Safe Exercise at Every Stage 2

SEES-2

A Clinical Guideline for Treating and Managing Maladaptive Movement in Eating Disorder Treatment

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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.

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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-2 (SEES-2) guideline aims to provide evidence-based information to support clinicians in the management of maladaptive movement during ED treatment. This guideline serves as a general tool for use under a practitioner's expert judgement, ***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-2 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-2 guideline is intended to be administered by a trained medical or exercise professional (see Glossary, pp.69) in conjunction with an interdisciplinary team (see Glossary, pp.69). The SEES-2 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.3-4). 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, movement needs to be 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., 2020). The SEES-2 guideline provides a framework for assessing an individual's current physical and psychological health status to inform movement interventions. These guidelines are intended to augment, not replace, clinical decision-making and judgement. The incorporation of the SEES-2 guideline as a component of evidence-based treatment for adults 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 biological, genetic, psychosocial, behavioural, socio-cultural and other factors (NEDC, 2024). 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) and we have seen increases in greater pathology and suicidal behavior for those with an ED (Cooper et al., 2020; Taquet et al., 2022; 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, Reba, Siega-Riz & Reichborn-Kjennerud, 2005; Crow, 2014; van Hoeken & Hoek, 2020). ED treatment typically includes psychotherapy, often in combination with pharmacological/medical treatment and nutrition counselling (Heruc et al., 2020; Kotilahti et al., 2020). Yet, particularly for adults with an ED, there is still a need to improve treatment outcomes, with remission rates of only 65% across diagnoses (Keshishian et al., 2019).

A key feature of eating disorders and a factor impacting relapse rates, chronicity and general prognosis in ED populations is engagement in maladaptive movement. Throughout the Safe Exercise at Every Stage –2nd edition guideline (SEES-2) 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; Hausenblaus & 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; see pp.27 for further details).

Maladaptive movement is reported to be present in 20-88% of individuals with an ED and is thought to be a common, core symptom particularly in AN-restrictive subtype (Alcaraz-Ibáñez et al., 2020; Casper et al., 2020; Dalle Grave, Calugi & Marchesini, 2008;Monell et al., 2018; Schroff et al., 2006; Watson et al., 2025). When maladaptive movement is not addressed during treatment, ED pathology is often exacerbated and both treatment and recovery can be undermined (Berends, Boonstra, & Van Elburg, 2018; Cook, Hausenblas, Tuccitto, & Giacobbi, 2011). Engaging in maladaptive movement with an ED 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 (Carter et al., 2004; Strober, Freeman, & Morrell, 1997). 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. Evidence over the past two decades suggests that incorporating nutritionally supported, safe, and supervised movement into ED treatment can improve treatment outcomes without undermining ED treatment and recovery or interfering with weight recovery and maintenance (Calogero & Pedrotty, 2004; Hallward et al., 2021; Martysen et al., 2022; Sundgot-Borgen et al., 2002). 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 movement programs, with movement 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 movement is an important component of recovery from an ED, there is an urgent need to know how to address maladaptive movement in individuals with an ED.

Despite demonstrated benefits and organizational support, many treatment protocols do not formally address how to manage return to movement during treatment. 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, Thomas, Markin, & Biringham, 2000; Zunker, Mitchell, & Wonderlich, 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, Arthur, Russell, & Touyz, 1994; Ng et al., 2013; Quesnel et al., 2018). Furthermore, individuals with lived experience of ED express the desire for activity to be incorporated into treatment to facilitate learning how to develop an adaptive and fulfilling relationship with movement (Brunet et al., 2021). Finally, data from individuals who have undergone activity interventions during ED treatment also report their appreciation for such interventions, in particular that these approaches teach beneficial tools to manage one's activity engagement (Bakland et al., 2019).

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 (SEES) guideline was initially developed in 2017 to support clinical decision-making for the assessment and management of physical activity during ED treatment. In the past 6 years, our team has presented the SEES guideline in workshops and conferences worldwide, worked with individuals and teams to incorporate SEES across all levels of care for individuals with ED, adapted guidelines for use with athletes and youth populations, and published several manuscripts to contribute to the growing evidence base on maladaptive movement and ED. Additionally, the field has moved forward substantially in our understanding of the assessment and treatment of maladaptive movement in ED (see

Updates for SEES-2). Therefore, we present the updated Safe Exercise at Every Stage 2nd edition (SEES-2). SEES-2 maintains much of the same procedures as the first edition of the SEES guideline, however, also incorporates newly published literature, language and perspectives to inform application of the guidelines and included recommendations.

Overview of the SEES-2 Guideline

Objective

Maladaptive movement is associated with a range of deleterious outcomes for individuals with ED symptomatology; yet safe activity engagement is associated with positive physical and mental health outcomes. As individuals with an ED often exhibit an array of medical health complications, it can be challenging for clinicians to determine safe activity engagement. The SEES-2 guideline was developed to address the management of activity in adult ED populations. Recommendations in this guideline are intended to provide guidance for clinicians to better facilitate clinical decision-making related to activity recommendations for individuals with ED symptomatology. We aim that use of these SEES-2 guideline will reduce the likelihood of over-and under-recommending activity relative to the patient's individual physical and psychological health status. Consequently, this is intended to support individuals with ED symptoms to engage in safe levels of activity and exercise education throughout their treatment, contributing to improved psychological and physical outcomes.

Target users and population

We developed the SEES-2 guideline for use by trained exercise, mental health and medical professionals working with individuals with ED symptomatology. This guideline is intended for use across all levels of care including inpatient and residential through to outpatient settings. The purpose of the SEES-2 guideline is to augment the clinical and medical knowledge of clinicians 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-2 guideline apply to individuals at all stages of their ED and to 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 individuals with ED symptomatology regardless of weight or BMI. Consequently, this guideline was developed for use with individuals over the age of 18 years exhibiting ED symptomatology (e.g. dietary restriction, purging, compensatory behaviours). The SEES-2 guideline may require adaptation by a trained medical team or accredited exercise professional for special populations such as: individuals with co-occurring conditions such as diabetes, osteopenia/osteoporosis, or other existing metabolic, neurological, cardiovascular/respiratory, psychological, or musculoskeletal conditions. For children/adolescents and athletes, please use the SEES-Youth and SEES-Athlete guidelines respectively.

