sport (no game play/contact): golfing, baseball, rock climbing, dance, soccer, basketball, volleyball, hockey, etc.	High impact, high intensity activities permitted; return to sport (e.g. rugby, football, martial arts, basketball, hockey); individualised; or may return to previously maladaptive exercise
Resistance exercise	As above	Social, functional body weight (e.g. circuit)	All resistance exercise (e.g. weightlifting, weights classes)	All resistance exercise; may return to previously maladaptive exercise
Setting	Indoor or outdoor			
Supervision	Medical supervision required	Medical OR parent/carer	Flexible (social partner encouraged where age appropriate)	Flexible, progressing to unsupervised (where age appropriate)
Incidental/Occupation Activity	Minimize movement at home and any school-related activity (e.g., stairs, carrying books)	Home and school-related movement is "counted" toward the activity plan	Return to normal levels of incidental activity (monitored)	Autonomous incidental activity
Psychological Intervention	**Principles of Phase 1** See suggestions in *Facilitating the implementation of SEES* Nutrition support Consider safe ambulation strategies & injury prevention in daily living tasks Tailor psychoeducation Identify unhealthy exercise beliefs	**Principles of Phase 1 and 2** Continue relevant interventions and: Further challenge unhealthy exercise beliefs Continue exploring & practicing attuned movement	**Principles of Phase 2 and 3** Continue relevant/outstanding interventions and: Option to increase exercise intensity in conjunction with body awareness Set future treatment-aligned exercise goals	**Principles of Phase 3** Complete outstanding interventions Address remaining aspects of exercise relationship Increase autonomy Develop future exercise plan in accordance with treatment plan & movement goals including focus on relapse prevention and support

Case example	Level A	Level B	Level C	Level D
<u>Maria 8y/o</u> Her parents note that she was always outside before her ED She played soccer and field hockey at school, typically playing sport/training ~ 3/week	**Planned movement:** Practice belly breaths with reach for the stars stretches (15 mins) three times per week	**Planned movement:** Take her dog for a casual walk (20mins) once per weekend Play frisbee and on playground with a friend once per weekend (30mins) Start back at school, no gym/exercise classes	**Planned movement:** Join in soccer training (30 mins) once per week Cycle with dad (30 minutes) once per week Start gym classes with no contact/high impact sport	**Planned movement:** Soccer training (45 minutes) once per week Soccer match (50 minutes) once per week Return to gym classes as usual
<u>Nikolai 12y/o</u> Enjoyed swimming but overall parents describe as a "bookish" child Stopped all exercise as part of the ED	**Planned movement:** Help laying the table daily	**Planned movement:** Ten-pin bowling with parents (30 mins) once per weekend Try paddleboarding (low intensity) with friends (30mins) once per weekend Start back at school, reduce walking between classes and school bag weight (e.g., books, clothes, food etc.)	**Planned movement:** Play beatsaber game with friend (30 mins) twice per week Play water polo with friends (30mins) once per week Return to normal school activities	**Planned movement:** Swim club training (45mins) twice per week
<u>Anya 17y/o</u> Disliked sports and physical activity prior to the ED. Throughout ED began doing online work out videos, sticking to rigid rules about exercise every day.	**Planned movement:** In-session practice mind-body connection during stretching (15mins) twice per week	**Planned movement:** In-session Pilates (30mins max) once per weekend Play table tennis with friends (15mins) once per weekend Start back at school, reduce walking between classes and school bag weight (e.g., books, clothes, food etc.)	**Planned movement:** Try dance class with friend (30 minutes) once per week Go rollerblading or ice skating with partner (30 minutes) once per week Return to normal school activities	**Planned movement:** Continue weekly dance class (1hr) once per week Pilates group class (45 minutes) once per week

Health Complications of Unmodified Movement with an Eating Disorder

The following section reviews *health complications* related to eating disorders, which may contraindicate or detrimentally impact unmodified movement engagement. In addition, SEES-Y Table 1. Risk Assessment (pp. 43/44) lists *signs and symptoms* that may contraindicate or impact activity engagement. Please note that this discussion is not exhaustive and does not cover exercise modifications/adaptations for comorbid conditions with existing guidelines (e.g., Type I diabetes, pregnancy).

Energy Availability

Low energy availability (LEA)

Optimal energy availability (OEA) is defined as adequate energy intake given an individual's typical metabolic functioning and level of activity. OEA is commonly estimated as at least 45 kilocalories (kcal) (188 kilojoules; kj) per kilogram (kg) of fat-free mass (FFM) per day (45kcal/kg of FFM/day) (Loucks, 2003; Loucks & Heath, 1994; Loucks & Thuma, 2003) for weight maintenance. It is critical to note that this amount may significantly increase for individuals who need to restore weight or when in a hypermetabolic state, as can be commonly seen in individuals with an ED. In youth, RED-S goes particularly unrecognized due to the lack of knowledge about the fuelling needs of this active and growing population (Gould et al., 2022). This intake provides the basic energy availability for the human body and its systems to thrive after subtracting the energy needed and used for regular activity and recovery. Increased energy demands due to physical activity will likely require more than this standard amount. Low energy availability (LEA) occurs when: 1) energy intake is insufficient to support vital bodily functions (after removing the energy cost of movement relative to metabolically active FFM) or 2) movement engagement increases without an adequate increase in energy to meet heightened energy output needs (Loucks et al., 2011). Importantly, LEA's numerous and detrimental effects can occur irrespective of an individual's body size, shape or weight or growth chart and do not solely occur in those with ED (Gaudiani, 2019; Gould et al., 2022).

Initially, LEA impacts the body's ability to engage in and recover from physical activity by hindering the adequacy of glycogen stores and protein synthesis (Tarnopolsky et al., 2001). If LEA persists, the body is forced to adapt and conserve energy wherever possible by no longer performing non-essential functions such as regular menses, hair growth, mood regulation, or executive thinking, as well as reducing cellular metabolism, weakening the potency of the immune system, and decreasing cardiovascular capacity (Mountjoy et al., 2018; 2023) This conservation process reduces both absolute and relative resting metabolic rates (RMR) to protect the unfavourable breakdown of FFM (metabolically active protein tissue including muscles, bones and organs; Woods et al., 2017). This RMR reduction can negatively impact health and performance outcomes (Mountjoy et al., 2018; 2023). If energy availability falls below optimal levels, metabolically active tissue can break down to provide the vital body systems with sufficient energy for survival, leading to even greater decreases in RMR (Mountjoy et al., 2018; 2023). Even the cardiac muscle may be used to produce this energy, with muscle mass and visceral adipose tissue also beginning to atrophy. Other negative consequences, such as psychological distress (Gaudiani, 2019), can also occur during this LEA state. For youth, the presentation of LEA are outlined in Box 2. Similar to adults, the consequences of LEA remain the same. However, there are increased long-term consequences of LEA in terms of bone health and fertility in both males and females (Gould et al., 2022).

Box 2. Common clinical presentation of RED-S in adolescent females

- Amenorrhoea* (primary/secondary; oligomenorrhoea)
- Musculoskeletal injury – bone stress injury/stress fracture; recurrent soft tissue injury
- Weight loss, changes in BMY centile or trajectory of height and/or weight gain
- Underperformance in sport
- Exercise-related symptoms (e.g., dizziness, palpitation, syncope – with normal specialist investigations)
- Fatigues, poor sleep
- Psychological – low mood, anxiety, stress, compulsive behaviours, disordered eating, pre-occupation with body image
- Gastrointestinal – constipation, diarrhea

Note. *females only adapted from Gould et al., 2022

Despite the serious consequences of LEA, there is not yet a standardised, reliable and valid assessment protocol for measuring energy availability (Mountjoy et al., 2018; 2023). Current measurement approaches require specialised equipment and expertise and are burdensome, requiring individuals to keep an excessively accurate food and movement log (Mountjoy et al., 2018). Adding to this complexity, activity output often changes during different training and/or competition phases (Mountjoy et al., 2018; 2023). Despite these measurement difficulties, LEA contributes to additional conditions described in subsequent sections of the article that may either contradict exercise, worsen performance, and/or endanger health. To mitigate these consequences and ensure healthful movement, individuals should increase their dietary intake and decrease the load of activity by modifying the intensity and duration of movement overall (Gould et al., 2022).

When LEA goes unaddressed, it can result in a starved state, which is distinctly different from LEA. Given the universality of diet culture, it is common for youth to use extreme measures such as starvation for weight and shape management (Daee et al., 2002; Neumark-Sztainer et al., 2013). When in a starved state, a loss of cardiac mass (particularly ventricular mass), along with glycogen depletion and bone mineral density, can cause a premature reduction in physical and physiological capacity. In youth, these consequences are further prominent in delayed linear growth, decreased muscle mass, and pubarche (Daee et al., 2002; El Ghoch et al., 2013). Consequences of severe starvation that merit immediate hospitalization are syncope, seizure, cardiac failure and pancreatitis, and thus contraindicate exercise (Golden et al., 2015). Engaging in activity in a starved state encourages circulatory lactate-producing widespread muscular pain (El Ghoch et al., 2013) and, with dehydration, may trigger muscular cramps due to a lack of sodium and potential magnesium. Individuals who are undernourished while engaging in movement programs may trigger loss of FFM (including cardiac mass), provoking a reduction in muscle strength and aerobic performance [lower maximal oxygen uptake (VO_2max), decreased work capacity] and EKG changes with exercise testing (El Ghoch et al., 2013). Beyond this, continued starvation can impede growth and development in youth (Golden et al., 2015). In youth, malnutrition related to starvation needs to be considered with the combination of historical growth curves to determine weight suppression, z-scores (Bone Mass section), and percent weight loss to classify the degree of malnutrition as BMI alone doesn't adequately indicate malnutrition in this population (Cooper et al., 2025; Mehta et al., 2013; Pediatrics, 2007; White et al., 2012). Starvation is not necessarily a direct contraindication for movement engagement; however, for those with an ED, exercise may be contraindicated on days when they have intentionally skipped a meal (Quesnel et al., 2020b). Additionally, continuous difficulty meeting one's nutritional plan may necessitate modifying movement due to the self-reinforcing cycle of restriction and activity (Giannini et al., 2016).

Purging

Purging is a compensatory behaviour (e.g., self-induced vomiting, laxative or diuretic abuse) to "get rid" of food or calories (American Psychiatric Association, 2013). All methods of purging detrimentally affect health and exercise performance and are associated with serious medical risks (Hornberger et al., 2021; Mehler & Anderson, 2017). Three mechanisms are described through which purging can influence exercise performance: 1) the generation of a negative caloric balance (through vomiting); 2) the facilitation of dehydration (vomiting and laxative use); and 3) the contribution to hypokalemia (vomiting and laxative use) (Mehler & Walsh, 2016). Purging (vomiting and laxative use) contributes to critical electrolyte disturbances and water loss, which are both exacerbated by exercise due to the natural loss of electrolytes and water in sweat (Hornberger et al., 2021; Lindsay, 2017; Mcardle et al., 2015; Mehler & Anderson, 2017). Purging may also lead to hypovolemia (decreased blood plasma volume), which can contraindicate exercise (Mehler & Anderson, 2017). Medical risk and complications differ across modes of purging and compensatory behaviors (e.g., exercise) and starvation; however, all compensatory behaviors may present specific risks to skeletal and reproductive development in youth (Hail & le Grange, 2018). This can be attributed to the concentration of acid and electrolytes in the relevant location and the impact of volume loss; for example, vomitus contains a high concentration of acid and potassium (Nilsson & Karlsen, 2020). We also observe differences in the mechanisms of action among common laxative classes, resulting in side effects ranging from bicarbonate resorption, expulsion of sodium, or potassium loss (Mascolo et al., 2011). These differences are observed in different rates of electrolyte imbalances across patients with ED, e.g., combined low BMI, laxative use, and vomiting yields the highest likelihood of developing hypokalemia, vomiting related to hypomagnesemia, and fasting or exercise relatively unrelated to potassium levels (Imbierowicz et al., 2004; Raj et al., 2012).

Cardiovascular Health

LEA contributes to many cardiovascular complications in youth with an ED, particularly with involved structural and functional cardiac abnormalities, aberration of heart rate and rhyme, and haemodynamic changes along with peripheral valve abnormalities (please see Friars et al., 2023 for detailed review), including arrhythmias, bradycardia, tachycardia, EKG abnormalities, and orthostatic vitals. Additionally, several cardiac risk markers, including mean R and T wave amplitude, may be abnormal in those with an ED (Friars et al., 2023; Green et al., 2016, 2019; Green et al., 2020). In youth with AN, cardiac complications are common and reflect the body's attempt to conserve energy to compensate for lower blood volume and poor nutrition (Friars et al., 2023). The following section provides an overview of the cardiovascular impacts of unmodified movement for individuals with an ED. In active adolescent and pediatric patients, training, sex, pubertal staging, and medication history are important considerations. During puberty, there are significant changes in cardiac size and function (Legaz-Arrese et al., 2017; Moodithaya & Avadhany, 2012; Pieles & Stuart, 2020). Puberty is a key time when underlying heart issues such as arrhythmia disorder or cardiomyopathies can emerge and inherited cardiac issues unveiled (Pieles & Stuart, 2020). Thus, it is particularly important to gain collateral information from parents about family's cardiac history and the patient past movement levels to assess the patient appropriately. Across heart conditions, cardiopulmonary exercise testing can be used as a core diagnostic tool to investigate respiratory, metabolic or cardiac pathology, especially if they do not recurve with improved nutrition (Pieles & Stuart, 2020).

Exercise testing can safely be administered to patients above the age of 8, and 12-lead ECG should be combined with cardiopulmonary tests to detect underlying arrhythmia (Pieles & Stuart, 2020). Anyone losing weight rapidly, medically compromised or engaging in purging behaviour should be assessed, particularly for QTc interval (Friars et al., 2023). This same test can also be used to detect stroke volume deficiency, ventricular dysfunction, cardiomyopathies or congenital heart diseases and should be administered prior to exercise engagement (Pieles & Stuart, 2020). Table 2 lists specific cardiac considerations for the youth athlete cardiac adaptations below.

Table 2. Cardiovascular Considerations of Youth and Athlete Hearts

Cardiovascular Changes in Child	Comparison with adult athletes	Comment
Resting heart rate falls	Resting heart rate remains higher than adult	Age-dependant, younger athletes have higher resting heart rates
Dilation of the left atrium	Similar pattern	Considerable variation between children in the same exercise group /across studies. Some demonstrate concentric hypertrophy, and others predominantly dilation. If LV above mm in diastole, consider pathology
Left ventricle dilates, mild LC hypertrophy	Less chamber dilation and more hypertrophies occur in adults	
Mild concentric hypertrophy with prolonged vigorous training	Eccentric hypertrophy tends to occur in adults with athletes' heart	
Increased LA relaxation, improved diastolic function	Similar patterns	Occurs in prepubertal and post-pubertal children
Raised Vo2 man in comparison to untrained	Lower Vo2 max relative to body size in comparison to adult athletes	Reflects lower maximal stroke volume and maturity-related increase in diastolic filling
Reduced vascular stiffness	Similar pattern	Acute effect known, but long-term effect not studied in children
No difference between the sexes	Females have higher resting heart rates, smaller cardiac chambers and less hypertrophy	Prepubertal changes are present but changes to adult patterns post-puberty

Note. Modified from Stuart & Pieles, 2019

Hypotension

In youth, hypotension is defined as low blood pressure (<90/45mmHg), where blood does not exert necessary pressure on the artery walls (American Heart Association, 2022b; Golden et al., 2015; Mehler & Anderson, 2017). Youth blood pressure is typically lower than that of adults due to their decreases in peripheral resistance. However, blood pressure should gradually increase as a child grows and will reach adult levels during adolescence. For pediatric populations, blood pressure is a less reliable marker of cardiovascular compromise as they have efficient compensatory mechanisms which allow them to remain in normal ranges until they have lost 25% of their intravascular volume (Friars et al., 2023). The hypotensive state is in response to increases in vagal tone and can also result from poor fluid intake, reduced elasticity of the blood vessels and dysregulation of the circadian rhythm (Friars et al., 2023; Katzman, 2005). Although often asymptomatic, hypotension coupled with pooling of the blood in the limbs can result in reduced cardiac output and slower heart rate, leading to pre-syncope or syncope (Friars et al., 2023). This pressure is required to supply vital organs with adequate oxygen and energy; thus, low blood pressure contributes to inadequate oxygen and nutrient availability, compromising vital organ functioning (Baker, 2017). Low blood pressure in youth with an ED may occur due to purging, insufficient food/fluid intake, resulting in circulating blood volume depletion (McCallum et al., 2006) or autonomic dysfunction related to disturbances in key hormones and/or other mechanisms regulated by the central nervous system (Oświecimska, 2007). Even mild cases of dehydration (1-2% of body weight) can cause an individual to become symptomatic (American Heart Association, 2022b). Lastly, hypotension can result from low electrolyte concentration, resulting in a low concentration gradient and subsequent loss of circulating blood volume (MacArdle, 2015).

Hypertension

Hypertension, also known as high blood pressure, is when the blood vessels experience persistently raised pressure against them (Hypertension Society of Canada, 202. It2). It is organized into three categories in youth above 13. Elevated blood pressure 120/<80 to 129/<80 mm Hg, Stage 1 hypertension 130/80 to 139/89 mm Hg and Stage 2 hypertension ≥140/90 mm Hg (Ashraf et al., 2023; Centers for Disease Control and Prevention, 2023). In patients under 18 years, a systolic reading below the 0.4th percentile of the appropriate age and sex-based reference range should be of concern (Friars et al., 2023). Over time, hypertension can damage arteries, prevent blood and oxygen supply to the brain, heart, and body, resulting in heart enlargement, and prevent kidneys from filtering blood effectively or arterial function (including the small vessels inside the eyes) (American Heart Association, 2022a). Patients with bulimia nervosa and binge eating disorder have higher rates of hypertension compared to other EDs (Olguin et al., 2016). Although activity can protect against the progression of hypertension and cardiovascular mortality risk, activity – particularly higher-intensity exercise- may require modification, medical supervision, or, at times, be contraindicated.

Additionally, rates of idiopathic intracranial hypertension in those with BED are also elevated (Raggi et al., 2017), which can lead to intracranial pressure and increased risk of stroke. When these individuals engage in youth, it may lead to headaches (Ruggeri-McKinley & McKinley, 2016). Despite this, contraindications to any type of exercise have not been proposed (Hypertension Society of Canada, 2022). However, the incidence of hypertension onset has been experienced by those who engage in high volumes of activity, which could be exacerbated by a lack of energy and nutrition (Sharman et al., 2015). Although exercise is often recommended for those with high blood pressure (130/80mmHg), individuals with very Stage 2 (140/90) may require pharmacological intervention and medical clearance prior to exercise.