Scope

- The SEES-2 guideline is a tool for supporting clinical decision-making regarding movement interventions for trained health professionals working with patients with eating disorder symptomatology.
- The SEES-2 guideline is intended for use across all levels of care for individuals experiencing eating disorder symptomatology.
- The SEES-2 guideline applies to individuals at every stage of their eating disorder, regardless of their weight, size, or diagnosis.
- The SEES-2 guideline was developed for use in adult populations and is not suitable for use with children or adolescents.
- The SEES-2 guideline is not intended to replace clinical or medical judgment and recommendations should be made with consideration of the patients' individual needs.
- The SEES-2 guideline may need to be adapted or may not be appropriate for individuals with co-occurring conditions or from special populations.

Methodology and Results

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

- Review of existing guideline.
- Two focus groups with both steering and consultation committees.
- Meta-analytic review of exercise interventions in ED populations.
- Consultation with steering committee experts.
- Review of final guideline by consultation committee (including clinicians and researchers from multiple relevant disciplines, as well as individuals with lived experience of an ED)
- Approval of SEES final document by steering committee

The authors completed the following procedure to support the modification of the original SEES guideline to inform the SEES-2 guideline:

- Reviewing of relevant literature from 2019-2023
- Consultation with steering committee experts.

Method of consultation process

Our initial consultation process was undertaken in members from both our consultation committee and steering committee (pp.3-4). Participants provided feedback during two online focus groups or via online submission of information. Following initial development of the SEES guideline, the consultation committee was again invited to provide feedback related to the guideline. In modifying the original guideline for this second edition, we incorporated feedback by our continuing steering committee members.

Results of initial consultation process

Potential contraindications to activity. Recommendations regarding the importance of BMI in determining safe return to exercise was controversial across participants, with current practices ranging from requiring a BMI => 14-18kg/m^2 prior to return to exercise and other individuals stating that BMI was not as important in decision-making as other physiological measurements. Common contraindications noted included electrolyte imbalances and cardiovascular abnormalities (e.g. bradycardia, postural tachycardia, and a prolonged QT interval). Only one participant highlighted psychological factors that may contraindicate movement.

Factors that may support increased activity engagement. Participants described multiple factors that would influence increased activity recommendations including increases in BMI where applicable, consistency and adequacy of nutritional intake, overall treatment adherence, improvements in cardiac health, medical stability, and reduced ED pathology/exercise compulsions. Suggestions varied in how prescriptive/black and white these steps should be (versus flexible steps), as well as which risks/factors would inform an increase to movement and what this recommendation would be.

Exercise modalities. Movement recommendations for individuals with more severe medical instability ranged from exercise abstinence to interventions tailored and monitored to the individual, stretching, gentle movement such as Tai Chi or Yoga, and body weight exercises. As health improved, clinicians recommended engaging in moderate levels of exercise such as dancing, swimming, walking, and stretching, progressing to higher levels of strength/resistance training and cardiorespiratory training. Appropriate durations of exercise were suggested to range from 10-60 minutes. Commonly used intensity ratings included rate of perceived exertion, talk test, and heart rate monitoring, whilst safe exercise frequency suggestions ranged from once per week to daily. Multiple respondents recommended beginning with supervised and transitioning to unsupervised movement.

Strategies for reducing harm related to activity. Here, the consultation committee recommended strategies that related directly to exercise (e.g. promoting diversity movement types, non-repetitive, social, and reduced duration/intensity/frequency

exercise), the use of exercise professionals for monitoring and selection of activity as well as the inclusion of medical professionals for medical monitoring, and adjunct treatments (e.g. CBT, psychoeducation, LEAP, DBT, FBT, ACT and medication) to help promote patient insight, healthy exercise beliefs, and intuitive movement (Hay et al., 2018; 2023).

Strategies for preventing relapse. Respondents often noted psychotherapeutic approaches, particularly CBT, as well as education, relapse planning, increasing awareness of one's physiological cues, challenging unhelpful exercise beliefs, symptom monitoring, goal setting and identifying triggers which cause maladaptive movement thoughts or engagement.

Important components of the guideline. Recommendations for the development of SEES diverged with some professionals asking for clearer guidance, cut offs, checklists, and rationales, whilst others encouraged avoidance of a black-and-white approach, more patient-centred collaboration, less rule-based, and more individualised guideline. Other responses included nutrition-related guidance, increased awareness of physical cues, recognition, and validation of the functions of movement, strategies for supporting patients to reduce maladaptive movement, and educational tips for patients.

Concerns about the guideline. Aligned with the above comments, respondents were split as to concerns about the guideline being overly rule-based and restrictive for individuals, or, opposingly, were cautionary that the guideline must be clear to follow and indisputable. Other key concerns highlighted were the need for patient education, professionals using guideline outside of their scope of practice, improper use of the guideline, the capacity to implement recommendations in an outpatient setting, as well as the potential for the guideline to contribute to beliefs that are overly permissive of patient movement or increase clinician fear related to movement engagement.

Key knowledge for clinicians. Respondents encouraged clinicians to be aware of the role of movement in the ED and the need for individualised approaches, benefits and risks of movement, and the importance of a collaborative relationship with patients.

Concerning co-occurring conditions/medications. These included supplement use in athletes, as well as individuals with depression, physical injuries, medical instability, or co-occurring diagnoses including diabetes, celiac disease, osteopenia, osteoporosis and pre-existing cardiovascular/ pulmonary complications.

Recommendations for exercise assessments. Weekly monitoring and review of movement engagement, at least initially, was nearly universally recommended. Other recommendations included once every 2-3 months.

Literature search strategy and data extraction

To inform the development of the initial SEES guideline, we initially conducted a comprehensive, systematic search of the literature during the period of January to March 2018. 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, studies must meet the following:

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 (AR, DQ and MC) 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 then 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. Initial findings were presented at the 2018 Australian and New Zealand Academy for Eating Disorders Conference in Melbourne, Australia for development of the first edition of the SEES guideline. In preparation for the SEES-2 guideline, we updated this review of literature in a recently published systematic review (Quesnel et al., 2023; https://doi.org/10.1186/s40337-022-00685-9).