Arrhythmias

Arrhythmias refer to any change from the normal sequence of electrical impulses within the heart, resulting in an abnormal heartbeat rhythm (American Heart Association, 2016). For an individual with an ED, arrhythmias may result from LEA (Spaulding-Barclay et al., 2016), malnutrition, and/or hypokalemia (Sachs et al., 2016). Arrhythmias occur when dietary intake is inadequate to support vital function and exercise engagement relative to metabolically active FFM (Mountjoy et al., 2018; 2024). Arrhythmias can present and persist, irrespective of weight status (Spaulding-Barclay et al., 2016). Symptoms of arrhythmia may include fatigue, weakness, dizziness, light-headedness, fainting or near fainting, rapid heartbeat, shortness of breath, anxiety, chest pain or pressure, and in extreme cases, collapse, syncope and cardiac arrest (American Heart Association, 2016). These symptoms may require close monitoring, including both EKG and Holter monitoring. The results of exercise testing by a professional can determine the safe duration, type, and intensity of exercise.

Bradycardia

Bradycardia is a low resting heart rate (moderate <60bmp, severe<50bpm/day or <45bpm/night) and is a subtype of arrhythmia (American Heart Association, 2021a). Bradycardia is often seen in AN and is one of the youth's most common cardiac abnormalities (Friars et al., 2023; Golden et al., 2015; McCallum et al., 2006). The specific physiological cause of bradycardia is unclear; however, hypothesized causes of bradycardia include increased parasympathetic tone and loss of cardiac mass (Kollai et al., 1994; Nagata et al., 2019), vagal hyperactivity (Nudel et al., 1984), and LEA (Spaulding-Barclay et al., 2016), in an effort to decrease strain on the heart by reducing cardiac output. Bradycardia can present and persist, irrespective of weight status (Spaulding-Barclay et al., 2016), and symptom severity is associated with greater frequency of exercise engagement and team sport engagement (Kollai et al., 1994; Nagata et al., 2019).

Gibbons and colleagues (2002) warn that sustained arrhythmia can interfere with cardiac output responses during exercise and that bradyarrhythmia (with the potential to become more complex or to impede hemodynamic stability) may contraindicate exercise (Gibbons et al., 2002). Fletcher et al. (2013) add that uncontrolled cardiac arrhythmias with hemodynamic compromise may contraindicate exercise engagement, particularly with their implication for sudden cardiac death. The American College of Sports Medicine (2018) recommends that any noticeable change in heart rhythm caused by palpitation or auscultation may contraindicate exercise. Likewise, McCallum et al. (2006) suggest individuals with bradycardia and purging should only engage in supervised exercise and only when nutritional intake and electrolyte and fluid levels are adequate, particularly when >80% of target body weight. Finally, Kolar & Gorrell (2021) highlight that extreme bradycardia (i.e., <50bpm) exercise is contraindicated.

Tachycardia

Tachycardia, a second subtype of arrhythmia, is a high resting heart rate of >90bpm (American Heart Association, 2021b). Youth heart rates are typically faster than adults (Friars et al., 2023). Children and adolescents are less able to alter cardiac contractility and rely more on HR to alter cardiac output in the demands of activity (Friars et al., 2023). Tachycardia in AN may indicate more severe autonomic nervous dysfunction than bradycardia and suggests a greater likelihood of poor long-term outcomes (Tokumura et al., 2012). Tachycardia comprises several subtypes, ranging from a natural stress response to abnormal, dangerous responses indicating a fault in the heart's electrical system (American Heart Association, 2021b). The latter may involve the heart beating faster than chambers can refill with blood, ultimately compromising vital blood flow to the rest of the body and potentially causing death (American Heart Association, 2021b). Tachycardia must be carefully investigated prior to any exercise engagement.

Postural Tachycardia

Orthostatic changes, as in postural tachycardia and orthostatic hypotension, represent the change between vital sign readings during the initial minutes of standing or upright tilt from the original lying position (McCallum et al., 2006; Raj, 2013). Postural tachycardia is when heart rate increase ≥30bpm (≥40 bpm in those aged 12-19 years old) persists for more than 30 seconds (Grubb, 2008; Grubb et al., 2005). A drop of 30-35bpm in youth aged 16 and under is of even greater concern. In a typical response to an upright posture change, the peripheral veins constrict, and an increase in heart contractility occurs (Grubb et al., 2008); however, when these changes do not occur, blood pools in the peripheral parts of the body, causing the heart to beat abnormally fast to return sufficient blood to the brain (Grubb et al., 2005; Katzman, 2005). This compensatory effort is crucial to ensure a constant oxygen supply to the brain (Grubb et al., 2005). Central nervous system symptoms, a complete loss of consciousness, or even sudden cardiac death can ultimately occur if too much blood remains pooled in the extremities, as the brain becomes starved of oxygen and nutrients (Grubb, 2008). Postural tachycardia may result from LEA (Gaudiani, 2018), autonomic nervous dysfunction (Jacob et al., 2000), weakness, postural dizziness (McCallum et al., 2006), decreased heart muscle mass (particularly the left ventricle), decreased stroke volume, decreased blood volume (Fu et al., 2010) and emotional stress (Sheldon et al., 2015). Postural tachycardia, which typically onsets in female youth (Friars et al., 2023), mimics the cardiac symptoms of Postural Orthostatic Tachycardia Syndrome. However, this syndrome should not be diagnosed in the presence of malnourishment (Gaudiani, 2018). While cardiac changes of malnourishment can present very similarly to those with Postural Orthostatic

Tachycardia Syndrome, such that making a diagnosis of POTS in someone with an active ED must be done cautiously, nonetheless, the two can definitively overlap, and concurrent treatment is often most beneficial. Typically, postural tachycardia resolves as weight and nutritional status improve (typically within 3 weeks of reaching 80% of the target body weight), suggesting that exercise may be gradually modified with symptom improvement (Katzman, 2005; McCallum et al., 2006).

Orthostatic Hypotension

Orthostatic hypotension is defined as a sustained drop in systolic blood pressure of ≥20mmHg or a diastolic pressure of ≥10 mmHg following orthostatic (postural) change and is the same requirement in youth as in adults (Freeman et al., 2011; Golden et al., 2015; Lanier et al., 2011). A sustained drop of 15 mmHg within 2 minutes of standing is of concern, and >= 20 mmHg would be indicated as high risk (Friars et al., 2023). A sustained drop in blood pressure means blood is not exerting sufficient pressure on artery walls, preventing the brain and other organs from receiving adequate oxygen and nutrients (Grubb et al., 2008). Orthostatic hypotension often presents similarly to postural tachycardia. However, the former only occurs in the presence of orthostatic stress, whereas the latter can be attributed to both orthostatic and emotional stress (Sheldon et al., 2015). In the absence of fatigue, activities such as riding a recumbent bike or doing other activities that do not provoke symptoms may be helpful to individuals with EDs, but only if they do not aggravate chronic fatigue (Gaudiani, 2019).

Prolonged QTc Interval

The QT interval denotes an important component of the heart's electrical activity on an electrocardiogram and represents part of the cardiac muscle's vital contraction and relaxation process (Garson, 1993). The QTc interval, more specifically, is a measure of the same time interval as the QT but has been corrected to account for the heart rate and is typically <0.44s in youth (Drew et al., 2010; Katzman, 2005). QTc will shorten with a faster heart rate and elongates with a slower heart rate (Friars et al., 2023). QTc intervals are generally longer in youth compared to adults, with QTc>460ms for females and >450ms for males under 18, which would be deemed as prolonged (Friars et al., 2023). QTc dispersion values of >100 should be considered a significant risk for cardiac morbidity and mortality and are common in youth in the acute phase of AN (Friars et al., 2023). As in adults, QTc prolongation can occur in youth during an ED but may also suggest independent and reversible causes such as low potassium (particularly important in influencing QTc prolongation), calcium, glucose, or magnesium, or the use of psychotropic medications (Friars et al., 2023; Golden et al., 2015; Krantz et al., 2012; Laitinen et al., 2008). A prolonged QTc interval can cause a life-threatening ventricular arrhythmia called torsade de pointes, ultimately resulting in ventricular fibrillation, preventing the heart from pumping vital blood to the body (American Heart Association, 2020). In EDs, QTtc abnormalities are particularly dangerous and can indicate risk for sudden death syndrome (Friars et al., 2023).

Structural and Functional Abnormalities

Pericardial effusion

Pericardial effusion, or the buildup of fluid in the saclike structure around the pericardium, can be present in up to 25% of individuals with AN and often goes undetected, also known as silent pericardial effusion (American Health Association, 2020; Friars et al., 2023). They result from a low BMI and reduce triiodothyronine (T3) levels. In AN, myocardial wasting and loss of pericardial fat result in a separation of the pericardial layers, predisposing patients. Although they generally resolve with nutritional rehabilitation, exercise is contraindicated if pericardial effusion is present (Kolar & Gorrell, 2021). The pulsus paradox, or a drop in BP>10mmHG with inspiration, suggests patients are at risk of complication pericardial effusion and medical investigation is needed via echocardiography (Friars et al., 2023).

Structural cardiac changes

Common left ventricular mass reduction is higher in those with AN, though studies suggest that its onset is not directly related to low body weight (Friars et al., 2023). Instead, cardiac atrophy may result from inactivity and endocrine changes. Functionally, this adaptation manifests through impaired diastolic filling and reduced cardiac output. Thus, the volume of blood expelled from the ventricles with each systole is lowered. These changes often resolve with nutrition improvement (Friars et al., 2023)

Electrolyte Abnormalities

Electrolytes

Electrolytes, or electrically charged particles or ions, are key regulators of the exchange of fluids, nutrients and waste products inside the body (Mcardle et al., 2015). Electrolytes are lost in sweat during activity and are negatively affected by purging behaviors, even at subclinical levels (Lindsay, 2017; Mehler, 2001; Mehler & Anderson, 2017). Common electrolytes affected in EDs are potassium, sodium and bicarbonate, with common symptoms including dizziness, weakness, fatigue, constipation, muscle pain, abnormal skin sensations and depression (Mehler & Anderson, 2017). Electrolyte imbalances often underlie cardiac abnormalities (Voderholzer et al., 2020) and can result in rhabdomyolysis (the breakdown of muscle from strenuous exercise) and sudden death (Mehler & Anderson, 2017).

Hypokalemia

Hypokalemia is one of the most common electrolyte imbalances in youth with ED, defined as low serum potassium (Normal range in 1 to 16 years is 3.5 to 5 mEq/L and low potassium considered <3.2 mEq/L, severe <2.5mEq/L, Campbell & Peebles, 2014; Peebles et al., 2017). Potassium is a key electrolyte involved in normal cellular function, particularly in producing muscle work and nerves (Stone et al., 2016). Hypokalemia commonly presents in youth with an ED engaging in purging behavior (BN or AN-P) and is prevalent in approximately 14% of those aged 13 – 30 with an ED (Hundemer et al., 2022). Hypokalemia can also be triggered by malnutrition or the weight restoration process (Funayama et al., 2021). Symptoms of hypokalemia may include muscle weakness, cramping, abnormal skin sensations, constipation, heart palpitations, fatigue, respiratory difficulty, and paralysis (American Heart Association, 2005; Mehler & Anderson, 2017). Severe hypokalemia (<2.5mmol/L) can cause rhabdomyolysis, significant cardiac arrhythmias, and sudden death (Mehler & Anderson, 2017; Peebles et al., 2017). EKG changes due to hypokalemia can include “flat or inverted T waves, ST segment depression, and prominent U waves, which can exceed the amplitude of the T waves” (Mehler & Anderson, 2017). In studies, recovered potassium has been considered a safe outcome and seen to recover in less than 4 weeks with adequate nutrition (Peebles et al., 2017). A consideration for exercise engagement is that in youth, sweat contains proportionally more potassium than in adult counterparts (12 mEq/L vs 5.5 mEq/L), highlighting the importance of rehydration, electrolytes replacement and considerations of movement in hot weather for youth (Armstrong, 2007).

Hypophosphatemia

Hypophosphatemia occurs mainly in AN and is defined as low serum phosphate, often resulting from malnutrition, chronic diarrhea, or overuse of diuretics or alcohol (Agency for Clinical Innovation, 2017; Voderholzer et al., 2020). Phosphates are particularly important in refeeding syndrome (Katzman, 2005). Healthy values of phosphate in youth include 12 to 15 years, 2.9 to 5.4 mg/dL, 16 to 19 years 2.7 to 4.7 mg/dL, where low phosphate is considered <2.7 to 3.0 mg/dL (American Heart Association Emergency Cardiovascular Care Committee, 2005; Peebles et al., 2017) In a sample of male youth with EDs, about 23% were found to have low phosphate (Coelho et al., 2018). Phosphate is a core component of the energy (adenosine triphosphate) used to produce muscular work (Armstrong, 2007; MacArdle, 2015). Symptoms of low phosphate include muscle dysfunction and weakness, demineralization of bone, loss of calcium, abnormal blood oxygen levels, and irregular heartbeats (Agency for Clinical Innovation, 2017; Armstrong, 2007). Hypophosphatemia may also induce a state of confusion and delirium, anemia, increased severity of infections, rhabdomyolysis, coma, and even death (Agency for Clinical Innovation, 2017). Given the core role of phosphates in energy production, an individual experiencing these symptoms may warrant modified exercise engagement.

Hypomagnesemia

Hypomagnesemia, or low serum levels of magnesium, can result from diarrhea, diuretic use, hormone dysfunction, alcohol intake and some medications (American Heart Association, 2005). Magnesium is largely responsible for protein synthesis in the body (MacArdle, 2015). Thus, low magnesium can lead to failures in growth muscle tremors or spasms and fasciculations, tetany, vertigo, eye problems, altered mental state, respiratory compromise, cardiac arrhythmias, ataxia, seizures, dysphagia, hormone and electrolyte disturbances, and sudden cardiac death (American Heart Association, 2005; MacArdle, 2015). Low magnesium is considered to be <1.5mg/dL with adequate ranges, including 1.5 to 2.5 mEq/L for youth (American Heart Association Emergency Cardiovascular Care Committee, 2005). In youth with EDs, 5- 9% encountered low magnesium prior to treatment (Coelho et al., 2018; Hundemer et al., 2022). During exercise, magnesium is redistributed throughout the body to meet metabolic needs. Magnesium deficiency impairs exercise abilities and amplifies the negative consequences of strenuous exercise (Nielsen & Lukaski, 2006). Intense exercise can increase sweat and urine production, increasing the need for magnesium by 10-20% (Nielsen & Lukaski, 2006). However, less magnesium is lost in sweat during exercise in youth than in adults (Armstrong, 2007). That said, if an individual continues to engage in high-intensity exercise during an ED, these cascades may be amplified, and thus, greater supplementation or dietary increase of magnesium-rich foods may be required to hinder the negative impacts of hypomagnesemia.

Metabolic alkalosis/acidosis

The body contains a buffer system that regulates the acidity of the blood and thus aims to maintain intracellular homeostasis, which can be impacted by the body's undertaking physical work (MacArdle, 2015). Like other electrolyte disturbances, metabolic alkalosis or acidosis can occur due to purging or the use of potassium-sparing diuretics (relating to chronic diarrhea) (Gaudiani, 2019; Mascolo et al., 2011). Hypercarbia, also known as metabolic alkalosis, is a common clinical imbalance in people with ED and is defined as serum bicarbonate of >30mmol/L or higher (Hundemer et al., 2022; Mehler & Anderson, 2017). Metabolic alkalosis is often asymptomatic; however, extreme cases may result in short and shallow breathing and respiratory complications (Mehler & Anderson, 2017). Metabolic alkalosis resulting from purging and diuretic use should not be confused with the positive impacts of short-term, high-intensity exercise (MacArdle, 2015). Indicators of abnormal respiration, such as shortness of breath and signs of poor perfusion, including light-headedness, cyanosis, confusion, nausea, ataxia, pallor or cold and clammy skin (American College of Sports Medicine, 2018) may contraindicate exercise engagement.

Similarly, metabolic acidosis occurs when serum bicarbonate is < 22mml/L and may also develop with greater propensity in those who abuse laxatives, including spironolactone, amiloride, and triamterene (Campbell & Peebles, 2014; Hundemer et al., 2022; Mascolo et al., 2011). Increasing acidosis due to lactate build can interfere with muscle contraction mechanisms and give way to pain and cramping during long-term activity, even in youth (Armstrong, 2007). In a populational study including youth with EDs, metabolic alkalosis and acidosis were higher than their non-ED counterparts (Hundemer et al., 2022).

Hyponatremia

Hyponatremia, low serum sodium concentration, may present with low blood volume status (a state where the body is left with lower than required salt and water levels). In blood planes, this is measured as a ratio of sodium to blood volume (Gaudiani, 2019). In youth, sodium concentration across age groups should be between 136 to 145 mEq/L (American Heart Association Emergency Cardiovascular Care Committee, 2005), where low serious sodium would be <135 mEq/L and <125 mEq/L is considered severe (MacArdle, 2015). Low sodium concentrations were found in 1.5% of adolescent males with EDs (Coelho et al., 2018). Sodium is responsible for the body's acid-base balance, body water balance and nerve functioning (MacArdle, 2015). Hyponatremia may occur due to purging or excessive sweating and is one of the most common electrolyte imbalances in both AN and BN (Mehler & Anderson, 2017). Hyponatremia may also result from malnutrition (i.e., kidneys cannot excrete excess water into the urine, so excess water remains in the body), or it can present as a result of excessive water intake (Armstrong, 2007; Gaudiani, 2018; Mehler & Anderson, 2017). Symptoms of hyponatremia include nausea, confusion, headaches, vomiting, delirium, impaired consciousness, seizures, and, in some cases, cardiorespiratory arrest (Henry, 2015). The main risk factors for these occurrences in the context of exercise are prolonged intense exercise in hot weather if an individual is exercising and following a "low sodium" diet, the use of diuretics, and the intake of large amounts of fluid during exercise (MacArdle, 2015). If these risk factors are present, it is important to introduce salt into the individual's routine. If symptoms arise, modified exercise may be warranted.

Biomedical Function Markers

Temperature: Hypothermia and Hyperthermia

Hypothermia can occur as a direct result of malnutrition and hypoglycemia and has been noted in about 25% of youth (age 11) at admission (Hudson et al., 2012; Nishita et al., 1985), yet it can also persist beyond weight restoration (Luck & Wakeling, 1982). In children specifically, there is an increased risk of hypothermia due to the large surface area relative to the body mass, and thus, a decrease in adipose tissue can increase the risk of bradycardia, cardiac instability, and arrest (Armstrong, 2007; Friars et al., 2023). The onset of hypothermia is related to decreased psychological and cardiac functioning, muscle rigidity, unconsciousness and death, and consequently, may warrant exercise modification (Luck & Wakeling, 1982).

In youth populations, there are significant differences in thermoregulation capacities due to differences in blood flow, lower overall cardiac output and sweat patterns (Armstrong, 2007). Hyperthermia can result from failed thermoregulation, which is more likely in younger patients (Armstrong, 2007), whereby the body produces or absorbs more heat than it can dispel through sweat. A serious medical complication of hyperthermia is heat cramps and fainting, which can proceed to heat stroke, which occurs due to excessive metabolic heat from intense exercise, excessive environmental heat, high humidity, some medications, and severe reactions to drugs (Armstrong, 2007; Mcardle et al., 2015). Exercising in a hyperthermic state, especially if heat stroke presents, is a medical emergency as it can result in organ damage and, ultimately, mortality; thus, exercise in this state is contraindicated. If exercising in an environment with a higher risk of hyperthermia, (see Armstrong 2007, pp. 262 for complete considerations).

Blood Urea Nitrogen and Urine Specific Gravity

Urine Specific Gravity is the ratio of urine density to water density. Blood Urea Nitrogen (BUN) indicates liver function and protein metabolism impacts this ratio; thus, together, these measures indicate bodily functioning, which may indicate diabetes, renal abnormalities, or overhydration, while high urine specific gravity can suggest adrenal, liver, heart or dehydration issues in individuals who are excessively sweating, vomiting, or who have diarrhea (Schumann & Schweitzer, 1996). In youth, USG is normal in the range of 1.005 – 1.030, and BUN should fall between 7 and 18 mg/dL (American Heart Association Emergency Cardiovascular Care Committee, 2005; Gaudiani, 2019). Some have recommended the consideration of creatine kinase (Cr; a marker of protein digestion; 10-14year; 0.31 to 0.88 mg/dL, >14 years; 0.5 to 1.06 mg/dL) in conjunction with BUN to help determine kidney functioning (American Heart Association Emergency Cardiovascular Care Committee, 2005; Gaudiani, 2019). If an individual's Cr is double their age group, it can be estimated that their liver function has fallen by 50% (Gaudiani, 2019). Exercise does not directly affect USG. However, both exercise and ED can impact hydration levels and kidney and adrenal function, which are reflected in USG and BUN levels (Schumann & Schweitzer, 1996). A negative balance in BUN indicates protein breakdown, which is harmful when it arises from muscle catabolism. Subsequently, it is recommended individuals only engage in strength training once a negative nitrogen balance is reversed, accompanied by consistent weight gain (McCallum et al., 2006). In sport contexts, 1.025 has been used as a marker in youth to indicate adequate hydration for sport engagement.

Transaminase

Transaminase, specifically alanine aminotransferase (1 to 19 years/ 5 to 45 units/L) and aspartate aminotransferase (10 to 15 years/ 10 to 40 units/L; 16 to 19 years: male 15 to 45 units/L, females: 5 to 30 units/L) are enzymes released into the bloodstream when the liver is damaged due to low weight, refeeding, alcohol intake, infection of the liver, or as a side effect of some medications (American Academy of Family Physicians & Hustead, 1970; Gaudiani, 2019; Hanachi et al., 2013; Voderholzer et al., 2020). Like adults, youth can also have high levels of these enzymes, with studies highlighting rates of 25- 37% prevalence upon admission for AN, typically due to starvation, and 4% upon nutritional resumption due to the process of nutrition, although this did occur in the absence of hypophosphatemia and thus refeeding syndrome (Coelho et al., 2018; Nagata et al., 2015). Adolescent boys may encounter high levels of these enzymes more frequently during an ED than girls (Nagata et al., 2015). A significant cause of elevated transaminase in youth is hepatic hypoperfusion secondary to acetaminophen or iron overdose (Smith et al., 2013). For youth with an AN, two pathophysiological causes have been proposed, including ischemia and hepatocyte autophagy (Smith et al., 2013). Other reasons have been proposed, such as hypophosphatemia, dehydration, excess glucose administration with the use of total nutrition, excessive exposure to proinflammatory cytokines such as tumour necrosis factor and interleukin-6, and excess free fatty acid exposure as seen in type 2 diabetes mellitus (Smith et al., 2013). Liver dysfunction has been shown to relate to the severity of cardiac atrophy, dysfunction and glycogen depletion (Nagata et al., 2015). Indeed, high levels of transaminase may result from the breakdown of bodily tissue (such as the liver) during severe low weight (BMI <12) before refeeding (Hanachi et al., 2013; Smith et al., 2013) and can indicate vital organ failure, specifically the heart (de Caprio et al., 2006).

Lastly, the use of anabolic steroids, ephedra and other muscle-building products has been shown to elevate further aminotransferase, which may also relate to the higher prevalence seen in men or individuals whose movement goal is to gain muscle (Kim & Wu, 2020). Exercise has been shown to improve levels of aminotransferases in youth with fatty liver diseases (González-Ruiz et al., 2017). During exercise, the liver is the main source of blood glucose maintenance. Thus, a significant increase in the rate of amino acid catabolism occurs, placing higher functional demands on the already compromised liver (Henriksson, 1991; McArdle, 2015). Exercising with elevated transaminase levels (most often seen in AN) may cause additional harm, and exercise should be modified accordingly and contraindicated if cardiac dysfunction is present. However, bodybuilding and higher-intensity activity have been noted further to increase aminotransferase levels in the absence of liver damage. Instead, this can be related to normal muscle reconstruction during strenuous movement (Kim & Wu, 2020). To prevent aminotransferase elevations during reintroductions to movement, particularly for those previously inactive, there is a need for gradual increase in intensity (Kim & Wu, 2020).

Hypoglycaemia/Hyperglycaemia

Hypoglycaemia is a state of low blood glucose and occurs commonly in individuals with AN (Rich et al., 1990; Voderholzer et al., 2020). Children's blood glucose levels should be between 60 to 100 mg/dL and 70 to 105 mg/dL in older youth (American Heart Association Emergency Cardiovascular Care Committee, 2005).

Hypoglycemia can trigger a breakdown of fat mass and FFM (i.e., muscle, bone, organs, etc.) in an attempt to provide the brain with vital energy (Gaudiani, 2018). Exercising while hypoglycaemic harms energy delivery to the organs, including the brain and working muscles (Mcardle et al., 2015). Exercise can also worsen hypoglycemia and its effects due to the high metabolic demand for glucose as energy during exercise (Mcardle et al., 2015). In younger children, the liver and related glycogen stores are smaller than in adults, placing them at an even greater risk of hypoglycemia (Armstrong, 2007). The exacerbation of hypoglycemia through exercise can result in coma and death due to hepatic failure and the consecutive impairment in the process needed to increase glucose availability gluconeogenesis (Brun et al., 2001; Riedlinger et al., 2020).

Individuals with BED may be at increased risk of hyperglycemia or elevated blood glucose (Canadian Diabetic Association, 2022). Exercise engagement, especially high-intensity or anaerobic exercise, can exacerbate hyperglycemia, increase the risk of ketosis, or cause insulin dysregulation (Lumb, 2014). Indications for managing movement recommendations based on glucose levels in individuals with diabetes (Type 1 and 2) are available (Lumb, 2014). However, there is a lack of research examining hyperglycemia in individuals with ED. That said, in adolescent populations, BED has been noted in up to 6% of the population with Type 2 diabetes. In Type 1 diabetes, a trend in adolescents and young females is the intentional omission of insulin with the goal of weight loss, which can be particularly dangerous (Pinhas-Hamiel & Levy-Shraga, 2013).

Dehydration (Hypohydration)

At baseline, dehydration is common (34%) in youth without an ED (Hudson et al., 2012). Moderate exercise engagement over one hour can produce a sweat loss of 0.5–1L (Mcardle et al., 2015). Individuals who experience >10% dehydration demonstrate a higher risk of developing tachypnoea or tachycardia, while those with 5-10% dehydration are at risk of developing peripheral edema (Baksh, 2017). Being severely dehydrated, either due to purging, diuretic/laxative use or an inability to rehydrate, contraindicates exercise as it may contribute to the exacerbation of electrolyte abnormalities, increased risk of heat illness, and negatively affect blood volume and exercise capacity (el Ghoch et al., 2013; Gaudiani, 2019; Mehler & Anderson, 2017). Mountjoy et al. (2014) note that dehydration-induced hemodynamic instability can contraindicate any sports engagement.

Sex Hormones

The following section relates to conditions of hormonal imbalances in EDs. The most effective method of preventing or reversing abnormal hormonal profiles is to increase energy availability via either reducing exercise expenditure and/or increasing energy intake (Melin et al., 2015). Adolescent females require greater energy availability than non-adolescent females to be able to continue normal menstrual function (Gordon et al., 2017).

Amenorrhea

When an ED onsets during childhood or adolescence, delay of menarche, interruption of pubertal maturation and menstrual cycle can occur (Vyver et al., 2008). Amenorrhea is the absence of a menstrual cycle for more than 90 days (NATTIV & A, 2007). Functional hypothalamic amenorrhea (FHA), a subtype of amenorrhea, results from metabolic stress, including LEA or psychological distress (Berga & Loucks, 2006). Importantly, FHA can occur in the absence of weight loss (Gordon et al., 2017). Normal menstrual function may return with 6–12 months of weight stabilization; however, longer durations of amenorrhea may take longer to reverse (Gordon et al., 2017). Girls with BED are also at elevated risk for both amenorrhea and oligomenorrhea, even when controlling for the occurrence of polycystic ovary syndrome (Ålgars et al., 2014). Engaging in unmodified exercise while amenorrhoeic may detrimentally impact bone health and fertility (Mcardle et al., 2015; Warren & Perlroth, 2001). Overall, it seems that malnutrition is combined with weight loss in youth. Exercise will increase the risk of amenorrhea occurring sooner and for a longer period of time (Vyver et al., 2008).

High-impact exercise, such as jumping or running, without return to normalised sex hormones or resumption of menses, is contraindicated due to effects on long-term bone health (Scheid et al., 2011; Zanker & Swaine, 2007). Failing to modify exercise while amenorrhoeic may worsen existing hormonal and energy disruptions, further contributing to menstrual dysfunction and its' consequences (Gordon et al., 2017).

Female Sex Hormones

Inadequate sex hormone concentrations, such as growth hormone-releasing hormone, luteinizing hormone, oestrogen and follicle-stimulating hormone, amongst others, can cause menstrual dysfunction, poor bone health, stunting of pubertal growth, infertility, and suboptimal muscular performance (Berga & Loucks, 2006; Culbert et al., 2016; Gordon et al., 2017; Kandemir et al., 2018; Silveira, 2002). Increasing energy availability and consistent weight gain can rapidly improve metabolic hormone profiles; however, exercise engagement must proceed cautiously while normalizing hormone profiles (Mountjoy et al., 2014).

Male Sex Hormones

Sex hormones in boys can be negatively affected in ED due to starvation-induced central hypothalamic hypogonadism (Culbert et al., 2016; Mehler & Brown, 2015). Decreased concentrations of sex hormones, including testosterone, luteinizing hormone, follicle-stimulating hormone, and gonadotrophin-releasing hormone, as well as abnormal luteinizing pulsatility, can impair reproductive function, decrease immunity, and impact bone health (Mehler & Brown, 2015; Mountjoy et al., 2014). Similar to girls, boys with abnormal sex hormone profiles require increased energy availability and accompanying weight gain to normalize concentrations, and exercise engagement must occur cautiously to prevent further damage to bone, the stunting of pubertal growth, infertility, and suboptimal muscular performance (Mountjoy et al., 2014).

Body Composition

Body Mass Index

Body mass index (BMI) is a measure of body mass as a ratio of body weight to body height (kg/m^2). In youth, BMI trajectories are impacted by EDs can impact lifelong trends (Yilmaz et al., 2019). In youth, having a high BMI is linked to ED onset and implicates exercise as a means by which to impact weight (Zou et al., 2022). BMI cannot solely or accurately depict health status; indeed, some individual's weight is not affected at any stage of an ED despite the presence of severe illness, reflecting the need to evaluate the medical and psychological parameters of an individual's health for a more accurate understanding (Gaudiani, 2018). However, BMI is still often used to help assess medical status in youth with an ED, and a BMI <75% of median values for age, sex, and height is suggested to indicate hospitalization (Geller et al., 2012). Engaging in intense endurance or strength training exercises with a low BMI may be contraindicated due to health and performance consequences from energy deficiency (e.g., increased risk of pericardial effusion and other effects of LEA; (Gaudiani, 2018; Mountjoy et al., 2018). Engaging in high-impact movement with a low BMI (Howgate et al., 2013) is suggested to be avoided due to LEA's detrimental and widespread effects.

Appropriate exercise engagement may also be determined via a progression of weight recovery considering an individual's premorbid weight history (Calogero & Pedrotty, 2004; Cook et al., 2016; Noetel et al., 2017). For example, a 5–10% weight loss in one month may contraindicate a return to sport (Mountjoy et al., 2014). Another suitable marker of body composition is a prolonged low body fat percentage [measured by dual-energy X-ray absorptiometry (DEXA) or, less accurately, anthropometry]. McCallum et al. also propose that before engaging in regular endurance or other rigorous training, an individual should restore to at least 90% of their target body weight (McCallum et al., 2006). Children have low muscle mass and less absolute power during exercise (Kappenstein et al., 2013).

Low Bone Mineral Density

Bone mineral density (BMD) is the amount of mineral density, particularly calcium and phosphorous, present in a volume of bone. Low BMD occurs when chronic LEA triggers a physiological adaptation within the bone to conserve energy for the vital organ systems (Table 3; De Souza, 2019). Bone adaptations in the presence of chronic LEA include reduced oestrogen concentration, which is also involved in disrupting or eliminating reproductive function to conserve energy and suppressing some metabolic hormones (De Souza, 2019). Hormonal changes resulting from LEA can cause the uncoupling of bone turnover, whereby low levels of oestrogen permit increased bone resorption and, combined with the changes in metabolic hormones, cause decreased bone formation (De Souza, 2019). BMD and bone mineral geometry may be compromised most when accompanied by a low BMI, late menarche, or when amenorrhea persists for several years (Mallinson et al., 2016). Although regular exercise engagement typically encourages bone growth (Mallinson et al., 2016), during a state of hypoestrogenism, exercise negates the usual positive effects of weight-bearing exercise (Kandemir et al., 2018).

Table 3. Office ISCD Interpretation of DEXA Findings

Scores. Children & Adolescents	Clinical Presentation	Interpretation
Z-score greater than –2.0	No recurrent fractures	Within the expected range for age
Z-score less than –2.0	No recurrent fractures	Below the expected range for age
Z-score less than –2.0	Vertebral compression fracture Or two long bone fractures by age 10 Or 3+ long bone fractures by age 19	Osteoporosis

Note. Adapted from Gaudiani, 2019 and Lewiecki et al., 2008

Girls acquire 90% of peak bone mass by age 18, and boys do so at the age of 20 (Gaudiani, 2019). Once bone breakdown occurs, it may take months to years to recover following the resumption of adequate energy availability and recovered menses; however, in some cases, it may never fully recover (De Souza, 2019; Warren et al., 2002). Consequences of poor bone health can include pain and disability, stress fractures and breaks, and permanent rounding of the upper back due to micro fractures (kyphosis). They may require the use of a walker aid or pain medications, which can cause dependency and constipation, amongst other negative sequelae (Gaudiani, 2019). LEA prior to puberty may be particularly damaging to bone, as it may directly stunt vital bone growth and important sexual development that contributes to bone growth (Schneider & Wade, 2021). Recovery from bone growth delays can be challenging, and interruptions to bone accrual during adolescence and early adulthood can lead to osteoporosis and stress fractures (Mallinson et al., 2016).

BMD can fully recover in adolescent girls with EDs, although data continues to be conflicted (Carruthe & Skinner 2000; Thornton & Gordon, 2018). Predictive factors of long-term BMD outcomes go beyond weight gain. However, there seems to be inconsistent data about the impact of exercise on BMD in the active phases of the ED. It may be the case that while patients show normal BMD at sites such as the femur, it may be reduced at the spine, complicating measurement landscapes (Baker et al., 2000; Thorton & Gordon, 2018). Howgate and colleagues recommend high impact movement may be contraindicated until a BMI of 16kg/m^2 is reached to prevent compromise to bone health (Howgate et al., 2013). Furthermore, unmodified exercise in the presence of LEA, amenorrhea, and low BMD increases one's risk of bone stress injury and stress fractures (Barrack et al., 2014; Mountjoy et al., 2014). Miller and colleagues (2006) found that the greatest increases in lumbar spine and hip bone density can occur with a simultaneous improvement in weight of >85% of ideal body weight and/or by 10% of body weight and through the resumption of menses (having had at least one menses in the past three months) (Miller et al., 2006). Indeed, fracture is the greatest risk of low BMD (Gaudiani, 2019). Thus, safe exercise needs to be considered of this fact. A yoga intervention lasting 24 weeks improved axial BMD compared to no yoga in youth (13-18; Adi et al., 2023). Similarly, 20 jumps twice daily were incorporated into adolescent ED treatment and found no detrimental effect on vital signs, serum N-telopeptide, bone-specific alkaline phosphatase, osteocalcin, or impede weight recovery (Marin et al., 2017). As such, low-impact movement can be safe in the presence of low BMD. Importantly, if low BMD presents in the absence of low BMI, malnutrition, LEA, or sex hormone disturbances, strength training can improve low BMD (Baker et al., 2000; Watson et al., 2019).

Superior Mesenteric Artery Syndrome

Superior mesenteric artery (SMA) syndrome is caused by the compression of the duodenum due to a diminished fat pad from weight loss that would usually separate the aorta and superior mesenteric artery (Mehler & Brown, 2015). Symptoms of SMA syndrome can include upper quadrant abdominal pain soon after eating, early satiety, nausea, and vomiting (Mehler & Brown, 2015). SMA is most commonly found in children or individuals with a low BMI and can resolve with weight gain (Arthurs et al., 2012; Shetty et al., 1999). However, as SMA syndrome occurs in severely underweight individuals, it may be prudent to modify exercise during this time.

Peripheral Edema

Peripheral edema is the retention of fluid, most commonly in one's extremities, and is particularly prominent in individuals with AN (Derman & Kılıç, 2009). Exercise can increase edema, which may already be aggravated during refeeding due to renal filtration of insulin or due to high levels of carbohydrate consumption (Beumont et al., 1994). Thus, exercise may be contraindicated in peripheral edema (Beumont et al., 1994). Edema can also occur for individuals who have stopped purging due to Pseudo-Batter Syndrome, which can last several weeks until the body remains hydrated and, for youth, has been found particularly distressing (Gaudiani, 2019; Hornberger & Lane, 2021). Having this syndrome can put an individual at increased risk during exercise due to the continuation of dispelling of potassium despite the body retaining water. Thus, recommendations presented in the hypokalemia section should be followed.