Results of search process

Core findings are published in the Journal of Eating Disorders article titled “Medical and physiological complications of exercise for individuals with an eating disorder: A narrative review.” (see https://doi.org/10.1186/s40337-022-00685-9). A summary of results can be found in Table 3. Summary of Exercise Recommendations on pp. 70. Since this time, we have also reviewed meta-analysis and systematic reviews published between 2019-2025.

Monitoring and Audit Process

We intend that the SEES-2 guideline is reviewed for updated information in 2029; although, this review may occur earlier should key information relevant become available.

The primary investigators will review updates to the literature at this time and, where applicable, update aspects of the guideline based upon the latest scientific evidence. Any modifications to the SEES-2 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-2 guideline through our website (https://www.safeexerciseateverystage.com/).

Limitations

It is important to highlight the following limitations to the SEES-2 guideline:

- This guideline was developed based upon clinical and research understanding of movement intervention and ED treatment at the time it was written. Throughout this development process, we identified highly divergent opinions in both the research and clinical field alike. To rectify these contrasting opinions within our guideline, we relied on both the current research evidence as well as the expert opinions of our steering committee.
- We recognise that there is currently a limited evidence base to support the safe return to exercise in ED populations, particularly in outpatient settings. Thus, the SEES-2 guideline will require updating as research into this area evolves.
- This guideline is not a manual for movement intervention. It is a review of current literature and movement interventions in samples of adult with an ED. Consequently, it is intended that the SEES-2 guideline will support clinicians in their decision-making related to safe movement and exercise education adjunctive to their implementation of an evidence-based treatment approach.
- This guideline is not intended to train clinicians in the physiology and psychology of movement 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 that the SEES-2 guideline will support trained medical and exercise professionals (pp.73) in these situations to augment their current clinical judgement and knowledge.
- The SEES-2 guideline was not developed to address the specific needs of diverse, cultural or special populations, however we prioritised the inclusion of current evidence-based recommendations throughout. We recommend that clinicians applying the SEES-2 guideline 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 or other standards of care (NEDC, 2024; SAMHSA, 2023; Kezelman & Stavropoulus, 2019; NADA, 2022, Victorian Government, 2022). However, exercise plays a number of roles in people's lives, and while in ED it uses calories and can act as a compensatory behaviour, it has a number of other functions it performs for people that may be central to wellbeing and recovery.

Conversely, engagement in nutritionally supported and individually tailored movement paired with psychological intervention 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 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 engagement (Quesnel et al., 2023). Therefore, movement recommendations in ED treatment must

promote the safety of patients (Cook et al., 2016). Despite progress forward, health professionals continue to describes limited knowledge of how to facilitate safe return to movement during ED treatment (Quesnel et al., 2017; 2025). The SEES, and subsequent SEES-2, 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 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 movement engagement, it is critical to also consider the other facets of exercise engagement such as how movement is related to psychological processes (e.g., how movement impacts one's emotional wellbeing, what helpful/unhelpful cognitions about movement an individual holds, rigid rules related to movement) as well as how movement impacts an individual's functioning (e.g., missing work obligations, impacting social relationships, contributes to financial wellbeing). 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-2 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, pp.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 pp.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, pp.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.21.

5. Collaborative

Establishing a collaborative relationship with patients, significant others, 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 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-2 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 directive, prescriptive, or expert-type approaches where clinicians may prescribe a specific exercise 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 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 movement while supporting individuals to build autonomy in movement-related decisions throughout their recovery process.

Updates for SEES-2

Field Advancements

The SEES guideline was originally released in 2019, since which time there have been many advancements in the field of ED and exercise. 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 second edition of SEES guideline.

Terminology and Conceptualization

We use the term maladaptive movement throughout SEES-2 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, Mathisen & Sundgot-Borgen, 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 activity 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 activity even within a single day. In sum, we use maladaptive movement throughout the SEES-2 guideline to refer to bouts of exercise or physical activity 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, etc. (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 Heathy Exercise Behavior intervention (Dittmer et al., 2018) integrates cognitive-behavioral therapy 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-2 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 31 and 32.

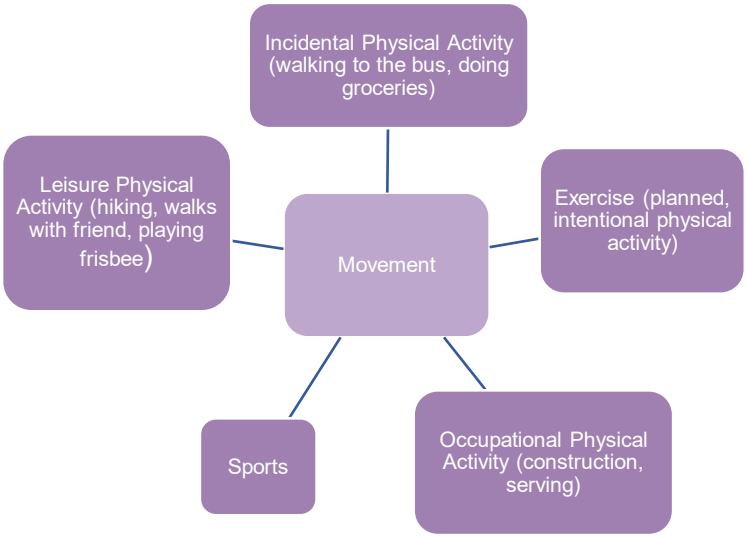
Use of Physical Fitness Markers and Screening Tools

A variety of physical fitness markers/protocols and screening tools have been implemented with individuals 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 that alternatives to weight-focused metrics, such as other health, quantity of life, performance and wellbeing metrics are prioritized as such, markers of fitness may become more common place in treatment and research settings. The section in Appendix 2 describes several physical fitness tests that could be utilized in research and clinical settings to measure progress. It is important that any implementation of these in clinical settings focuses 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.