Glossary of Terms

Anorexia Nervosa (AN): Anorexia nervosa is a psychiatric disorder characterised by persistent restriction of energy intake leading to body weight that is significantly below expected body weight. These symptoms comprise restricted food intake with or without behaviours of bingeing, purging and compensation. These factors are coupled with an intense fear of gaining weight/becoming fat, distorted weight/shape perception, undue influence of weight/shape on self-evaluation, lack of recognition of the seriousness of their illness, or behaviors interfering with weight gain. Subtypes of AN include restrictive and binge-eating and/or purging subtype (American Psychiatry Association, 2013).

Binge Eating Disorder (BED): Binge eating disorder is a recent addition to the *DSM-5* as an eating and feeding disorder. It is characterized by recurrent episodes of eating significantly more in a discrete period of time (typically less than two hours) than most people would under similar circumstances, with these episodes being marked by a sense of a lack of control. During these episodes, individuals may eat alone, too rapidly, until overly full, or overeat when not physically hungry; while afterward, they may feel guilty, disgusted, embarrassed and/or distressed (American Psychiatric Association, 2013). BED is differentiated from BN (below) by an absence of compensatory/purging behaviours.

Body Image: Body image is a multifaceted construct comprising an individual's cognitive, affective and perceptual experience of one's body (Cash & Pruzinsky, 2002). Disordered body image arises when cognitions and emotions associated with an individual's body image perception and satisfaction begin to detrimentally affect their self-worth or body esteem, or result in clinical distress and dysfunctional behaviours (Barlett, Harris, Smith, & Bonds-Raacke, 2005).

Body Mass Index (BMI): A statistical measure of weight according to height. The calculation for BMI is kilograms/metre^2 (McArdle et al., 2010).

Bulimia Nervosa (BN): Bulimia nervosa is a psychiatric disorder characterised by frequent episodes of binge eating (as with BED above) in conjunction with inappropriate compensation methods, such as self-induced vomiting, excessive exercising, fasting, or misuse of laxatives or diuretics to avoid weight gain. Self-evaluation is unduly influenced by weight/shape (American Psychiatric Association, 2013).

Clinician: A clinician is defined as a person (such as a doctor or nurse) who works directly with patients rather than in a laboratory or as a researcher (Marriam-Webster, 2016).

Disordered Eating: This term encompasses eating behaviours that are maladaptive, such as restrictive dieting, bingeing, dietary restraint, rumination, among others. Individuals may engage in these behaviours less frequently or may experience less impairment/dysfunction related to these behaviours than is required to meet full threshold for an eating disorder diagnosis (Canadian Mental Health Association, 2015).

Exercise: Planned, structured, repetitive and purposeful physical activity (McArdle et al., 2010).

Exercise Prescription: A specific plan of fitness related activities designed by a fitness or rehabilitation specialist (American College of Sport Medicine, 2010).

Exercise Professional/Specialist: A professional who has received a tertiary degree in Exercise Physiology, Kinesiology (in Canada) or Human Kinetics with a focus on exercise physiology and/or promoting physical activity and exercise behaviours.

Health Professional: For the purpose of this guideline, this broad range category will encompass clinicians and researchers who hold a minimum of a Bachelors' degree recognising certification in health service provision. This may include but is not limited to, medical practitioners, psychiatrists, nurses, psychologists, exercise physiologists, physiotherapists or occupational therapists.

Incidental Physical Activity: Any unstructured or unplanned physical activity that occurs as part of daily living activities, such as walking to work, taking the stairs instead of the elevator, or doing household chores. This type of activity is often accumulated throughout the day and may not be performed specifically for exercise or fitness purposes (Hurd and Anderson, 2010).

Interdisciplinary Team: This refers to a group of professionals from a range of disciplines who are working collaboratively in support of an individual. While this may include any health professional, clinical guidelines for eating disorders recommend that this team should minimally include professionals administering medical, psychological and dietetic interventions (Hay et al., 2014).

Leisure Physical Activity: physical activity undertaken during one's leisure time or free time, primarily for enjoyment, recreation, relaxation, or personal fulfillment rather than for work or necessity (Dishman et al., 2021).

Lived Experience: In phenomenological research, lived experience is a person’s perspective of a situation that was acquired through their first-hand account of a situation (Creswell, 2007).

Medical Professional: A medical professional is defined as an individual with a graduate degree and license to practice medicine. Their aim is to promote, protect health while, diagnosing and treating illness with specialized and scientific knowledge.

Movement: the change in position of an individual or a body part, typically involving the contraction and relaxation of muscles and the coordination of various body systems to achieve a specific action or task. It encompasses various forms of physical activity, ranging from everyday activities such as walking and climbing stairs to structured exercise programs designed to improve fitness and health outcomes (American College of Sports Medicine, 1991).

Occupational Physical Activity: physical activity associated with one's job or occupation. This includes any bodily movement or muscular exertion required to perform work-related tasks (Donnelly et al., 1996).

One Repetition Maximum: The maximal amount that can be lifted in one complete repetition with proper technique (Canadian Society of Exercise Physiology, 2006).

Physical Activity: Any bodily movement produced by skeletal muscles that results in energy expenditure (McCardle et al., 2010).

Quality of Life: Encompasses multi-dimensional aspects of one’s life including; physical and material well being, social well being, emotional well being and development and activity (Felce & Perry, 1995).

Resistance training: This refers to the combination of many consecutive resistance exercise sessions over time. Resistance exercise involves muscular work that causes the muscle to use force against an external resistance (ACSM, 2013).

Youth: Individuals from aged 8-18 years old.

References

Aasland, E., Walseth, K., & Engelsrud, G. (2017). The changing value of vigorous activity and the paradox of utilising exercise as punishment in physical education. *Physical Education and Sport Pedagogy, 22*(5), 518–530. 10.1080/17408989.2016.1276964

Accurso, E. C., Sim, L., Muhlheim, L., & Lebow, J. (2020). Parents know best: Caregiver perspectives on eating disorder recovery. *International Journal of Eating Disorders, 53*(8), 1252–1260. 10.1002/eat.23236

Agency for Clinical Innovation. (2017). *Phosphate – Hypophosphatemia*.

Agne, A., Quesnel, D. A., Larumbe-Zabala, E., Olmedillas, H., Graell-Berna, M., Pérez-Ruiz, M., & Fernandez-del-Valle, M. (2022). Progressive resistance exercise as complementary therapy improves quality of life and body composition in anorexia nervosa: A randomized controlled trial. *Complementary Therapies in Clinical Practice*, *48*, 101576. 10.1016/J.CTCP.2022.101576

Ålgars, M., Huang, L., von Holle, A. F., Peat, C. M., Thornton, L. M., Lichtenstein, P., & Bulik, C. M. (2014). Binge eating and menstrual dysfunction. *Journal of Psychosomatic Research*, *76*(1), 19–22. 10.1016/J.JPSYCHORES.2013.11.011

Allen, K. L., Crosby, R. D., Oddy, W. H., & Byrne, S. M. (2013). Eating disorder symptom trajectories in adolescence: Effects of time, participant sex, and early adolescent depressive symptoms. *Journal of Eating Disorders, 1*, 1–14. 10.1186/2050-2974-1-14

American Academy of Family Physicians., R. C., & Hustead, T. R. (1970). American family physician. In *American Family Physician* (Vol. 84, Issue 9). American Academy of Family Physicians. https://www.aafp.org/afp/2011/1101/p1003.html

American College of Sport Medicine. (2018). *ACSM's guidelines for exercise testing and prescription* (10th ed.). Wolters Kluwer Health.

American Heart Association. (2005). Part 10.1: Life-Threatening Electrolyte Abnormalities. *Circulation* , *112*, IV121–IV125. 10.1161/CIRCULATIONAHA.105.166563

American Heart Association. (2016). *About arrhythmia*. Retrieved from https://www.heart.org

American Heart Association. (2021a). *Bradycardia: Slow heart rate*. Retrieved from https://www.heart.org

American Heart Association. (2021b). *Tachycardia: Fast heart rate*. Retrieved from https://www.heart.org

American Heart Association. (2022a). *Health Threats from High Blood Pressure | American Heart Association*. https://www.heart.org/en/health-topics/high-blood-pressure/health-threats-from-high-blood-pressure

American Heart Association. (2022b). *Low Blood Pressure – When Blood Pressure Is Too Low*. Retrieved from https://www.heart.org

American Heart Association Emergency Cardiovascular Care Committee. (2005). Reference values for children. *Circulation, 112*(24), 120–167.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.).

Arundell, L., Fletcher, E., Salmon, J., Veitch, J., & Hinkley, T. (2016). A systematic review of the prevalence of sedentary behavior during the after-school period among children aged 5–18 years. *International Journal of Behavioral Nutrition and Physical Activity, 13*, 1–9. 10.1186/s12966-016-0419-1

Armstrong, N. (2007). *Paediatric exercise physiology.* Elsevier Health Sciences.

Arthurs, O. J., Mehta, U., & Set, P. A. K. (2012). Nutcracker and SMA syndromes: What is the normal SMA angle in children? *European Journal of Radiology*, *81*(8), e854–e861. 10.1016/j.ejrad.2012.04.010

Artero, E. G., España-Romero, V., Castro-Piñero, J., Ortega, F. B., Suni, J., Castillo-Garzón, M. J., & Ruiz, J. R. (2011). Reliability of field-based fitness tests in youth. *International Journal of Sports Medicine, 32*(3), 159–169. 10.1055/s-0030-1268488

Ashdown-Franks, G., Meadows, A., & Pila, E. (2021). "Negative things that kids should never have to hear": Exploring women's histories of weight stigma in physical activity. *Journal of Sport and Exercise Psychology*, 44(1), 1-13. 10.1123/jsep.2021-0139

Ashraf, M., Irshad, M., & Parry, N. A. (2020). Pediatric hypertension: An updated review. *Clinical Hypertension, 26*, 1–6. 10.1186/s40885-020-00146-0

Austin, S. B., Ziyadeh, N. J., Vohra, S., Forman, S., Gordon, C. M., Prokop, L. A., Keliher, A., & Jacobs, D. (2008). Irregular Menses Linked to Vomiting in a Nonclinical Sample: Findings from the National Eating Disorders Screening Program in High Schools. *Journal of Adolescent Health*, *42*(5), 450–457. 10.1016/J.JADOHEALTH.2007.11.139

Baker, L. B. (2017). Sweating Rate and Sweat Sodium Concentration in Athletes: A Review of Methodology and Intra/Interindividual Variability. *Sports Medicine (Auckland, N.Z.)*, *47*(Suppl 1), 111–128. 10.1007/s40279-017-0691-5

Baksh, G. (2017). *Refeeding Guideline May 2018*. https://ashfordstpeters.net/Guidelines_Paediatrics/Refeeding%20Guideline%20May%202018.pdf

Barker, J. L., Stults-Kolehmainen, M., Tierney, A., & Peterson, C. B. (2024). Industrial athletes, relative energy deficit in occupation, and equitable eating disorder treatment and recovery. *International Journal of Eating Disorders*, *57*(1), 62–69. 10.1002/EAT.24093

Barrack, M. T., Gibbs, J. C., De Souza, M. J., Williams, N. I., Nichols, J. F., Rauh, M. J., & Nattiv, A. (2014). Higher Incidence of Bone Stress Injuries With Increasing Female Athlete Triad-Related Risk Factors A Prospective Multisite Study of Exercising Girls and Women. *Journals.Sagepub.Com*, *42*(4), 949–958. 10.1177/0363546513520295

Baker, L. B. (2017). Sweating rate and sweat sodium concentration in athletes: A review of methodology and intra/interindividual variability. *Sports Medicine, 47*(Suppl 1), 111–128. 10.1007/s40279-017-0691-5

Berends, T., Boonstra, N., & Van Elburg, A. (2018). Relapse in anorexia nervosa: A systematic review and meta-analysis. In *Current Opinion in Psychiatry* (Vol. 31, Issue 6, pp. 445–455). Lippincott Williams and Wilkins. 10.1097/YCO.0000000000000453

Berga, S. L., & Loucks, T. L. (2006). Use of cognitive behavior therapy for functional hypothalamic amenorrhea. *Annals of the New York Academy of Sciences*, *1092*, 114–129. 10.1196/annals.1365.010

Bergmeier, H. J., Morris, H., Mundell, N., & Skouteris, H. (2021). What role can accredited exercise physiologists play in the treatment of eating disorders? A descriptive study. *Eating Disorders*, *29*(6), 561–579. 10.1080/10640266.2019.1701351

Berkman, N. D., Lohr, K. N., & Bulik, C. M. (2007). Outcomes of eating disorders: A systematic review of the literature. *International Journal of Eating Disorders*, *40*(4), 293–309. 10.1002/EAT.20369

Beumont, P. J. V., Arthur, B., Russell, J. D., & Touyz, S. W. (1994). Excessive physical activity in dieting disorder patients: Proposals for a supervised exercise program. *International Journal of Eating Disorders*, *15*(1), 21–36. 10.1002/1098-108X(199401)15:1<21::AID-EAT2260150104>3.0.CO;2-K

Birgegård, A., Monell, E., Borg, S., Bulik, C. M., & Mantilla, E. F. (2024). Maladaptive exercise in eating disorders: lifetime and current impact on mental health and treatment seeking.

Borden, A., & Cook-Cottone, C. (2020). Yoga and eating disorder prevention and treatment: A comprehensive review and meta-analysis. *Eating Disorders*, *28*(4), 400–437. 10.1080/10640266.2020.1798172

Borden, A., & Cook-Cottone, C. (2022). Yoga and eating disorder prevention and treatment: a comprehensive review and meta-analysis. *Yoga for Positive Embodiment in Eating Disorder Prevention and Treatment*, 97–134. 10.4324/9781003201731-8

Bratland-Sanda, S., Martinsen, E. W., & Sundgot-Borgen, J. (2012). Changes in Physical Fitness, Bone Mineral Density and Body Composition During Inpatient Treatment of Underweight and Normal Weight Females with Longstanding Eating Disorders. *International Journal of Environmental Research and Public Health 2012, Vol. 9, Pages 315-330*, *9*(1), 315–330. 10.3390/IJERPH9010315

Bratland-Sanda, S., Schmidt, S. K., Reinboth, M. S., & Vrabel, K. A. (2022). Under pressure to exercise: A cross-sectional study of characteristics and predictors of compulsive exercise in early adolescents. *Journal of Eating Disorders, 10*(1), 156. 10.1186/s40337-022-00639-4

Brun, J. F., Dumortier, M., Fedou, C., & Mercier, J. (2001). EXERCISE HYPOGLYCEMIA IN NONDIABETIC SUBJECTS. *Diabetes Metabolism*, *27*, 92–106. http://jeanfrederic.brun.free.fr/hypo_exercise.pdf

Calogero, R. M., & Pedrotty, K. N. (2004). Eating Disorders The Practice and Process of Healthy Exercise: An Investigation of the Treatment of Exercise Abuse in Women with Eating Disorders. *Taylor & Francis*, *12*(4), 273–291. 10.1080/10640260490521352

Campbell, K., & Peebles, R. (2014). Eating disorders in children and adolescents: State of the art review. In *Pediatrics* (Vol. 134, Issue 3, pp. 582–592). American Academy of Pediatrics. 10.1542/peds.2014-0194

Canadian Diabetic Association. (2022). About diabetes. https://diabetes.ca/

Carruth, B. R., & Skinner, J. D. (2000). Bone mineral status in adolescent girls: effects of eating disorders and exercise. Journal of Adolescent Health, 26(5), 322-329.

Chubbs-Payne, A., Lee, J., Isserlin, L., Norris, M. L., Spettigue, W., Spence, K., & Longmuir, P. E. (2021). Attitudes toward physical activity as a treatment component for adolescents with anorexia nervosa: An exploratory qualitative study of patient perceptions. *International Journal of Eating Disorders, 54*(3), 336–345. 10.1002/eat.23445

Coatsworth, J. D., & Conroy, D. E. (2007). Youth sport as a component of organized afterschool programs. New directions for youth development, 2007(115), 57-74

Coelho, J. S., Lee, T., Karnabi, P., Burns, A., Marshall, S., Geller, J., & Lam, P. Y. (2018). Eating disorders in biological males: Clinical presentation and consideration of sex differences in a pediatric sample. *Journal of Eating Disorders*, *6*(1), 1–12. 10.1186/S40337-018-0226-Y/TABLES/4

Coelho, J. S., Suen, J., Marshall, S., Burns, A., Geller, J., & Lam, P. Y. (2021). Gender differences in symptom presentation and treatment outcome in children and youths with eating disorders. *Journal of Eating Disorders, 9*, 1–13. 10.1186/s40337-021-00392-2

Cook, B., Hausenblas, H., Tuccitto, D., & Giacobbi, P. R. (2011). Eating disorders and exercise: A structural equation modelling analysis of a conceptual model. *European Eating Disorders Review*, *19*(3), 216–225. 10.1002/erv.1111

Cook, B., & Leininger, L. (2017). The ethics of exercise in eating disorders: Can an ethical principles approach guide the next generation of research and clinical practice? *Journal of Sport and Health Science*, *6*(3), 295–298.10.1016/j.jshs.2017.03.004

Cook, B., Wonderlich, S. A., Mitchell, J., Thompson, R., Sherman, R., & McCallum, K. (2016). Exercise in eating disorders treatment: systematic review and proposal of guidelines. *Medicine & Science in Sports & Exercise, 48*(7), 1408–1414. 10.1249/MSS.0000000000000912

Couturier, J. L., & Lock, J. (2006). Denial and minimization in adolescents with anorexia nervosa. *International Journal of Eating Disorders, 39*, 212–216. 10.1002/eat.20241

Crone, C., Fochtmann, L. J., Attia, E., Boland, R., Escobar, J., Fornari, V., Golden, N., Guarda, A., Jackson-Triche, M., Manzo, L., Mascolo, M., Pierce, K., Riddle, M., Seritan, A., Uniacke, B., Zucker, N., Yager, J., Craig, T. J., Hong, S. H., & Medicus, J. (2023). The American Psychiatric Association practice guideline for the treatment of patients with eating disorders. *American Journal of Psychiatry, 180*(2), 167–171. 10.1176/appi.ajp.23180001

Culbert, K. M., Racine, S. E., & Klump, K. L. (2016). Hormonal factors and disturbances in eating disorders. *Current Psychiatry Reports, 18*, 1–16. 10.1007/s11920-016-0701-6

Cusumano, D. L., & Thompson, J. K. (1997). Body image and body shape ideals in magazines: Exposure, awareness, and internalization. *Sex roles*, *37*, 701-721.

Daee, A., Robinson, P., Lawson, M., Turpin, J. A., Gregory, B., & Tobias, J. D. (2002). Psychologic and physiologic effects of dieting in adolescents. (Review Article). *Southern Medical Journal*, *95*(9), 1032–1042. https://go.gale.com/ps/i.do?id=GALE%7CA92683171&sid=googleScholar&v=2.1&it=r&linkaccess=abs&issn=00384348&p=AONE&sw=w&userGroupName=anon%7E96fdd73b

Dalle Grave, R., Calugi, S., & Marchesini, G. (2008). Compulsive exercise to control shape or weight in eating disorders: Prevalence, associated features, and treatment outcome. *Comprehensive Psychiatry, 49*(4), 346–352. 10.1016/j.comppsych.2007.12.001

Dalle Grave, R., Sartirana, M., Sermattei, S., & Calugi, S. (2021). Treatment of eating disorders in adults versus adolescents: Similarities and differences. *Clinical Therapeutics, 43*(1), 70–84. 10.1016/j.clinthera.2020.11.007

Datta, N., Matheson, B. E., Citron, K., Van Wye, E. M., & Lock, J. D. (2022). Evidence Based Update on Psychosocial Treatments for Eating Disorders in Children and

Adolescents. Journal of Clinical Child & Adolescent Psychology, 52(2), 159–170. 10.1080/15374416.2022.2109650

Datta, N., Matheson, B., Plessow, F., Citron, K., Le Grange, D., Schlegl, S., & Lock, J. (2024). The impact of family-based treatment for adolescent anorexia nervosa on compulsive exercise attitudes and behaviors. *International Journal of Eating Disorders.* 10.1002/eat.24273

Davis, C., Kennedy, S. H., Ravelski, E., & Dionne, M. (1994). The Role of Physical Activity in the Development and Maintenance of Eating Disorders. *Psychological Medicine*, *24*(4), 957–967. 10.1017/S0033291700029044

de Caprio, C., Alfano, A., Senatore, I., Zarrella, L., Pasanisi, F., & Contaldo, F. (2006). Severe acute liver damage in anorexia nervosa: two case reports. *Nutrition*, *22*(5), 572–575. 10.1016/J.NUT.2006.01.003

Deighton-Smith, N., & Bell, B. T. (2018). Objectifying fitness: A content and thematic analysis of #fitspiration images on social media. *Psychology of Popular Media Culture, 7*(4), 467–483. 10.1037/ppm0000143

De Souza, M. J. (2019). *The Female Athlete Triad and implications for sports nutrition strategies for recovery.* https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=De+Souza%2C+M.+J.+%28Producer%29.+%282019%2C+January+16%29.+The+Female+Athlete+Triad+and+implications+for+sports+nutrition+strategies+for+recovery.+American+College+of+Sports+Medicine.+Podcast+retrie

Derman, O., & Kılıç, E. Z. (2009). Edema can be a handicap in treatment of anorexia nervosa. *The Turkish Journal of Pediatrics, 51*, 372–374.

Downey, A. E., Richards, A., & Tanner, A. B. (2023). Linear growth in young people with restrictive eating disorders: “Inching” toward consensus. *Frontiers in Psychiatry, 14*, 1094222. 10.3389/fpsyt.2023.1094222

Drew, B. J., Ackerman, M. J., Funk, M., Gibler, W. B., Kligfield, P., Menon, V., Philippides, G. J., Roden, D. M., & Zareba, W. (2010). Prevention of Torsade de Pointes in hospital settings: A scientific statement from the American Heart Association and the American College of Cardiology Foundation endorsed by the American Association of Critical-Care Nurses and the International Society. *Journal of the American College of Cardiology, 55*(9), 934–947. 10.1016/j.jacc.2010.01.001

el Ghoch, M., Soave, F., Calugi, S., & Dalle Grave, R. (2013). Eating Disorders, Physical Fitness and Sport Performance: A Systematic Review. *Nutrients*, *5*(12), 5140–5160. 10.3390/nu5125140

Electrocardiogram (ECG or EKG) | American Heart Association. (2020). Retrieved November 25, 2020, from https://www.heart.org/en/health-topics/heart-attack/diagnosing-a-heart-attack/electrocardiogram-ecg-or-ekg

Esparza-Ros, F., Vaquero-Cristóbal, R., & Marfell-Jones, M. (2019). *International protocol for anthropometric assessment*. International Society for the Advancement of Kinanthropometry (ISAK).

España-Romero, V., Ortega, F. B., Vicente-Rodríguez, G., Artero, E. G., Rey, J. P., & Ruiz, J. R. (2010). Elbow position affects handgrip strength in adolescents: Validity and reliability of Jamar, DynEx, and TKK dynamometers. *The Journal of Strength & Conditioning Research, 24*(1), 272–277. 10.1519/JSC.0b013e3181c27d1b

Fietz, M., Touyz, S., & Hay, P. (2014). A risk profile of compulsive exercise in adolescents with an eating disorder: A systematic review. *Advances in Eating Disorders: Theory, Research and Practice, 2*(3), 241–263. 10.1080/21662630.2014.894470

Fletcher, G. F., Ades, P. A., Kligfield, P., Arena, R., Balady, G. J., Bittner, V. A., Coke, L. A., Fleg, J. L., Forman, D. E., Gerber, T. C., Gulati, M., Madan, K., Rhodes, J., Thompson, P. D., & Williams, M. A. (2013). Exercise Standards for Testing and Training. *Circulation*, *128*(8), 873–934. 10.1161/CIR.0b013e31829b5b44

Freeman, R., Wieling, W., Axelrod, F. B., Benditt, D. G., Benarroch, E., Biaggioni, I., Cheshire, W. P., Chelimsky, T., Cortelli, P., Gibbons, C. H., Goldstein, D. S., Hainsworth, R., Hilz, M. J., Jacob, G., Kaufmann, H., Jordan, J., Lipsitz, L. A., Levine, B. D., Low, P. A., … van Dijk, J. G. (2011). Consensus statement on the definition of orthostatic hypotension, neurally mediated syncope and the postural tachycardia syndrome. *Autonomic Neuroscience: Basic and Clinical, 161*(1), 46–48. 10.1007/s10286-011-0119-5

Friars, D., Walsh, O., & McNicholas, F. (2023). Assessment and management of cardiovascular complications in eating disorders. *Journal of Eating Disorders*, *11*(1), 13. 10.1186/s40337-022-00724-5

Fu, Q., VanGundy, T., Shibata, S., Auchus, R. J., Williams, E. L., Gibbons, C. H., … Levine, B. D. (2010). Cardiac origins of the postural orthostatic tachycardia syndrome. *Journal of the American College of Cardiology, 55*(25), 2858–2868. 10.1016/j.jacc.2010.02.043

Funayama, M., Mimura, Y., Takata, T., Red, H., Hospital, C., Koreki, A., Daigakuin, D. I., Kenkyuka, I., Gekagaku, N., Shin, B., Ashikaga, K., Cross, R., Ashikaga, H., Byoin, S., & Shimizu, Y. (2021). *Hypokalemia in patients with eating disorders is associated with binge-purge behavior, lower body mass index, and hypoalbuminemia: Predicting hypokalemia during refeeding*. 10.21203/rs.3.rs-556323/v1

Garson, A. (1993). How to measure the QT interval-What is normal? *The American Journal of Cardiology*, *72*(6), B14–B16. 10.1016/0002-9149(93)90034-A

Gaudiani, J. (2019). *Sick enough: A guide to the medical complications of eating disorders*. Routledge.

Gaudiani, J. L. (2018). *Sick enough: A guide to the medical complications of eating disorders.* Routledge.

Geller, J., Goodrich, S., Chan, K., Cockell, S., & Srikameswaran, S. (2012). *Clinical practice guidelines for the BC eating disorder continuum of services.* BC Ministry of Health Services.

Gianini, L. M., Klein, D. A., Call, C., Mayer, L., Foltin, R. W., Walsh, B. T., Wang, Y., Wu, P., & Attia, E. (2016). The reinforcing effect of exercise in anorexia nervosa: Clinical correlates and relationship to outcome. *Eating Disorders*, *24*(5), 412–423. 10.1080/10640266.2016.1198204

Gibbons, R. J., Balady, G. J., Timothy Bricker, J., Chaitman, B. R., Fletcher, G. F., Froelicher, V. F., Mark, D. B., McCallister, B. D., Mooss, A. N., O'Reilly, M. G., Winters, W. L., Gibbons, R. J., Antman, E. M., Alpert, J. S., Faxon, D. P., Fuster, V., Gregoratos, G., Hiratzka, L. F., Jacobs, A. K., … Smith, S. C. (2002). ACC/AHA 2002 guideline update for exercise testing: summary article. *Journal of the American College of Cardiology*, *40*(8), 1531–1540. 10.1016/S0735-1097(02)02164-2

Golden, N. H., Katzman, D. K., Sawyer, S. M., Ornstein, R. M., Rome, E. S., Garber, A. K., Kohn, M., & Kreipe, R. E. (2015). Update on the Medical Management of Eating Disorders in Adolescents. *Journal of Adolescent Health*, *56*(4), 370–375. 10.1016/J.JADOHEALTH.2014.11.020

González-Ruiz, K., Ramírez-Vélez, R., Correa-Bautista, J. E., Peterson, M. D., & García-Hermoso, A. (2017). The effects of exercise on abdominal fat and liver enzymes in pediatric obesity: A systematic review and meta-analysis. *Childhood Obesity, 13*(4), 272–282. 10.1089/chi.2017.0027

Gordon, C. M., Ackerman, K. E., Berga, S. L., Kaplan, J. R., Mastorakos, G., Misra, M., Murad, M. H., Santoro, N. F., & Warren, M. P. (2017). Functional Hypothalamic Amenorrhea: An Endocrine Society Clinical Practice Guideline. *The Journal of Clinical Endocrinology & Metabolism*, *102*(5), 1413–1439. 10.1210/jc.2017-00131

Gould, R., Ridout Ashley, & Newton, J. L. (2022). Relative Energy Deficiency in Sport (RED-S) in Adolescents – A Practical Review. *International Journal of Sports Medicine*.10.1055/a-1947-3174

Green, M. A., Miles, L., Sage, E., Smith, J., Carlson, G., Hogan, K., Bogucki, J., Ferenzi, L., Hartman, E., Tao, Y., Peng, Y., Roche, A. I., Bolenbaugh, M. A., Wienkes, C., Garrison, Y., & Eilers, S. (2020). Cardiac biomarkers of disordered eating as a function of diagnostic subtypes. *Eating Behaviors*, *39*, 101425. 10.1016/J.EATBEH.2020.101425

Green, M., Herrick, A., Kroska, E., Reyes, S., Sage, E., & Miles, L. (2019). Cardiac biomarkers of disordered eating: A case for decreased mean R wave amplitude. *Psychiatry Research*, *272*, 555–561. 10.1016/J.PSYCHRES.2018.12.162

Green, M., Rogers, J., Nguyen, C., Blasko, K., Martin, A., Hudson, D., Fernandez-Kong, K., Kaza-Amlak, Z., Thimmesch, B., & Thorne, T. (2016). Cardiac Risk and Disordered Eating: Decreased R Wave Amplitude in Women with Bulimia Nervosa and Women with Subclinical Binge/Purge Symptoms. *European Eating Disorders Review*, *24*(6), 455–459. 10.1002/erv.2463

Grubb, B. P. (2008). Postural tachycardia syndrome. In *Circulation* (Vol. 117, Issue 21, pp. 2814–2817). Lippincott Williams & Wilkins. 10.1161/CIRCULATIONAHA.107.761643

Grubb, B. P., Kanjwal, Y., Karabin, B., & Imran, N. (2008). Orthostatic Hypotension and Autonomic Failure: A Concise Guide to Diagnosis and Management. *Clinical Medicine. Cardiology*, *2*, CMC.S926. 10.4137/CMC.S926

Grubb, B. P., Kanjwal, Y., & Kosinski, D. J. (2005). The postural tachycardia syndrome: A concise guide to diagnosis and management. *Journal of Cardiovascular Electrophysiology, 16*(3), 357–363. 10.1111/j.1540-8167.2005.00318.x

Gümmer, R., Giel, K. E., Schag, K., Resmark, G., Junne, F. P., Becker, S., Zipfel, S., & Teufel, M. (2015). High Levels of Physical Activity in Anorexia Nervosa: A Systematic Review. *European Eating Disorders Review*, *23*(5), 333–344. 10.1002/erv.2377

Hail, L., & le Grange, D. (2018). Bulimia nervosa in adolescents: prevalence and treatment challenges. *Adolescent Health, Medicine and Therapeutics*, *9*, 11–16. 10.2147/AHMT.S135326

Hanachi, M., Melchior, J. C., & Crenn, P. (2013). Hypertransaminasemia in severely malnourished adult anorexia nervosa patients: risk factors and evolution under enteral nutrition. *Clinical Nutrition (Edinburgh, Scotland)*, *32*(3), 391–395. 10.1016/j.clnu.2012.08.020

Harris, A., Aouad, P., Noetel, M., Hay, P., & Touyz, S. (2022). Measuring exercise in eating disorder patients: a Delphi study to aggregate clinical and research knowledge. *Journal of Eating Disorders*, *10*(1), 1–15. 10.1186/S40337-022-00641-7/TABLES/6

Harris, A., Mannan, H., Hay, P., Aouad, P., Arcelus, J., Attia, E., … Touyz, S. (2024). Assessment and treatment of compulsive exercise in anorexia nervosa – A combined investigation of Compulsive Exercise Activity Therapy (LEAP) and Compulsive Exercise Test subscales. *Eating Behaviors, 52*, 101825. 10.1016/j.eatbeh.2023.101825

Henriksson, J. (1991). Effect of exercise on amino acid concentrations in skeletal muscle and plasma. *Journal of Experimental Biology, 160*(1), 149–165.

Hay, P., Aouad, P., Le, A., Marks, P., Maloney, D., Touyz, S., & Maguire, S. (2023). Epidemiology of eating disorders: Population, prevalence, disease burden and quality of life informing public policy in Australia- A rapid review. *Journal of Eating Disorders, 11*(1), 23. 10.1186/s40337-023-00826-2

Henry, D. A. (2015). Hyponatremia. *Annals of Internal Medicine*, *163*(3), ITC1. 10.7326/AITC201508040

Heruc, G., Hurst, K., Casey, A., Fleming, K., Freeman, J., Fursland, A., Hart, S., Jeffrey, S., Knight, R., Roberton, M., Roberts, M., Shelton, B., Stiles, G., Sutherland, F., Thornton, C., Wallis, A., & Wade, T. (2020). ANZAED eating disorder treatment principles and general clinical practice and training standards. *Journal of Eating Disorders*, *8*(1), 1–9. 10.1186/S40337-020-00341-0/TABLES/1

Heymsfield, S. B., McManus, C., Smith, J., Stevens, V., & Nixon, D. W. (1982). Anthropometric measurement of muscle mass: revised equations for calculating bone-free arm muscle area. *The American Journal of Clinical Nutrition*, *36*(4), 680–690. 10.1093/AJCN/36.4.680

Holtkamp, K., Hebebrand, J., & Herpertz-Dahlmann, B. (2004). The contribution of anxiety and food restric- tion on physical activity levels in acute anorexia nervosa. International Journal of Eating Disorders, 36 (2), 163–171. 0.1002/eat.20035

Hornberger, L. L., & Lane, M. A. (2021). Identification and management of eating disorders in children and adolescents. *Pediatrics*, *147*(1). https://doi.org/10.1542/PEDS.2020-040279/33504

Hornberger, L. L., Lane, M. A., Hornberger, L. L., Lane, M., Breuner, C. C., Alderman, E. M., Grubb, L. K., Powers, M., Upadhya, K. K., Wallace, S. B., Hornberger, L. L., Lane, M., FRCPC, M., Loveless, M., Menon, S., Zapata, L., Hua, L., Smith, K., Baumberger, J., & Baumberger, J. (2021). Identification and Management of Eating Disorders in Children and Adolescents. *Pediatrics*, *147*(1). 10.1542/peds.2020-040279

Howgate, D. J., Graham, S. M., Leonidou, A., Korres, N., Tsiridis, E., & Tsapakis, E. (2013). Bone metabolism in anorexia nervosa: molecular pathways and current treatment modalities. *Osteoporosis International*, *24*(2), 407–421. 10.1007/s00198-012-2095-6

Hübel, C., Yilmaz, Z., Schaumberg, K. E., Breithaupt, L., Hunjan, A., Horne, E., García-González, J., O'Reilly, P. F., Bulik, C. M., & Breen, G. (2019). Body composition in anorexia nervosa: Meta-analysis and meta-regression of cross-sectional and longitudinal studies. *International Journal of Eating Disorders*, *52*(11), 1205–1223. 10.1002/EAT.23158

Hudson, L. D., Nicholls, D. E., & Lynn, R. M. (2012). Medical instability and growth of children and adolescents with early onset eating disorders. *Arch Dis Child*. 10.1136/archdischild-2011-301055

Hundemer, G. L., Clarke, A., Akbari, A., Bugeja, A., Massicotte-Azarniouch, D., Knoll, G., Myran, D. T., Tanuseputro, P., & Sood, M. M. (2022). Analysis of Electrolyte Abnormalities in Adolescents and Adults and Subsequent Diagnosis of an Eating Disorder. *JAMA Network Open*, *5*(11), e2240809–e2240809. 10.1001/JAMANETWORKOPEN.2022.40809

Hypertension Canada. (2022). *Health behaviour management*. Retrieved November 2025 from https://hypertension.ca/guidelines/prevention-treatment/health-behaviour-management

Imbierowicz, K., Curkovic, I., Braks, K., Geiser, F., Liedtke, R., & Jacoby, G. E. (2004). Effect of weight-regulating practices on potassium level in patients with anorexia or bulimia nervosa. *European Eating Disorders Review, 12*(5), 300–306. 10.1002/erv.591

Jacob, G., Costa, F., Shannon, J. R., Robertson, R. M., Wathen, M., Stein, M., Biaggioni, I., Ertl, A., Black, B., & Robertson, D. (2000). The neuropathic postural tachycardia syndrome. *New England Journal of Medicine, 343*(14), 1008–1014. 10.1056/NEJM200010053431404

Kandemir, N., Slattery, M., Ackerman, K. E., Tulsiani, S., Bose, A., Singhal, V., Baskaran, C., Ebrahimi, S., Goldstein, M., Eddy, K., Klibanski, A., & Misra, M. (2018). Bone Parameters in Anorexia Nervosa and Athletic Amenorrhea: Comparison of Two Hypothalamic Amenorrhea States. *The Journal of Clinical Endocrinology & Metabolism*, *103*(6), 2392–2402. 10.1210/jc.2018-00338

Kappenstein, J., Ferrauti, A., Runkel, B., Fernandez-Fernandez, J., Müller, K., Zange, J., Ferrauti, A. A., Fernandez-Fernandez, J. A., Runkel, B., Müller, K., & Zange, J. (2013). Changes in phosphocreatine concentration of skeletal muscle during high-intensity intermittent exercise in children and adults. *European Journal of Applied Physiology, 113*, 2769–2779. 10.1007/s00421-013-2712-x

Kramer, R., Drury, C. R., Forsberg, S., et al. (2025). Weight stigma in the development, maintenance, and treatment of eating disorders: A case series informing implications for research and practice. *Research on Child and Adolescent Psychopathology, 53*, 747–760. 10.1007/s10802-024-01260-3

Katzman, D. K. (2005). Medical complications in adolescents with anorexia nervosa: A review of the literature. *International Journal of Eating Disorders*, *37*(S1), S52–S59. 10.1002/EAT.20118

Kerrigan, S. G., Lydecker, J. A., & Grilo, C. M. (2019). Associations between physical activity and eating-disorder psychopathology among individuals categorised with binge-eating disorder and bulimia nervosa. *International Journal of Clinical Practice*, *73*(11), e13401. 10.1111/IJCP.13401

Kim, J. V., & Wu, G. Y. (2020). Body Building and Aminotransferase Elevations: A Review. *Journal of Clinical and Translational Hepatology*, *8*(2), 161. 10.14218/JCTH.2020.00005

Kolar, D. R., & Gorrell, S. (2021). A call to experimentally study acute affect-regulation mechanisms specific to driven exercise in eating disorders. *International Journal of Eating Disorders*, *54*(3), 280–286. 10.1002/EAT.23427

Kollai, M., Bonyhay, I., Jokkel, G., & Szonyi, L. (1994). Cardiac vagal hyperactivity in adolescent anorexia nervosa. *European Heart Journal*, *15*(8), 1113–1118. 10.1093/oxfordjournals.eurheartj.a060636

Kotilahti, E., West, M., Isomaa, R., Karhunen, L., Rocks, T., & Ruusunen, A. (2020). Treatment interventions for Severe and Enduring Eating Disorders: Systematic review. *International Journal of Eating Disorders*, *53*(8), 1280–1302. 10.1002/EAT.23322

Kowalski, K. C., Crocker, P. R., & Kowalski, N. P. (1997). Convergent validity of the physical activity questionnaire for adolescents. Pediatric exercise science, 9(4), 342-352.