Greater Emphasis on Incidental and Daily Movement

General conceptualizations of movement in the ED field include an emphasis on sport and high intensity exercise as a main modality of activity. 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, grocery shopping) 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. When stepping down from hospital or residential to outpatient settings, individuals must navigate real-life demands including engagement in incidental and occupational physical activity. Thus, a thorough assessment of all types of activity should occur continuously throughout treatment to manage patient misconceptions of what physical activity "looks like," prevent detrimental treatment outcomes, and promote patient safety.

Figure 1. Types of Movement



Weight Inclusive Approach

Though always a goal of SEES, focusing on weight has not been a priority. We would like to reiterate that SEES is for individuals across the weight spectrum. Despite much of the societal and research focusing on individuals with AN, the more common EDs are Binge Eating Disorder, Bulimia Nervosa and OSFED, which typically involves presentation with a weight in the normal range or higher (Da Luz et al., 2017; Qian et al.,

2022). Similarly SEES is meant for individuals who have a maladaptive relationship with movement which may manifest in a lot of movement engagement or none at all. Regardless of weight or diagnosis maladaptive movement is prevalent across the eating disorder spectrum (Cook et al., 2015; Vancampfort et al., 2014). Existing guidelines for the management of EDs 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).

Implementation Advancements

Assessment Form

There is no clear consensus in on best approaches for assessing or defining maladaptive movement (Gümmer et al., 2015). However, the SEES-2 guideline is complemented by an updated Assessment Form that can be used in conjunction with the SEES-2 guideline to help the treatment team to collaboratively determine return to activity plans. The Assessment Form (see Appendix 1) offers a step-by-step guide to conduct a comprehensive assessment of an individual's movement history, goals, current movement, and risk levels. Use of this form is valuable to the comprehensive implementation of the SEES-2 guideline. It is intended to help clinicians in gathering required information to implement the guideline and facilitate individualized movement intervention.

Complimentary Psychological Intervention

Studies highlight the need for patients to engage in both the practice (in vivo activity) and process (psychotherapeutic intervention) of activity to address their relationships with movement (Calogero & Pedrotty-Stump, 2010; Kern et al., 2020; Mathiesen et al., 2023). There is no first line approach recommended for addressing movement during ED treatment; however, existing interventions/protocols may be helpful in addressing specific functions/symptoms of maladaptive movement. The SEES-2 has utilized existing exercise and eating disorder intervention protocols as a foundation to develop recommendation for determining the psychological interventions that may be used adjunctive to the activity recommendations (pp.32).

Use of the Compulsive Exercise Test and Semi-Structured Interview

There are many existing measures to assess maladaptive movement derived from varying conceptualizations of maladaptive movement (Harris et al., 2020; 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 part of the SEES-2 guideline as a standardized measurement of an individual's relationship with movement. Despite being a well-validated measure (Harris et al,. 2020), there are noted shortcomings in solely relying on CET scores to understand an individual's relationship with movement and inform appropriate intervention. For example, the CET does not account for problematic incidental physical activity or motor restlessness and does not consider how an individual's relationship with exercise may vary across bouts of adaptive and maladaptive movement. Thus, we recommend using the CET alongside clinical information gathered via a semi-structured interview (Harris et al., 2022). As such, we have also added a semi structed interview guide that complements the CET as part of the assessment form.

Application of Guideline

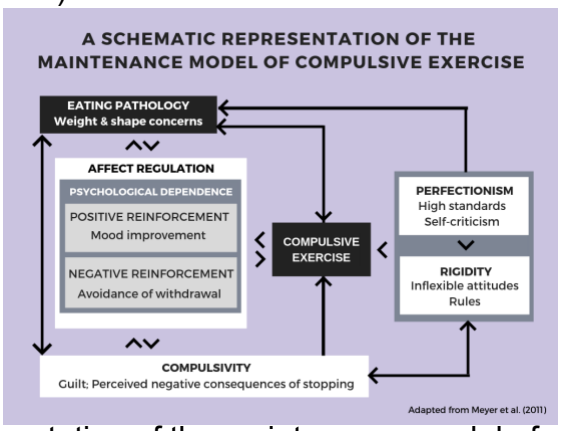
The SEES-2 guideline is a summary of current evidence and clinical practices for managing maladaptive movement during ED treatment. It is a tool to augment clinical judgment and aims to provide a standard of practice for movement interventions. In creating this clinical tool, we will review evidence-based strategies to support the implementation of the SEES-2 guideline and recognise potential barriers in the application.

Facilitating the implementation of SEES-2

The following are encouraged strategies for supporting the implementation of the SEES-2 guideline when working with individuals with an ED.

1. Increase Awareness of the Function of Movement in their ED

Conceptualising the role of movement within the ED is helpful for both the clinician aiming to address maladaptive movement as well as for the patient wishing to gain a further understanding of their relationship with movement. Meyer et al. (2011) presented an evidence-based model that may help in developing of this conceptualisation (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 movement 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 be helpful in helping patients understand how their relationship with movement developed and is maintained.

2. Use of Behavioral Contracting

Cook et al. (2016) recommend that developing a collaboratively written behavior contract may be useful in ED treatment. Contracts should be developed collaboratively with patients and other treatment team members, as well as being an ongoing, flexible process throughout the course of treatment (Yeager, 1992; Cobbaert and Rose, 2023). They may include goals, outcomes, expectations, rules, 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 movement within the parameters of the guidelines, and setting appropriate consequences.

3. In Vivo Exercise

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

4. Interdisciplinary Approach

Interdisciplinary treatment teams for those with ED are a key component for recovery (NEDC, 2024; Wonderlich et al., 2012). Clinical guidelines for ED recommend this 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 (see pp. 69) are often cited as key personnel in conducting group and individual movement 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 physical activity, conduct

fitness/functional capacity assessments, provide exercise-related education, and develop or monitor safety of movement programs given patient limitations/co-occurring conditions (Bergmeier et al., 2021; Blaszczynski et al., 2023; Lederman et al., 2016; NEDC, 2016). Further, physical therapists as part of the rehabilitative team can help assist with heightened falls risk (during ambulation, and standing from lying or sitting), and later, to complement nutritional rehabilitation during the medical stabilisation process (Laging, Brinton, Sabel, Gaudiani & Mehler, 2017).

5. Involve Social Support

Involving support people and carers during ED treatment may include providing collateral information, behaviour monitoring or supervision, supporting behaviour change, and provision of emotional support (National Institute for Clinical Excellence, 2017). The NICE guidelines (2017) highlight the following factors when involving carers in ED treatment: psychoeducation regarding ED and the impact of mental health issues on carers; information regarding available treatments; clinician awareness of carers potential feelings of guilt or responsibility related to their loved ones' ED; and that support people should be engaged with empathy, compassion, and respect; and note risks of carer burden.

6. Motivational and Collaborative Approach

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 rates of dropout, reduced ambivalence toward change, and increased treatment acceptability by both patients and clinicians (Geller et al., 2003). Geller and Srikameswaran (2006) recommend a collaborative patient-practitioner relationship may be helpful in establishing treatment non-negotiables, and upholding the values of patient safety, autonomy, and respect. Clear therapeutic boundaries continue to be paramount in collaborative settings to ensure medical and psychiatric safety, efficient use of treatment resources, and a level of patient and clinician responsibilities (Geller, Goodrich, Chan, & Srikameswaran, 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.

7. 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 activity 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.

Barriers to Implementing SEES-2

We recognise several potential barriers to implementing the SEES-2 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 both 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-2 guideline is not intended to replace clinical training/education. Thus, its effective implementation is limited by each clinician's skills and knowledge. The SEES-2 guideline should only be used by trained medical, mental health and accredited exercise professionals (pp.73) with expert knowledge in the physiology of ED.

3. Professional Attitudes & Perceptions of Movement and Eating Disorders

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. Difficulty with 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 Safe Exercise at Every Stage (SEES-2) guideline – 2nd edition was developed to facilitate clinical decision-making related to safe movement for individuals with ED symptoms. This step-up/down model involves three 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 movement and nutrition interventions to best support patients. These should include addressing factors contributing to the development and maintenance of maladaptive movement behaviours as well as 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-2 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. 45) 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 pp. 46). 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-2 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 appointments/work, cleaning/gardening, carrying groceries), occupational-related physical activity, 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 physical activity.

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 adult population (aged 18 and over). 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.69) before recommending an appropriate supervised exercise and psychoeducation plan. Please note, this does not preclude such groups from engaging in movement; however, we encourage that adaptations to the SEES-2 guideline for these individuals should 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. For children/adolescents and athletes, please refer to the SEES-Youth and SEES-Athlete guidelines respectively Finally, whilst purging as a behaviour is not included in the literature as a contraindication to exercise, we encourage practitioners to ensure a thorough and frequent assessment for individuals engaged in vomiting, laxative, or diuretic use and exercise 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-2 guideline is complemented by an updated Assessment Form that can be used in conjunction with the SEES-2 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-2 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 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, nor does it consider how an individual's relationship with exercise may vary across bouts. Thus, we recommend using the CET alongside 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.

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

Individuals with an ED 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-2 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 the process of determining the adjunct psychological interventions that could be recommended for patients managing their relationship with activity during ED treatment.

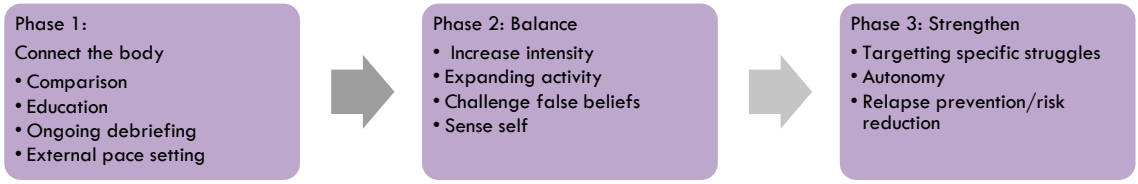
Assessment. The results of the CET and the semi-structured interview (Step 2 of the Assessment Form) will offer the baseline information used to determine the "Phases of Return to Activity" and the "Psychological Interventions" that can be utilized with your patients.

Phases of Return to Movement. Calogero and Pedrotty (2004) describe three overarching phases of return to activity. Phase 1*,* "connection to the body," focuses on the development of skills to foster awareness of the body and it's needs during activity (Calogero & Pedrotty, 2004; Duesund, & Skarderud, 2003). The goal of this phase is for patients to remain safe as they develop a relationship a process-oriented, rather than goal-oriented, relationship with movement that promotes life enhancing outcomes such as enjoyment, mind-body connection, and rejuvenation. 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 movement and use these internal signals to choose/adapt movement where possible (Calogero & Pedrotty, 2007). The range and intensity of activity can be expanded, e.g., modifying the duration, intensity, modality, and environment of physical activity. During this phase, other interventions may include challenging false beliefs about activity, expanding individual's repertoire of activities and environments, and trying new activities.

Phase 3 aims include fostering independence and strengthening the individual's ability to implement learnings into real world settings. Independent selection of activity and engagement is gradually encouraged. Targeting patient-specific difficulties with return to movement is core goal as well as development of a relapse prevention/risk reduction plan (Figure 2).

Figure 2. Phases of Return to Activity



These return to activity phases are loosely reflected in the psychological interventions recommendation section of SEES-2. Although not strictly applied, they can help guide the progression of activity and aim of the adjunct psychological interventions.

Psychological strategies for managing maladaptive movement. Within the overarching "Phase of Return to Activity", specific psychological interventions can be implemented. Clinicians may use the CET to identify elevated scores on 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 different phases of returning to activity. The interventions described in Table 1 correspond to each of the CET subscale. These initiatives are depicted in the assessment form (see Section 2 of the Assessment Form) and follow the subscales of the CET. Largely, the Phases of Return to Activity should guide the chosen psychological interventions and progress accordingly.