Kowalski, K. C., Crocker, P. R., & Donen, R. M. (2004). The physical activity questionnaire for older children (PAQ-C) and adolescents (PAQ-A) manual. College of kinesiology, University of Saskatchewan, 87(1), 1-38.

Kraemer, W. J., & Fleck, S. J. (2007). *Optimizing strength training: designing nonlinear periodization workouts*. 245. https://books.google.com/books/about/Optimizing_Strength_Training.html?id=cLz_mwWQXucC

Krantz, M. J., Sabel, A. L., Sagar, U., Long, C. S., Barbey, J. T., White, K. v., Gaudiani, J. L., & Mehler, P. S. (2012). Factors influencing QT prolongation in patients hospitalized with severe anorexia nervosa. *General Hospital Psychiatry*, *34*(2), 173–177. 10.1016/J.GENHOSPPSYCH.2011.08.003

Laitinen, T., Lyyra-Laitinen, T., Huopio, H., Vauhkonen, I., Halonen, T., Hartikainen, J., Niskanen, L., & Laakso, M. (2008). Electrocardiographic Alterations during Hyperinsulinemic Hypoglycemia in Healthy Subjects. *Annals of Noninvasive Electrocardiology*, *13*(2), 97–105. 10.1111/j.1542-474X.2008.00208.x

Lampe, E. W., Forman, E. M., Juarascio, A. S., & Manasse, S. M. (2022). Feasibility, Acceptability, and Preliminary Target Engagement of a Healthy Physical Activity Promotion Intervention for Bulimia Nervosa: Development and Evaluation via Case Series Design. *Cognitive and Behavioral Practice*, *29*(3), 598–613. 10.1016/J.CBPRA.2021.05.006

Landry, B. W., & Driscoll, S. W. (2012). Physical activity in children and adolescents. *PM&R, 4*(11), 826–832. 10.1016/j.pmrj.2012.09.585

Lanier, J. B., Mote, M. B., & Clay, E. C. (2011). Evaluation and management of orthostatic hypotension. *American Family Physician, 84*(5), 527–536.

Lebow, J., Sim, L. A., & Kransdorf, L. N. (2015). Prevalence of a history of overweight and obesity in adolescents with restrictive eating disorders. *Journal of Adolescent Health*, *56*(1), 19-24. 10.1016/j.jadohealth.2014.06.005

Legaz-Arrese, A., Carranza-García, L. E., Navarro-Orocio, R., Valadez-Lira, A., Mayolas-Pi, C., Munguía-Izquierdo, D., Reverter-Masía, J., & George, K. (2017). Cardiac Biomarker Release after Endurance Exercise in Male and Female Adults and Adolescents. *The Journal of Pediatrics*, *191*, 96–102. 10.1016/j.jpeds.2017.08.061

Levallius, J., Collin, C., & Birgegård, A. (2017). Now you see it, Now you don’t: compulsive exercise in adolescents with an eating disorder. *Journal of Eating Disorders*, *5*(1), 9. 10.1186/s40337-016-0129-8

Langman, C. B., Plotkin, H., Rauch, F., Zemel, B. S., Binkley, N., Bilezikian, J. P., Kendler, D. L., Hans, D. B., & Silverman, S. (2008). International Society for Clinical Densitometry 2007 adult and pediatric official positions. *Bone, 43*(6), 1115–1121. 10.1016/j.bone.2008.08.106

Lindsay, B. (2017). Sweating Rate and Sweat Sodium Concentration in Athletes: A Review of Methodology and Intra/Interindividual Variability. *Sports Medicine*, *47*(1), 111–128.

Loucks, A. B. (2003). Energy availability, not body fatness, regulates reproductive function in women. *Exercise and Sport Sciences Reviews*, *31*(3), 144–148. 10.1097/00003677-200307000-00008

Loucks, A. B., & Heath, E. M. (1994). Induction of low-T3 syndrome in exercising women occurs at a threshold of energy availability. *The American Journal of Physiology*, *266*(3 Pt 2), R817-23. https://doi.org/10.1152/ajpregu.1994.266.3.R817

Loucks, A. B., Kiens, B., & Wright, H. H. (2011). Energy availability in athletes. *Journal of Sports Sciences*, *29*(sup1), S7–S15. 10.1080/02640414.2011.588958

Luck, P., & Wakeling, A. (1982). Set-point displacement for behavioural thermoregulation in anorexia nervosa. *Clinical Science*, *62*(6), 677–682. 10.1042/cs0620677

Lumb, A. (2014). Diabetes and exercise. *Clinical Medicine, 14*(6), 673–676. 10.7861/clinmedicine.14-6-673

Lydecker, J. A., Silverman, J. A., & Grilo, C. M. (2021). Disentangling associations of children's sports participation and compulsive exercise with parenting practices and child disordered eating behavior. *Journal of Adolescent Health, 68*(1), 178–183. 10.1016/j.jadohealth.2020.04.028

Madison, J. K., & Ruma, S. L. (2003). Exercise and athletic involvement as moderators of severity in ado- lescents with eating disorders. Journal of Applied Sport Psychology, 15(3), 213–222.10.
108010413200305386

MacArdle, W. D., K. F. I. , & K. V. L. (2015). *Exercise physiology: Nutrition, energy, and human performance*. Wolters Kluwer-Lippincott Williams & Wilkins Health.

Mang, L., Garghan, A., Grant, J., Lacey, H., & Matthews, R. (2021). An evaluation of efficacy and acceptability of a novel manualised JuniorLEAP group programme for compulsive exercise, for children and adolescents with anorexia nervosa, within an inpatient setting. *Eating and Weight Disorders – Studies on Anorexia, Bulimia and Obesity, 26*(2), 591–597. 10.1007/s40519-020-00884-w

Mallinson, R. J., Williams, N. I., Gibbs, J. C., Koehler, K., Allaway, H. C. M., Southmayd, E., & De Souza, M. J. (2016). Current and past menstrual status is an important determinant of femoral neck geometry in exercising women. *Bone*, *88*, 101–112. 10.1016/j.bone.2016.01.030

Mascolo, M., Chu, E. S., & Mehler, P. S. (2011). Abuse and clinical value of diuretics in eating disorders therapeutic applications. *International Journal of Eating Disorders*, *44*(3), 200–202. 10.1002/eat.20814

Mariano, P., Watson, H. J., Leach, D. J., McCormack, J., & Forbes, D. A. (2013). Parent–child concordance in reporting of child eating disorder pathology as assessed by the Eating Disorder Examination. *International Journal of Eating Disorders, 46*, 617–625. 10.1002/eat.22158

Mcardle, W. D., Katch, F. I., & Katch, V. L. (2015). *Exercise physiology: Nutrition, energy, and human performance.*

McCallum, K., Bermudez, O., Ohlemeyer, C., Tyson, E., Portilla, M., & Ferdman, B. (2006). How should the clinician evaluate and manage the cardiovascular complications of anorexia nervosa? *Eating Disorders*, *14*(1), 73–80. 10.1080/10640260500403915

McEntee, M. L., Philip, S. R., & Phelan, S. M. (2023). Dismantling weight stigma in eating disorder treatment: Next steps for the field. *Frontiers in psychiatry*, *14*, 1157594. 10.3389/fpsyt.2023.1157594

Mehler, P., & Anderson, A. (2017). *Eating Disorders: A Guide to Medical Care and Complications – Google Books*.

Mehler, P. S. (2001). Diagnosis and care of patients with anorexia nervosa in primary care settings. *Annals of Internal Medicine, 134*(11), 1048–1059. 10.7326/0003-4819-134-11-200106050-00011

Mehler, P. S., & Brown, C. (2015). Anorexia nervosa – Medical complications. *Journal of Eating Disorders, 3*(1), 1–8. 10.1186/s40337-015-0040-8

Mehler, P. S., Sabel, A. L., Watson, T., & Andersen, A. E. (2008). High risk of osteoporosis in male patients with eating disorders. *International Journal of Eating Disorders*, *41*(7), 666–672. 10.1002/eat.20554

Mehler, P. S., & Walsh, K. (2016). Electrolyte and acid-base abnormalities associated with purging behaviors. *International Journal of Eating Disorders*, *49*(3), 311–318. 10.1002/eat.22503

Mehta, N. M., Corkins, M. R., Lyman, B., Malone, A., Goday, P. S., Carney, L. (Nieman), Monczka, J. L., Plogsted, S. W., & Schwenk, W. F. (2013). Defining Pediatric Malnutrition. *Journal of Parenteral and Enteral Nutrition*, *37*(4), 460–481. 10.1177/0148607113479972

Melin, A., Tornberg, Å. B., Skouby, S., Møller, S. S., Sundgot-Borgen, J., Faber, J., Sidelmann, J. J., Aziz, M., & Sjödin, A. (2015). Energy availability and the female athlete triad in elite endurance athletes. *Scandinavian Journal of Medicine & Science in Sports*, *25*(5), 610–622. 10.1111/sms.12261

Micali, N., Solmi, F., Horton, N. J., Crosby, R. D., Eddy, K. T., Calzo, J. P., Sonneville, K. R., Swanson, S. A., & Field, A. E. (2015). Adolescent eating disorders predict psychiatric, high-risk behaviors and weight outcomes in young adulthood. *Journal of the American Academy of Child & Adolescent Psychiatry, 54*(8), 652–659. 10.1016/j.jaac.2015.05.009

Misra, M. (2008). Long-term skeletal effects of eating disorders with onset in adolescence. *Annals of the New York Academy of Sciences*, *1135*(1), 212-218.

Melissa, R., Lama, M., Laurence, K., Sylvie, B., Jeanne, D., Odile, V., & Nathalie, G. (2020). Physical activity in eating disorders: A systematic review. *Nutrients,12(1)*. 10.3390/nu12010183

Miller, K. K., Lee, E. E., Lawson, E. A., Misra, M., Minihan, J., Grinspoon, S. K., Gleysteen, S., Mickley, D., Herzog, D., & Klibanski, A. (2006). Determinants of Skeletal Loss and Recovery in Anorexia Nervosa. *The Journal of Clinical Endocrinology & Metabolism*, *91*(8), 2931–2937. 10.1210/jc.2005-2818

Mond, J., & Gorrell, S. (2021). "Excessive exercise" in eating disorders research: problems of definition and perspective. *Eating and Weight Disorders*, *26*(4), 1017–1020. 10.1007/S40519-020-01075-3/METRICS

Moodithaya, S., & Avadhany, S. T. (2012). Gender differences in age-related changes in cardiac autonomic nervous function. *Journal of Aging Research*, *2012*, 679345. 10.1155/2012/679345

Mountjoy, M., Sundgot-Borgen, J., Burke, L., Carter, S., Constantini, N., Lebrun, C., Meyer, N., Sherman, R., Steffen, K., Budgett, R., & Ljungqvist, A. (2014). The IOC consensus statement: Beyond the Female Athlete Triad-Relative Energy Deficiency in Sport (RED-S). *British Journal of Sports Medicine*, *48*(7), 491–497. 10.1136/bjsports-2014-093502

Mountjoy, M., Sundgot-Borgen, J. K., Burke, L. M., Ackerman, K. E., Blauwet, C., Constantini, N., Lebrun, C., Lundy, B., Melin, A. K., Meyer, N. L., Sherman, R. T., Tenforde, A. S., Torstveit, M. K., & Budgett, R. (2018). IOC consensus statement on relative energy deficiency in sport (RED-S): 2018 update. *British Journal of Sports Medicine, 0*, 1–11. 10.1136/bjsports-2018-099193

Nagata, J. M., Carlson, J. L., Golden, N. H., Murray, S. B., Long, J., Leonard, M. B., & Peebles, R. (2019). Associations between exercise, bone mineral density, and body composition in adolescents with anorexia nervosa. *Eating and Weight Disorders – Studies on Anorexia, Bulimia and Obesity*, *24*(5), 939–945. 10.1007/s40519-018-0521-2

Nagata, J. M., Park, K. T., Colditz, K., & Golden, N. H. (2015). Associations of Elevated Liver Enzymes among Hospitalized Adolescents with Anorexia Nervosa. *The Journal of Pediatrics*, *166*(2), 439-443.e1. 10.1016/J.JPEDS.2014.10.048

Nattiv, & A. (2007). The female athlete triad: ACSM position stand. *Med Sci Sports Exerc*, *39*, 1867–1882. 20001200794/

Nielsen, F. H., & Lukaski, H. C. (2006). Update on the relationship between magnesium and exercise. *Magnesium Research, 19*(3), 180–189.

Nilsson, L., & Karlsen, C. (2020). *Kvinnors upplevelser av att leva med anorexia nervosa : Ett patientperspektiv*. https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1501559&dswid=-9740

Nishita, J. K., Ellinwood, E. H., & Rockwell, W. J. K. (1985). Hypothermia in anorexia nervosa: An increase in nonshivering thermogenesis? *International Journal of Eating Disorders*, *4*(3), 307–319. 10.1002/1098-108X(198508)4:3<307::AID-EAT2260040307>3.0.CO;2-H

Noetel, M., Dawson, L., Hay, P., & Touyz, S. (2017). The assessment and treatment of unhealthy exercise in adolescents with anorexia nervosa: A Delphi study to synthesize clinical knowledge. *International Journal of Eating Disorders*, *50*(4), 378–388. 10.1002/eat.22657

Nudel, D. B., Gootman, N., Nussbaum, M. P., & Shenker, I. R. (1984). Altered exercise performance and abnormal sympathetic responses to exercise in patients with anorexia nervosa. *The Journal of Pediatrics*, *105*(1), 34–37. 10.1016/S0022-3476(84)80352-2

Olguin, P., Fuentes, M., Gabler, G., Guerdjikova, A. I., Keck, P. E., & McElroy, S. L. (2016). Medical comorbidity of binge eating disorder. *Eating and Weight Disorders – Studies on Anorexia, Bulimia and Obesity*, *22*(1), 13–26. 10.1007/S40519-016-0313-5

Ostermann, T., Vogel, H., Boehm, K., & Cramer, H. (2019). Effects of yoga on eating disorders-A systematic review. *Complementary Therapies in Medicine*, *46*, 73–80. 10.1016/J.CTIM.2019.07.021

Oświecimska, J., Ziora, K., Błońska-Fajfrowska, B., Więcek, A., Pluskiewicz, W., & Karasek, M. (2007). Effects of neuroendocrine changes on results of ambulatory blood pressure monitoring (ABPM) in adolescent girls with anorexia nervosa. *Neuroendocrinology Letters, 28*(4), 503–510.

Pate, R., Oria, M., & Pillsbury, L. (2012). Committee on fitness measures and health outcomes in youth. *Food and Nutrition Board*, *2012*.

Pediatrics, A. A. of. (2007). Statement of Endorsement. *Pediatrics*, *120*(6), 1402–1402. 10.1542/peds.2007-3255

Peebles, R., Lesser, A., Park, C. C., Heckert, K., Timko, C. A., Lantzouni, E., Liebman, R., & Weaver, L. (2017). Outcomes of an inpatient medical nutritional rehabilitation protocol in children and adolescents with eating disorders. *Journal of Eating Disorders*, *5*(1), 1–14. 10.1186/S40337-017-0134-6/FIGURES/5

Pieles, G. E., & Stuart, A. G. (2020). The adolescent athlete's heart: A miniature adult or grown-up child? *Clinical Cardiology, 43*(12), 1482–1491. 10.1002/clc.23417

Pinhas-Hamiel, O., & Levy-Shraga, Y. (2013). Eating disorders in adolescents with type 2 and type 1 diabetes. *Current Diabetes Reports*, *13*(2), 289–297. 10.1007/S11892-012-0355-7/METRICS

Prado, S., Bachrach, L. K., & Golden, N. H. (2017). Controlled pilot study of high-impact, low-frequency exercise on bone loss and vital-sign stabilization in adolescents with eating disorders. *Journal of Adolescent Health, 60*(1), 33–37. 10.1016/j.jadohealth.2016.08.020

Quesnel, D. A., Cook, B., & Caperchione, C. (2020a). Guiding Principles to Inform Future Exercise Protocols for Eating Disorder Treatment. *The Health & Fitness Journal of Canada*, *13*(2), 3–15. 0.14288/HFJC.V13I2.297

Quesnel, D. A., Libben, M., D. Oelke, N., I. Clark, M., Willis-Stewart, S., & Caperchione, C. M. (2018). Is abstinence really the best option? Exploring the role of exercise in the treatment and management of eating disorders. *Eating Disorders*, *26*(3), 290–310. 10.1080/10640266.2017.1397421

Quesnel, D. A., Cooper, M., Cook, B., & Calogero, R. M. (2025). Evaluating the Impact of a Safe Exercise Training on Clinician Knowledge and Self-Efficacy in Managing Dysfunctional Exercise in an Eating Disorder Treatment Setting. *Journal of Evaluation in Clinical Practice*, *31*(1), e14319. 10.1111/jep.14319

Raghuveer, G., Hartz, J., Lubans, D. R., Takken, T., Wiltz, J. L., Mietus-Snyder, M., … American Heart Association Young Hearts Athero, Hypertension and Obesity in the Young Committee of the Council on Lifelong Congenital Heart Disease and Heart Health in the Young. (2020). Cardiorespiratory fitness in youth: An important marker of health: A scientific statement from the American Heart Association. *Circulation, 142*(7), e101–e118. 10.1161/CIR.0000000000000896

Raggi, A., Curone, M., Bianchi Marzoli, S., Chiapparini, L., Ciasca, P., Ciceri, E. F., Erbetta, A., Faragò, G., Leonardi, M., & D'Amico, D. (2017). Impact of obesity and binge eating disorder on patients with idiopathic intracranial hypertension. *Cephalalgia : An International Journal of Headache*, *37*(3), 278–283. 10.1177/0333102416640514

Raj, K. S., Keane-Miller, C., & Golden, N. H. (2012). Hypomagnesemia in Adolescents With Eating Disorders Hospitalized for Medical Instability. *Nutrition in Clinical Practice*, *27*(5), 689–694. 10.1177/0884533612446799

Raj, S. R. (2013). Postural tachycardia syndrome (POTS). *Circulation*, *127*(23), 2336–2342. 10.1161/CIRCULATIONAHA.112.144501

Ralph, A.F., Brennan, L., Byrne, S. *et al.* Management of eating disorders for people with higher weight: clinical practice guideline. *Journal of Eating Disorders,* 10, 121 (2022). 10.1186/s40337-022-00622-w

Riva, A., Falbo, M., Passoni, P., Polizzi, S., Cattoni, A., & Nacinovich, R. (2021). High levels of physical activity in female adolescents with anorexia nervosa: Medical and psychopathological correlates. *Eating and Weight Disorders – Studies on Anorexia, Bulimia and Obesity.* Advance online publication. 10.1007/s40519-021-01200-8

Renz, J. A., Fisher, M., Vidair, H. B., Hirsch, D., Malizio, J., Barger, H., & Fornari, V. (2019). Excessive exercise among adolescents with eating disorders: Examination of psychological and demographic variables. *International Journal of Adolescent Medicine and Health, 31*(4), 20170032. 10.1515/ijamh-2017-0032

Reynolds, K. A., Plateau, C. R., & Haycraft, E. (2023). Sociocultural influences on compulsive exercise in young people: A systematic review. *Adolescent Research Review, 8*(2), 179–194. 10.1007/s40894-022-00196-2

Rosenthal, M. B., Pagnano-Richardson, K., & Burak, L. (2010). Alternatives to using exercise as punishment. *Journal of Physical Education, Recreation & Dance*, *81*(5), 44-48.

Rozé, C., Doyen, C., Le Heuzey, M. F., Armoogum, P., Mouren, M. C., & Léger, J. (2007). Predictors of late menarche and adult height in children with anorexia nervosa. *Clinical Endocrinology, 67*(3), 462–467. 10.1111/j.1365-2265.2007.02906.x

Rich, L. M., Caine, M. R., Findling, J. W., & Shaker, J. L. (1990). Hypoglycemic Coma in Anorexia Nervosa. *Archives of Internal Medicine*, *150*(4), 894. 10.1001/archinte.1990.00390160134027

Riedlinger, C., Schmidt, G., Weiland, A., Stengel, A., Giel, K. E., Zipfel, S., Enck, P., & Mack, I. (2020). Which Symptoms, Complaints and Complications of the Gastrointestinal Tract Occur in Patients With Eating Disorders? A Systematic Review and Quantitative Analysis. *Frontiers in Psychiatry*, *11*, 195. 10.3389/fpsyt.2020.00195

Rienecke, R. D., & Le Grange, D. (2022). The five tenets of family-based treatment for adolescent eating disorders. *Journal of Eating Disorders, 10*(1), 60. 10.1186/s40337-022-00610-8

Ruggeri-McKinley, A. N., & McKinley, B. C. (2016). The commonly missed diagnosis of intracranial hypotension. *Interdisciplinary Neurosurgery*, *4*, 11–12. 10.1016/J.INAT.2016.01.002

Sachs, K. V., Harnke, B., Mehler, P. S., & Krantz, M. J. (2016). Cardiovascular complications of anorexia nervosa: A systematic review. *International Journal of Eating Disorders*, *49*(3), 238–248. 10.1002/eat.22481

Saldanha, N., & Fisher, M. (2022). Menstrual disorders in adolescents and young adults with eating disorders. *Current Problems in Pediatric and Adolescent Health Care, 52*(8), 101240. 10.1016/j.cppeds.2022.101240

Scharmer, C., Gorrell, S., Schaumberg, K., & Anderson, D. (2020). Compulsive exercise or exercise dependence? Clarifying conceptualizations of exercise in the context of eating disorder pathology. *Psychology of Sport and Exercise*, *46*, 101586. 10.1016/J.PSYCHSPORT.2019.101586

Schaumberg, K. E., Robinson, L., Hochman, A., & Micali, N. (2022). Prospective associations between driven exercise and other eating disorder behaviors in adolescence: A longitudinal cohort study. *Journal of Adolescent Health, 70*(5), 781–787. 10.1016/j.jadohealth.2021.12.018

Scheid, J. L., Toombs, R. J., Ducher, G., Gibbs, J. C., Williams, N. I., & De Souza, M. J. (2011). Estrogen and peptide YY are associated with bone mineral density in premenopausal exercising women. *Bone*, *49*(2), 194–201. 10.1016/j.bone.2011.04.011

Schneider, J. E., & WADE, G. N. (n.d.). Inhibition of reproduction in se rvice of energy balance. *Reproduction in Context: Social and Environmental Influences on Reproductive Physiology and Behavior, K. Wallen and J. E. Schneider Eds. Cambridge: The MIT Press,* 35.

Schumann, G. B., & Schweitzer, S. C. (1996). Examination of urine. In *Clinical Chemistry, Theory, Analysis and Correlation.* (Third edit, pp. 1118–1119). Year Book Inc.

Silbiger, K. (2024). Mental health providers' perceptions of restrictive eating disorders: Relationship with client body weight. International Journal of Eating Disorders, 57(4), 916-923. 10.1002/eat.24154

Seigel, K., & Hetta, J. (2001). Exercise and eating disorder symptoms among young females. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, *6*, 32-39. 10.1007/BF03339749

Seitz, J., Herpertz-Dahlmann, B., & Konrad, K. (2016). Brain morphological changes in adolescent and adult patients with anorexia nervosa. *Journal of Neural Transmission, 123*, 949–959. 10.1007/s00702-016-1573-9

Sharman, J. E., la Gerche, A., & Coombes, J. S. (2015). Exercise and Cardiovascular Risk in Patients With Hypertension. *American Journal of Hypertension*, *28*(2), 147–158. 10.1093/ajh/hpu191

Sheldon, R. S., Grubb, B. P., Olshansky, B., Shen, W. K., Calkins, H., Brignole, M., Raj, S. R., Krahn, A. D., Morillo, C. A., Stewart, J. M., Sutton, R., Sandroni, P., Friday, K. J., Hachul, D. T., Cohen, M. I., Lau, D. H., Mayuga, K. A., Moak, J. P., Sandhu, R. K., & Kanjwal, K. (2015). 2015 Heart Rhythm Society expert consensus statement on the diagnosis and treatment of postural tachycardia syndrome, inappropriate sinus tachycardia, and vasovagal syncope. *Heart Rhythm, 12*(6), e41–e63. 10.1016/j.hrthm.2015.03.029

Shetty, A. K., Schmidt-Sommerfeld, E., Haymon, M.-L., & Udall John N., Jr. (1999). Radiological Case of the Month. *Archives of Pediatrics & Adolescent Medicine*, *153*(3), 303.

Silén Y, Keski-Rahkonen A. Worldwide prevalence of DSM-5 eating disorders among young people. Curr Opin Psychiatry. 2022 Nov 1;35(6):362-371. 10.1097/YCO.0000000000000818.

Silveira, L. G. (2002). Article in Seminars in Reproductive Medicine. *Seminars in Reproductive Medicine*, *12*(6), 41–63. 10.1055/s-2002-36707

Smith, R. W., Korenblum, C., Thacker, K., Bonifacio, H. J., Gonska, T., & Katzman, D. K. (2013). Severely elevated transaminases in an adolescent male with anorexia nervosa. *International Journal of Eating Disorders*, *46*(7), 751–754. 10.1002/EAT.22162

Smith, J. J., Eather, N., Weaver, R. G., Riley, N., Beets, M. W., & Lubans, D. R. (2019). Behavioral correlates of muscular fitness in children and adolescents: A systematic review. *Sports Medicine, 49*, 887–904. 10.1007/s40279-019-01072-8

Spaulding-Barclay, M. A., Stern, J., & Mehler, P. S. (2016). Cardiac changes in anorexia nervosa. *Cardiology in the Young*, *26*(4), 623–628. 10.1017/S104795111500267X

Stiles-Shields, E. C., Goldschmidt, A. B., Boepple, L., Glunz, C., & Le Grange, D. (2011). Driven exercise among treatment-seeking youth with eating disorders. *Eating Behaviors, 12*(4), 328–331. 10.1016/j.eatbeh.2011.09.008

Stiles-Shields, C., Bamford, B., Lock, J., & Le Grange, D. (2015). The effect of driven exercise on treatment outcomes for adolescents with anorexia and bulimia nervosa. *International Journal of Eating Disorders, 48*(4), 392–396. 10.1002/eat.22373

Steinhausen, H. C., Seidel, R., & Metzke, C. W. (2000). Evaluation of treatment and intermediate and long-term outcome of adolescent eating disorders. *Psychological Medicine, 30*(5), 1089–1098.10.1017/S0033291799002354

Stone, M. S., Martyn, L., & Weaver, C. M. (2016). Potassium intake, bioavailability, hypertension, and glucose control. *Nutrients, 8*(7), 444. 10.3390/nu8070444

Strober, M., Freeman, R., & Morrell, W. (1997). The long-term course of severe anorexia nervosa in adolescents: Survival analysis of recovery, relapse, and outcome predictors over 10–15 years in a prospective study. *International Journal of Eating Disorders, 22*(4), 339–360. 10.1002/(SICI)1098-108X(199712)22:4<339::AID-EAT1>3.0.CO;2-N

Stuart, G., & Pieles, G. E. (2019). 1.2.3 The athlete's heart in children and adolescents. In *The ESC Textbook of Sports Cardiology*. European Society of Cardiology.

Swenne, I. (2018). Changes and predictive value for treatment outcome of the Compulsive Exercise Test (CET) during a family-based intervention for adolescent eating disorders. *BMC Psychology, 6*, 1–9. 10.1186/s40359-018-0272-8

Tarnopolsky, M. A., Zawada, C., Richmond, L. B., Carter, S., Shearer, J., Graham, T., & Phillips, S. M. (2001). Gender differences in carbohydrate loading are related to energy intake. *Journal of Applied Physiology*, *91*(1), 225–230. 10.1152/jappl.2001.91.1.225

Thedinga, H. K., Zehl, R., & Thiel, A. (2021). Weight stigma experiences and self-exclusion from sport and exercise settings among people with obesity. *BMC Public Health, 21*, 565. 10.1186/s12889-021-10565-7

Thomas, E., Petrigna, L., Tabacchi, G., Teixeira, E., Pajaujienė, S., Sturm, D. J., & Bianco, A. (2020). Percentile values of the standing broad jump in children and adolescents aged 6–18 years old. *European Journal of Translational Myology, 30*(2), 9302. 10.4081/ejtm.2020.9302

Thornton, D., & Gordon, C. M. (2017). Restrictive eating disorders and skeletal health in adolescent girls and young women. *Calcified Tissue International, 100*, 449–460. 10.1007/s00223-016-0216-1

Tokumura, M., Watanabe, H., & Esaki, T. (2012). Convalescent resting tachycardia predicts unfavorable outcome of anorexia nervosa. *Pediatrics International*, *54*(6), 844–848. 10.1111/j.1442-200X.2012.03703.x

van Sluijs, E. M., Ekelund, U., Crochemore-Silva, I., Guthold, R., Ha, A., Lubans, D., … Katzmarzyk, P. T. (2021). Physical activity behaviours in adolescence: Current evidence and opportunities for intervention. *The Lancet, 398*(10298), 429–442. 10.1016/S0140-6736(21)01259-9

Vanzhula, I., Hagan, K., Duck, S. A., Pan, I., Wang, E. Y., Steinglass, J., … Schreyer, C. (2024). Eating disorder symptom non-endorsers in hospitalised patients with anorexia nervosa: Who are they? *European Eating Disorders Review, 32*(4), 795–808. 10.1002/erv.3028

Voderholzer, U., Haas, V., Correll, C. U., & Körner, T. (2020). Medical management of eating disorders: An update. *Current Opinion in Psychiatry*, *33*(6), 542–553. 10.1097/YCO.0000000000000653

Vrabel, K. R., & Bratland-Sanda, S. (2024). Effects of inpatient treatment on compulsive exercise in adults with longstanding eating disorders: Secondary analysis from a randomized controlled trial with 12-month follow-up. *International Journal of Eating Disorders, 57*(2), 437–449. 10.1002/eat.24157

Vyver, E., Steinegger, C., & Katzman, D. K. (2008). Eating disorders and menstrual dysfunction in adolescents. Annals of the New York Academy of Sciences, 1135(1), 253-264.

Walker, T., Watson, H. J., Leach, D. J., McCormack, J., Tobias, K., Hamilton, M. J., & Forbes, D. A. (2014). Comparative study of children and adolescents referred for eating disorder treatment at a specialist tertiary setting. *International Journal of Eating Disorders*, *47*(1), 47-53.

Wallhead, T. L., & Buckworth, J. (2004). The role of physical educationin the promotionof youth physical activity. Quest, 56(3), 285-301.

Warren, M. P., Brooks-Gunn, J., Fox, R. P., Holderness, C. C., Hyle, E. P., & Hamilton, W. G. (2002). Osteopenia in exercise-associated amenorrhea using ballet dancers as a model: A longitudinal study. *Journal of Clinical Endocrinology and Metabolism*, *87*(7), 3162–3168. 10.1210/jcem.87.7.8637

Warren, M. P., & Perlroth, N. E. (2001). The effects of intense exercise on the female reproductive system. *Journal of Endocrinology*, *170*(1), 3–11. 10.1677/joe.0.1700003

Watson, S., Weeks, B., Weis, L., Harding, A., Horan, S., & Beck, B. (2019). High-intensity resistance and impact training improves bone mineral density and physical function in postmenopausal women with osteopenia and osteoporosis: The LIFTMOR randomized controlled trial. *Journal of Bone and Mineral Research, 34*(3), 572–579. 10.1002/jbmr.3659

Wells, K. R., Jeacocke, N. A., Appaneal, R., Smith, H. D., Vlahovich, N., Burke, L. M., Hughes, D., & Australian Institute of Sport. (2020). The Australian Institute of Sport (AIS) and National Eating Disorders Collaboration (NEDC) position statement on disordered eating in high performance sport: Consensus statement. *British Journal of Sports Medicine, 0*, 1–13. 10.1136/bjsports-2019-101813

White, J. v., Guenter, P., Jensen, G., Malone, A., & Schofield, M. (2012). Consensus Statement of the Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition: Characteristics Recommended for the Identification and Documentation of Adult Malnutrition (Undernutrition). *Journal of the Academy of Nutrition and Dietetics*, *112*(5), 730–738. 10.1016/J.JAND.2012.03.012

Woods, A. L., Garvican-Lewis, L. A., Lundy, B., Rice, A. J., & Thompson, K. G. (2017). New approaches to determine fatigue in elite athletes during intensified training: Resting metabolic rate and pacing profile. *PloS ONE*, *12*(3). 10.1371/journal.pone.0173807

Yilmaz, Z., Gottfredson, N. C., Zerwas, S. C., Bulik, C. M., & Micali, N. (2019). Developmental premorbid body mass index trajectories of adolescents with eating disorders in a longitudinal population cohort. *Journal of the American Academy of Child & Adolescent Psychiatry, 58*(2), 191–199. 10.1016/j.jaac.2018.11.008

Zanker, C. L., & Swaine, I. L. (2007). Bone turnover in amenorrhoeic and eumenorrhoeic women distance runners. *Scandinavian Journal of Medicine & Science in Sports*, *8*(1), 20–26. 10.1111/j.1600-0838.1998.tb00224.x

Ziv, A., Barnea-Melamed, S., Meisman, A., Ofei-Tenkorang, N. A., O'Donnell, J., Altaye, M., ... & Gordon, C. M. (2023). Yoga as an intervention to promote bone and mental health in adolescent females with anorexia nervosa: a pilot study. *Eating Disorders*, *31*(5), 526-532. 10.1080/10640266.2023.2196493

Zou, L., Yang, P., Herold, F., Liu, W., Szabo, A., Taylor, A., … & Ji, L. (2022). The contribution of BMI, body image inflexibility, and generalized anxiety to symptoms of eating disorders and exercise dependence in exercisers. International Journal of Mental Health Promotion, 24(6), 811-823. 10.32604/ijmhp.2022.024862

Appendices
Appendix 1. Physical Fitness Markers and Screening Tools

A variety of physical fitness markers/protocols and screening tools have been implemented in youth with an ED throughout research contexts. Here*, physical fitness* is defined as a set of characteristics, including strength, cardiorespiratory capacity, flexibility, proprioception, and more, that relate to a person's ability to perform physical activities and activities of daily living (ACSM, 2021). Fitness capacity has a strong relationship with overall quality of life, health and wellbeing, functional capacity, and the prevalence of long-term conditions and risk factors (ACSM, 2021). The National Eating Disorders Collaboration's 2024 Eating Disorder Safe Principles advocate for alternatives to weight-focused metrics, such as other health, quantity of life, performance and wellbeing metrics are prioritized in treatment. As such, fitness markers may become more common in treatment and research settings. The below section describes several physical fitness tests that could be utilized in research and clinical settings to measure progress. Any implementation of these in clinical settings must focus on a progression of health, and that the clinical care is mindful *not* to introduce these health markers in a manner that encourages obsessive or other pathological thinking patterns.