Table 1. Psychological Interventions

Rigidity	• Introduce flexibility into routine • Distress tolerance • Behavioural experiments
Compulsivity	• Habit-based approaches • Increase awareness of physical activity • 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 nutritional plan

SEES-2 Table 1. Risk Assessment

Level A Review weekly	Level B Review Biweekly	Level C Review monthly	Level D Review as required
Cardiovascular profile: HR<60bpm 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:** Positive 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 IBW (considering individual weight history & 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

SEES-2 Table 2. Movement Recommendations

Movement Components:	SEES Recommendations: 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 impact; social/games focus (excluding return to sport) (e.g. gentle Yoga and Pilates, table tennis, walking, swimming)	Moderate impact (excluding return to sport) (e.g. cardio classes, jogging)	High impact; return to sport (e.g. rugby, football, martial arts, basketball, hockey); individualised; or may return to previously maladaptive cardiorespiratory 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 resistance exercise
Setting	Indoor or outdoor			
Supervision	Medical supervision required	Medical OR friend/family	Flexible (social partner encouraged)	Flexible, progressing to unsupervised
Incidental/Occupation Activity	Seek reductions in incidental and occupational activity where permitted	Incidental/occupational activity is "counted" part of the activity plan	Unlimited but monitored incidental/ occupational activity	Autonomous incidental /occupational activity
Psychological Intervention	**Principles of Phase 1** Consider suggestions in *Facilitating the implementation of SEES* section Nutrition support Consider safe ambulation strategies & injury prevention in daily living tasks Explore tailored psychoeducation Identify unhealthy movement beliefs	**Principles of Phase 1 and 2** Continue relevant interventions and: Further challenge unhealthy movement beliefs Continue exploring & practicing attuned movement	**Principles of Phase 2 and 3** Continue relevant/outstanding interventions and: Option to increase movement intensity in conjunction with body awareness Set future treatment-aligned movement goals	**Principles of Phase 3** Continue relevant/outstanding interventions and: Address remaining aspects of movement relationship, renormalising & increasing autonomy Develop future movement plan in accordance with treatment plan & activity goals including focus on relapse prevention and support

Case example	Level A	Level B	Level C	Level D
Maria Describes self as very sporty as a child, "always outside." Played field hockey and lacrosse in high school. Prior to ED, enjoyed HIIT classes with friends ~3/week. During ED, struggled with compulsive cycling every day to manage negative affect. Goals include to reduce rigid rules/routines around movement and to be able to workout for health without getting "obsessed."	**Exercise programming:** Functional movement exercise (getting out of bed, safe lifting) with team member, practice alongside debriefing Practice static stretching (15 mins) 3 times/week **Psychological interventions:** Education about risks related to maladaptive movement Introduce debriefing and intuitive movement	**Exercise programming:** In-session body weight resistance exercises (max 10 reps) Play at the park with nephew (30mins) once/week Try one group class per week with sister at the gym (max 30min hatha yoga or Pilates) **Psychological interventions:** Practice body awareness Learn muscle relaxation and assertiveness for coping	**Exercise programming:** In-session rowing machine, moderate intensity cardio circuits (30 mins) then practice once/week at home Play badminton with friends Expand to different group classes with sister at the gym (no cycle but can include weights or dance class) **Psychological interventions:** Find local sports' leagues Begin using an exercise log at home to identify cognitions & urges during movement	**Exercise programming:** Attempt cycling with debriefing in-session Work toward group spin classes 1-2 times/week (45 mins) Soccer training 1/week (1 hr) Soccer match 1/week (90 minutes) **Psychological interventions:** Establish independence in decision-making when to/not to attend spin class Create relapse prevention plan
Nikolai Enjoyed athletics and swimming as a child but emphasizes that he was "never an athlete." During prior ED treatment, he was told to abstain from exercise so he has not been engaging in planned physical activity in recent years. Goals include "feeling strong in his body again," and including physical activity as part of a healthy lifestyle.	**Exercise programming:** In-session guided stretching (15 mins) Put away groceries with partner (max 15 minutes, no orthostatic change) **Psychological interventions:** Identify exercise goals and preferences Introduce debriefing and intuitive movement	**Exercise programming:** In-session Pilates with orthostatic change (30 mins) Try paddleboarding (low intensity) with friends (30mins) 1/week **Psychological interventions:** Observe and challenge social comparison Practice body awareness	**Exercise programming:** In-session weight-training/functional fitness resistance training (30 mins) Swim laps alongside friend (30mins) max 3/week **Psychological interventions:** Use body awareness and mindfulness to observe sensations and emotions	**Exercise programming:** Transition to swimming alone (45mins) Kayaking with friends (60min) **Psychological interventions:** Foster autonomy in movement Continue trying different movement types and finding a flexible exercise routine
Anya Disliked sports and physical activity as a child. Describes self as introverted and always feeling self-conscious in exercise classes in youth. Throughout ED has had a very "black and white" approach to movement, either going to the gym every	**Exercise programming:** In-session practice mind-body connection during stretching (15mins) **Psychological interventions:** Introduce intuitive movement and debriefing Practice breathing exercises	**Exercise programming:** In-session pole dancing (30mins max) Play croquet or table tennis or indoor bowling with friends 2/week **Psychological interventions:** Identify and address social comparison	**Exercise programming:** Try salsa or ballroom dance class with partner Go rollerblading or ice skating with friend **Psychological interventions:** Practice fostering joy in movement Try new types of movement	**Exercise programming:** Continue weekly dance classes with partner **Psychological interventions:** Address remaining "all-or-nothing" thinking about with exercise Develop future exercise plan in accordance with treatment plan & activity goals

day or avoiding exercise altogether. Goals include to find balance with movement and find movement she enjoys.		Identify and challenge unhelpful beliefs about movement		

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 exercise engagement. In addition, SEES-2 Table 1 (pp. 42) 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 exercise engagement. 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; Box 2) (Loucks, 2003; Loucks & Heath, 1994) 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. 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 exercise 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 exercise relative to metabolically active FFM) or 2) exercise engagement increases without an adequate increase in energy to meet heightened energy output needs (Loucks et al., 2011). Importantly, the numerous and detrimental effects of LEA can occur irrespective of an individual's body size, shape or weight and does not solely occur in those with ED (Gaudiani et al., 2012).

Box 2. Energy Availability explained

Energy availability explained:

Energy Availability (EA) = [Energy intake (EI) (kcal) - Exercise Energy Expenditure (EEE) (kcal)] / fat-free mass (FFM) (kg)

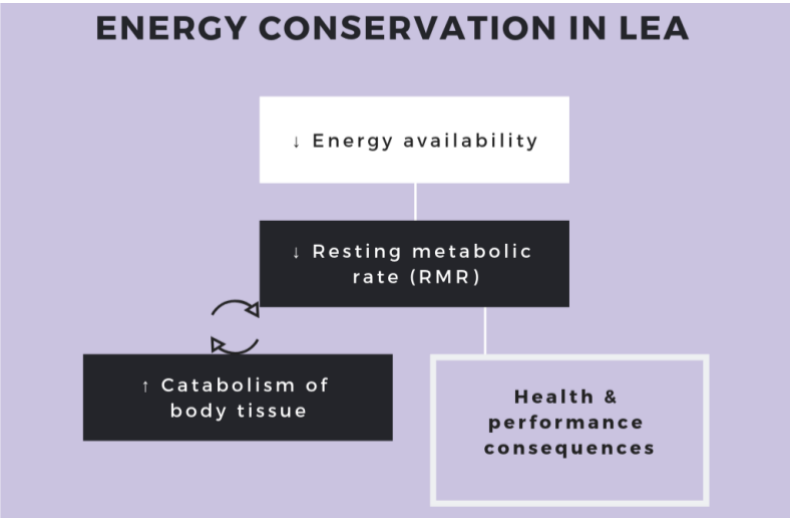
WHERE:

- **Optimal EA (OEA):** 45 kcal/kg FFM/day (188 kJ/kg FFM/day)
- **Low EA (LEA):** 30 kcal/kg FFM/day (125 kJ/kg FFM/day)

LEA can occur irrespective of body size and shape

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; see Box 3; Woods et al., 2017). This reduction in RMR can negatively impact both health and performance outcomes (Mountjoy et al., 2018; 2023). If energy availability falls below optimal levels, metabolically active tissue can breakdown to provide 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 energy, with muscle mass and visceral adipose tissue also beginning to atrophy. Other negative consequences, e.g., psychological distress (Gaudiani, 2018), can also occur during LEA.

Box 3. Energy conservation in a low energy availability state



Despite the serious consequences of LEA, there is not yet a standardized, reliable, and valid assessment protocol for measuring energy availability (Mountjoy et al., 2018; 2023). Current measurement approaches require specialized equipment and expertise and are burdensome, requiring individuals to keep an excessively accurate food and exercise log (Mountjoy et al., 2018; 2023). Adding to this complexity, exercise 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 that LEA. 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 (El Ghoch et al., 2013). Exercising 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 lack of sodium and potential magnesium. Individuals who are undernourished while engaging in exercise 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). Starvation is not, necessarily, a direct contraindication for exercise 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 exercise, due to the self-reinforcing cycle of restriction and exercise(Gianini 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. Mehler and Andersen (2017) describe three mechanisms 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 (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. This can be attributed to the concentration of acid and electrolytes in the relevant location and 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 individuals with an ED 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 (Green et al., 2016, 2019; Green et al., 2020). The following section provides an overview of cardiovascular impacts of unmodified exercise for individuals with an ED.

Box 4. Potential cardiovascular contraindications to exercise

Potential cardiovascular contraindications to exercise

The following conditions may contraindicate exercise engagement. These conditions may be applied througout each section of 'Cardiovascular health'.

- Tachyarrhythmias with uncontrolled ventricular rates
- Uncontrolled cardiac arrhythmias with hemodynamic compromise
- "Noticeable changes in heart rhythm by palpation or auscultation"
- "Sustained ventricular tachycardia or other arrhythmia… that interferes with normal maintenance of cardiac output during exercise… (and) that (has) the potential to become more complex or to interfere with hemodynamic stability"
- "Uncorrected medical conditions, such as… important electrolyte imbalance…"

Sources: ACSM, 2018; Fletcher et al., 2013; Gibbons et al., 2002; McCallum et al., 2006; Mountjoy et al., 2018; 2023.

Modifying exercise engagement, both with and/or without increased caloric and nutritional consumption, may favour improved energy and nutritional availability and the improvement of LEA-related cardiac consequences (Mountjoy et al., 2018; 2023).

Hypotension

Hypotension is defined as a low blood pressure (<90/60mmHg), where blood does not exert necessary pressure on the artery walls (American Heart Association, 2022b; Mehler & Anderson, 2017). This pressure is required to supply vital organs with adequate oxygen and energy to function; thus, low blood pressure contributes to inadequate oxygen and

nutrient availability, compromising vital organ functioning (Baker, 2017). Low blood pressure in individuals with an ED may occur due to purging or 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 J, 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 low concentration gradient and subsequent loss of circulating blood volume (MacArdle, 2015).

Hypertension

Hypertension, also known as high blood pressure (>140/90 mmHg) is a condition in which the blood vessels experience persistently raised pressure against them (Hypertension Society of Canada, 2022). Over time, hypertension can damage arteries, prevent blood and oxygen supply to the brain, heart, and body, result in heart enlargement, 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 BED have higher rates of hypertension compared to other EDs (Olguin et al., 2016). Although exercise can be protective against progression of hypertension and cardiovascular mortality risk, exercise for individuals with hypertension may require modification, medical supervision, or at times may 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 exercise 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 exercise, which could be exacerbated by a lack of energy and nutrition (Sharman et al., 2015). Although exercise is often recommended or those with high blood pressure (140/90mm/Hg), individuals with very high blood pressure (>200mm/Hg) 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). Arrythmias occur when dietary intake is inadequate to support both vital function and exercise engagement, relative to metabolically active FFM (Mountjoy et al., 2018;2023). 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 (<60bpm) and is a subtype of arrhythmia (American Heart Association, 2021a), often seen in AN (McCallum et al., 2006). The specific physiological cause of bradycardia is unclear (Mehler & Anderson, 2017). 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 et al. (Gibbons et al., 2002) warn that sustained arrhythmia can interfere with cardiac output responses during exercising and, in particular, that bradyarrhythmia (with the potential to become more complex or to impede hemodynamic stability) may contraindicate exercise (Gibbons et al., 2002). Fletcher et al. (Fletcher et al., 2013) add that uncontrolled cardiac arrhythmias with hemodynamic compromise may contraindicate exercise engagement (Fletcher et al., 2013). The American College of Sports Medicine (American College of Sport Medicine, 2018) recommends any noticeable change in heart rhythm by palpitation or auscultation may contraindicate exercise (American College of Sport Medicine, 2018). Likewise, McCallum et al. (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.