Cardiorespiratory Fitness: Cardiorespiratory fitness (CRF) is defined as "the ability of the circulatory and respiratory system to supply oxygen during sustained physical activity" (ACSM, 2021 pp. 69). It reflects the functional capabilities of the heart, blood vessels, lungs and skeletal muscles to transport and use oxygen to perform physical work (ACSM, 2021). CRF is most accurately assessed via maximal exertion protocols which uses highly specialised respiratory gas analysis via indirect calorimetry to determine maximal volumes of oxygen consumed per unit of time (VO2max). Submaximal CRF "field tests", are clinical exercise assessments which aim to assess safe exercise capacity, estimate prognosis, evaluate responses to treatment and provide tailored activity counselling in people with long-term health conditions (ACSM, 2021). Generally, they are much more tolerated, simple, accessible, low cost and non-laboratory-based (ACSM, 2021).

Although it is commonly assessed in youth with chronic diseases, CRF is not frequently assessed in otherwise healthy young people. In youth, CRF predicts cardiometabolic health and disease, academic achievement and mental health (Raghuveer et al., 2020; Pate et al., 2012). However, reporting of $\dot{V}O_2$max in youth is challenging due to variations in body size. In the case of youth, there is no universally accepted standard for scaling CRF (values relative to body weight, lean body mass or absolute values), so it is important to consider the possible effects of body size when interpreting data (Raghuveer et al. 2020; Pate et al. 2012). The submaximal CRF "field tests" are better tolerated, simple, accessible, low cost and non-laboratory-based clinical exercise assessments which aim to assess safe exercise capacity, estimate prognosis, evaluate responses to treatment and provide tailored activity counselling in people with long-term health conditions (ACSM, 2021). Fitness testing may help gauge cardiovascular health in youth with ED and assess fitness throughout an exercise intervention (McCullum et al., 2006). From field tests, 1.5-mile distance and 12-minute run tests show a higher correlation to VO2max in youth (Raghuveer et al., 2020). In fact, research studies have used a number of protocols to assess cardiovascular fitness in those with ED, including the Bruce protocol (Bratland-Sanda et al., 2012), incremental modified Balke protocol (Tokumura et al., 2003), or even protocols designed for ED patients (Fernandez-del-Valle et al., 2014; Agne et al. 2022).

Muscular Fitness: Muscular fitness is an umbrella term used to describe distinct aspects of muscular function such as muscular strength (the muscle's ability to exert maximal force on one occasion), muscular endurance (the muscle's ability to perform successive repetitions against a sub-maximal load) and muscular power (the muscle's ability to exert force per unit of time) (ACSM, 2021). Muscular fitness directly impacts a person's health and quantity of life and is underpinned by the presence of adequate muscle mass, bone mass and other fat-free mass (ACSM, 2021). These factors strongly influence important health and wellbeing outcomes such as cellular metabolism, bone density, glucose tolerance, musculotendinous integrity, functional independence, immunity, all-cause risk of mortality, quality of life and mental health (ACSM, 2021). More importantly, many of these benefits are independent of CRF, highlighting muscular fitness' distinct role in supporting health and well-being (Smith et al. 2019). In fact, muscular fitness can more effectively mitigate the risk of mortality than CFR alone (ACSM, 2021), which also correlates with appropriate sleep and activity levels (Smith et al., 2019)

Muscle function has also been assessed using performance-oriented protocols such as 1 Repetition Maximum protocol (Chantler et al., 2006; Mathisen et al., 2018) or complex and expensive laboratory equipment such as isokinetic dynamometers (Chantler et al., 2006). Limitations of these approaches led to implementing the 6 Repetition Maximum protocol (Fernandez-del-Valle et al., 2010; 2014; 2022), which is more suitable for individuals with pathologies. However, the difficulty of carrying out the protocols correctly in youth and the absence of equipment and trained professionals in clinical settings make these options very difficult to implement at the clinical level. In clinical settings, trained exercise professionals may opt for tests already in place or require little to no equipment (e.g., Handgrip dynamometry, Standing Broad Jump or Bent Arm Hang Test (Artero et al., 2011; Pate et al. 2012). The most reliable field evidence-based muscular fitness tests for youth include the handgrip dynamometry (with full extended elbow and using equations specific to age, sex and hand-size) and the Standing Broad Jump Test (with normative values for age and sex) (Artero et al. 2011; España-Romero et al. 2010; Pate et al. 2012; Thomas et al., 2020). Note that these tests do not assess all the dimensions of muscular fitness but rather muscular strength in the upper extremities and muscular power in the lower extremities, and it seems no reliable muscular endurance test for youth has been sufficiently explored. If equipment and trained specialists are available, a 6-10 Repetition Maximum protocol might benefit program exercise routines and assess progression, at least in the lower extremities (Kraemer & Fleck, 2007). Also, other tests, such as the sit-to-stand test or the isometric half-squat test, may be useful in assessing progress in youth with EDs.

Muscle mass is another dimension of muscular fitness. Given that measurement of body weight and BMI do not differentiate muscle from fat mass, there is no straightforward way to evaluate improvements in muscle mass during treatment. It is important to note that restoring body weight or BMI to premorbid levels does not necessarily indicate the return of premorbid muscle mass and function, and an altered central fat accumulation is common (Agne et al., 2022; Hübel et al., 2019).

Body composition has been measured successfully in EDs using different methods: anthropometry, bioimpedance or dual-energy x-ray absorptiometry (DXA). The most cost-effective method is anthropometry; however, it has some important limitations. First, the professional must be properly trained to minimize technical error (most important in those with AN) (Artero et al., 2011; Esparza-Ros et al., 1982). The recommended variables to measure are waist, hip, mid-thigh, and mid-arm circumferences, as well as mid-thigh and triceps skinfolds, allowing follow-up on muscle and fat tissue progress. In fact, mid-thigh and mid-arm variables may be used to calculate cross-sectional muscle areas (Heymsfield et al., 1982). However, anthropometric measurements in youth must be performed, and feedback provided, with consideration of percentiles and how this information (or evaluation) may impact ED psychopathology. Another option for muscle mass and fat distribution assessment is bioimpedance analysis (BIA). In this case, the BIA equipment must allow segmental body composition analysis, which will provide data on each segment of the body. We note that these assessments are influenced by hydration, food intake, and assessment time, so they should be conducted under standardized conditions. Further, these methods are likely to be inaccurate in malnourished individuals due to low-fat mass and dehydration common in these patients. Overall, BIA is fast and relatively inexpensive compared to DXA, but the latter is the gold-standard method. It is important to note that BIA and DXA methods might pose less stress to patients, so they could be a more feasible choice in cases where anthropometry is not a good option (see Table 4).

Broadly speaking, it is not unreasonable to summarize that while following fitness markers over time might be appealing both from research and progress monitoring perspectives, most clinicians and patients will not use these in typical clinical practice. For elite athletes, more advanced measurement mechanisms may be available. Pragmatically, it is appropriate to assess how patients view their present level of fitness by asking, “In what ways can your body presently do what brings you joy and satisfaction as far as movement, and in what ways can it not? How would you like to change that, and what would be the pros and cons of moving toward those goals?”

Table 4. Fitness Marker Summary

Fitness Marker	Assessments	Observations
Maximal oxygen consumption	• Laboratory methods: Metabolic Cart & ECG • Field methods: 12-minute walk test or 1.5-mile run test	• Often unavailable • Lacks ECG
Cardiac health	• Stress test (ECG) when using field method	• Useful with field tests
Muscle strength	• 6-10RM • Handgrip dynamometry	• Often unavailable & requires trained professionals. • Easy to apply & normative values available.
Muscle power	• Standing broad jump test	
Muscle endurance	• Sit-to-stand test (5 times) • Isometric half-squat	• Lack of evidence • Lack of evidence
Muscle mass & Fat distribution	• Anthropometry (percentiles): ○ *Muscle mass*: mid-arm and mid-thigh cross-sectional muscle area and hip circumference. ○ *Fat distribution*: waist circumference, and triceps and mid-thigh skinfolds • BIA: segmental analysis • DXA: segmental análisis	• Inexpensive but not suitable and may increase patient distress or body weight/shape concerns. (Use with caution) • Problems with very low BMI & following protocols is essential. • Often unavailable

Note. Additional information can be found in Chapters 4, 5 and 6 in *Fitness measures and health outcomes in youth* (PMID 25187939) in the National Library of Medicine (Pate et al. 2012).

Appendix 2. Assessment Form

The following is an assessment form that will determine a safe level of movement for patients. Step 1 is meant to be completed during the intake for each patient and should be completed in collaboration with a parent/carer for additional information.

<u>Step 1. Physical Activity Background</u> "I am going to ask you questions about your physical activity. We are trying to find out about your level of physical activity from ***the last 7 days*** (in the last week). This includes sports or dance that make you sweat or make your legs feel tired, or games that make you breathe hard, like tag, skipping, running, climbing, and others".

There are no right and wrong answers — this is not a test. Please answer all the questions as honestly and accurately as you can.

1. Physical activity in your spare time: Have you done any of the following activities in the past 7 days (last week)? If yes, how many times?

	No	1-2	3-4	5-6	7 or more times
Skipping					
Rowing/canoeing					
In-line skating					
Tag					
Walking for exercise					
Bicycling					
Jogging or running					
Aerobics					
Swimming					
Baseball, softball					
Dance					
Football					
Badminton					
Skateboarding					
Soccer					
Street hockey					
Volleyball					
Floor hockey					
Basketball					
Ice skating					
Cross-country skiing					
Ice hockey/ringette					
Other:					

Firstly, I want to ask about times when you were very active, meaning when you were doing activities and were out of breath or finding it difficult to hold a conversation. This may be playing hard, running, jumping, throwing.

2. In the last 7 days, what did you do during your gym/physical education (PE) classes? How often were you very active in gym class/PE? (respond below)

I don't do PE	Hardly ever	Sometimes	Quite often	Always

3. In the last 7 days, what did you normally do *at lunch* (besides eating lunch)? (Check one only.)

Sat down (talking, reading, doing schoolwork).	Stood around or walked around	Ran or played a little bit	Ran around and played quite a bit	Ran and played hard most of the time

4. In the last 7 days, on how many days *right after school*, did you do sports, dance, or play games in which you were very active? (Check one only.)

None	1 time last week	2 or 3 times last week	4 times last week	5 times last week

5. In the last 7 days, on how many *evenings* did you do sports, dance, or play games in which you were very active? (Check one only.)

None	1 time last week	2 or 3 times last week	4 times last week	5 times last week	6 or 7 times last week

6. *Last weekend*, how many times did you do sports, dance, or play games in which you were very active? (Check one only.)

None	1 time last week	2 or 3 times last week	4 times last week	5 times last week	6 or 7 times last week

7. Which *one* of the following describes you best for the last 7 days? Read *all five* statements before deciding on the *one* answer that describes you.

a. All or most of my free time was spent doing things that involve little physical effort
b. I sometimes (1 — 2 times last week) did physical things in my free time (e.g. played sports, went running, swimming, bike riding, did aerobics)
c. I often (3 — 4 times last week) did physical things in my free time.
d. I quite often (5 — 6 times last week) did physical things in my free time.
e. I very often (7 or more times last week) did physical things in my free time

8. How often did you do physical activity (like playing sports, games, doing dance, or any other physical activity) each day last week? This doesn't have to instances when you were "very active", it can be walking to school, playing in the park or going to sports.

	None	Little bit (1-2 times)	Medium (3-4 times)	Often (5-6 times)	Very often (7 or more)
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					
Saturday					
Sunday					

8.5 Were you sick last week, or did anything prevent you from doing your normal physical activities? If yes what?

9. Was your physical activity above different before you started to struggle with your eating (e.g., how active were you 1 year ago or 5 years ago compared to now?) This may include the types of activity you did (e.g., playing soccer vs. cycling) or how hard you worked when exercising (e.g., how puffed or tired you were, whether you had fun or just felt like you had to)**. Did the above table change since you have been struggling with your eating? If yes how so? Please show me what that would have looked like before your eating difficulties started**

	None	Little bit (1-2 times)	Medium (3-4 times)	Often (5-6 times)	Very often (7 or more)
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					
Saturday					
Sunday					

10. Incidental activity

Over the last **week,** do you find yourself trying to “take the long road” more than other people? For example, getting off the bus early to get more “steps” or walk more? Has there been a time where you couldn’t take the “long way” or did meet your “step goals” that you found upsetting? Can you tell me more about that?

11. Hyperactivity

Over the last **week** did you find yourself with an urge to move when you are meant to be staying still, for example standing up while others are sitting down watching a movie?

12. Maladaptive Movement Relationship			
Criteria	**Question**	**Yes/ No**	**Patient Response**
A1. Movement driven in response to an obsession or according to rules that must be applied rigidly. *(required)*	Do you feel like you have to exercise over and over again and can't resist doing so?	**Y N**	
	Do you have specific rules or routines related to exercise that you must follow?	**Y N**	
	What would happen/how would you feel if you did not follow your normal rules or routines related to exercise?	**Y N**	
	Do you feel bad if you cannot exercise as you usually do?	**Y N**	
A2. Movement aimed at preventing a dreaded consequence or at preventing or reducing distress, often based on distorted beliefs about exercise. *(required)*	Why do you have to exercise? Select "Yes" if it is to prevent a dreaded consequence i.e., "getting fat"	**Y N**	
	How would you feel if you did not exercise? Select "Yes" if not exercising causes a negative reactions i.e., distress, fear, anger, frustration	**Y N**	
	What would happen if you did not exercise? Select "Yes" if patient endorses negative emotion, experience, or food compensation	**Y N**	
B. Movement is time-consuming, significantly interferes with daily routine, occupational functioning or social relationships or is continued despite medical injury, illness, or lack of enjoyment. *(required)*	How much time do you spend exercising in a normal day? Select "Yes" if patient endorses over an hour of activity per day*	**Y N**	
	What effect does your exercise behaviour have on your life? Select "Yes" if patient endorses negative impact i.e., missing school/work, takes up "a lot of time", negative emotions	**Y N**	
	Do you continue exercising when sick or injured?	**Y N**	
	Do you change plans with friends, modify your life/work so you can fit in your exercise routine?	**Y N**	
	Do you exercise even when it's not enjoyable?	**Y N**	
		Total: A minimum of score of 7 is required to meet criteria (with at least one per category)	
C. At some point during the course of the disorder the person has recognized that the compulsive exercising is excessive or unreasonable.	Do you think you exercise more than you should or that makes sense? Can you tell me more about that?	**Y N**	
	Have you ever wanted to change your exercise behavior and struggled to do so? What happened?	**Y N**	
		Insight: High Medium Low	

13. Exercise Profile Summary		
Current Activity Engagement (average across the last week)	**Type** **Frequency**	**Duration** **Intensity** (high/moderate/low)
Patient meets criteria for Maladaptive Movement?		
Maladaptive Movement present across (select)	**Exercise (including Sport)** **Incidental Activity** **Hyperactivity**	
Activity Goal		

Step 2. Medical Assessment

Step 2 is to be complete at **baseline** and **throughout treatment (weekly or with acute changes)** to track patient's medical and psychological health and determine level of movement safety. A new page should be used for each reassessment.

1. Risk assessment completed by completed weekly or with change (e.g., MD, RN, and RD):
The colour corresponds to the level of risk associated with exercise engagement as per Table 1 SEES-Y Risk Assessment (pp.43). Where red = highest risk associated with exercise (SEES-Y Level A) and green = lowest risk (SEES-Y Level D). Grey = overarching criteria.

Cardiac markers
***meets hospitalisation criteria as per the RANZCP guideline.**

	Heart rate <50bpm* or >100bpm*		Postural tachycardia >20bpm*
	Orthostatic hypotension >20mmHg systole (independent of symptoms)*		Systolic blood pressure <90mmHg*
	Prolonged QT/c interval >450ms*		Arrhythmias*
Biochemical markers:			
	Hypokalemia		Hypophosphatemia
	Hypomagnesemia		Hypercarbia
	Hyponatremia		Hypoglycaemia
Other markers:			
	Temperature <35°C*		Higher scores on the CET indicating greater dysfunction
	Positive weight gain trajectory in line with treatment goals		Weight stabilisation/mobilisation in line with treatment goals
Recommended to assess BMD if:			
	(i) underweight for > 6mths		(ii) amenorrhea for > 6mths
	(iii) low testosterone in males		(iv) history of stress or fragility fracture
	Weight stabilisation or gain if still required		Level A markers related to ED are completely normalised as per medical recommendation
	Managing ED behaviours (e.g. self-induced vomiting, restriction/ bingeing, fear fat, & laxative use)		Normalised sex hormones without exogenous replacement (return to menses & normalized estrogen or testosterone
	Weight progression >90% of BAW		

	Adhering to treatment		Increasing nutritional consumption		Exhibiting improvements in health status (i.e., no symptom regression)

2. Compulsive Exercise Test					
Total Score	**Weight control**	**Mood improvement**	**Lack of enjoyment**	**Rigidity**	**Avoidance**

3. Risk Assessment Recommendation
See Table 1 of SEES-Y Risk Assessment (pp.43) to determine risk and patient level

As of__________________________ patient ___________________ is in level _____________

Date Name SEES-Y Level

Reassessment is scheduled for ______________________

Step 3. Movement Recommendations

Using SEES-Y Table 2. Movement Recommendations, on pp.44 of the guideline, determine the activity recommendations that are safe for your patients.

Activity Level _______

1. Movement Recommendations Using the supplemental document, determine which frequency, intensity, time and type of activity you are recommending for your patient.	
Step A. Intensity	**Step B. Type**
Step C. Duration	**Step D. Frequency:**
Supervision required? Yes/No Who will be supervising?	
Step E. Incidental physical activity	
Step F. Nutrition requirements	

Activity Recommendation Week Summary

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

Incidental/Play Activity Week Summary

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

Appendix 3. Movement Recommendations Tools

1. Measures of Intensity

Intensity Measures					
Description of intensity	**Rating**	**Talk Test**	**Exertion (work)**	**% of heart rate maximum**	**MET value***
Maximal	**10**	Cannot talk, gasping for breath	Difficult to continue, can only maintain for 10-30 sec	86-100%	6+
High	**9**				
	8	Broken speech, heavy breath	Uncomfortable to continue, can maintain for 5-10 mins	76-85%	
	7				
Moderate	**6**	Can only finish 1-2 sentences, moderately short of breath	The work is tough, can maintain for 30 mins	61-75%	3 - 5.9
	5				
	4	Taking more effort to talk, slight shortness of breath	Can comfortably maintain for at least 60 mins	51-60%	
Low	**3**				1.1 - 2.9
	2	Normal talking and breathing	Can continue for an extended time	40-50%	
	1				

2. Compendium of Physical Activity

Youth Compendium of Physical Activity can be found here: https://www.nccor.org/nccor-tools/youthcompendium/