Box 5. Bradycardia: Fitness or ED?

Bradycardia: Fitness or ED?

- Both athletes and individuals with ED commonly exhibit a ↓ HR at rest.
- However, upon minimal exertion (such as sittng to standing), an athlete's HR will barely increase and quickly return to normal.
- Conversely, upon minimal exertion, an individual with ED's HR may increase excessively and take extensive time to return to normal.

Tachycardia

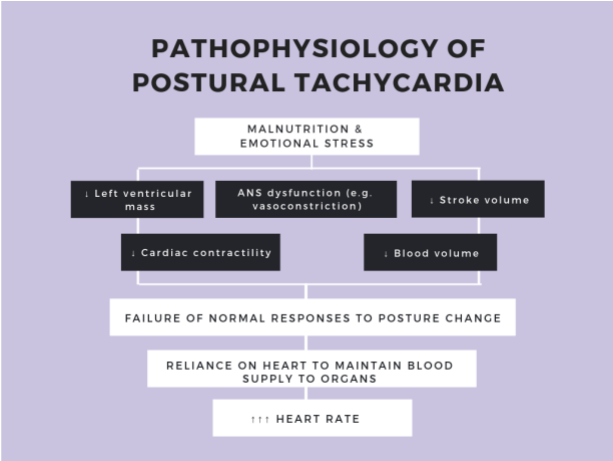
Tachycardia, a second subtype of arrhythmia, is a high resting heart rate of >100bpm (American Heart Association, 2021b). Tachycardia in AN may indicate more severe autonomic nervous dysfunction than bradycardia and suggests a greater likelihood of poor long-term outcomes (Tokumura et al., 2012). Tachycardia 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 a heart rate increases of ≥30bpm (≥40 bpm in those aged 12-19 years old) persists for more than 30 seconds See Box 6 (Grubb, 2005; 2008). 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 in an effort to return sufficient blood to the brain (Grubb et al., 2005). This compensatory effort is crucial to ensure 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 mimics the cardiac symptoms of Postural Orthostatic Tachycardic 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, suggesting that exercise may be gradually modified with symptom improvement (McCallum et al., 2006).

Box 6. Pathophysiology of postural tachycardia



Orthostatic Hypotension

Orthostatic hypotension is defined as a sustained drop in systolic blood pressure of ≥20mmHg or diastolic pressure of ≥10 mmHg following orthostatic (postural) change (Freeman et al., 2011; 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 vital contraction and relaxation process of the cardiac muscle (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 (Drew et al., 2010). QTc prolongation can occur during an ED but may also suggest independent and reversible causes such as low potassium, calcium, glucose, or magnesium, or the use of psychotropic medications (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, which prevents the heart from pumping vital blood supply to the body (American Heart Association, n.d.). 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 exercise and are negatively affected by purging behaviors, even at subclinical levels (Lindsay, 2017; Mehler, 2001; Mehler & Anderson, 2017).

Box 7. Electrolyte facts

Electrolytes:

- Electrically-charged particles or ions within the body.
- Key regulators of fluid, nutrients and waste products
- Commonly depleted with purging and in sweat

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).

Potential electrolyte contraindications to exercise

The following conditions may contraindicate exercise engagement. These conditions may be applied througout each section of 'Electrolyte Abnormalities'.

- Electrolyte imbalance and/or a hypohydrated state

Sources: Fletcher et al., 2013 and Thomas, Erdman & Burke, 2016.

Modifying exercise engagement, both with and/or without increased caloric and nutritional consumption, may favour improved energy and nutritional availability and the improvement of LEA-related electrolyte consequences.

Hypokalemia

Hypokalemia is a common electrolyte imbalance in ED, defined as low serum potassium. Potassium is a key electrolyte involved in normal cellular function, particularly in muscles and nerves (Stone et al., 2016). Hypokalemia commonly presents in individuals with an ED engaging in purging behavior (BN or AN-P) and is prevalent in approximately 14% of individuals with BN (Mehler & Anderson, 2017). Hypokalemia can also be triggered by malnutrition or the refeeding 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). 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).

Hypophosphatemia

Hypophosphatemia occurs mainly in AN and is defined as low serum phosphate, often as a result of refeeding, malnutrition, chronic diarrhea, or overuse of diuretics or alcohol (Agency for Clinical Innovation, 2017; Voderholzer et al., 2020). Phosphate is a core component of the energy (adenosine triphosphate) used to produce muscular work (McArdle, 2015). Symptoms of low phosphate include muscle dysfunction and weakness, abnormal blood oxygen levels, and irregular heartbeats (Agency for Clinical Innovation, 2017). Hypophosphatemia may also induce a state of confusion and delirium, anaemia, an 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 will 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). Low magnesium can lead to muscle tremors 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).

Hypercarbia

Hypercarbia, also known as metabolic alkalosis, is a common clinical imbalance in people with ED (Mehler & Anderson, 2017). Typically, a bicarbonate level on a serum chemistry panel of over 30 mmol/L in someone who purges should be considered a marker of chronic volume depletion/dehydration; however, many who abuse laxatives will appear to have a normal bicarbonate level due to a mixed acid-base state. Assume those

who abuse laxatives are volume depleted and should engage in modified movement protocols. Similar to other electrolyte disturbances, hypercarbia can occur as a result of purging. Metabolic alkalosis is often asymptomatic; however, extreme cases may result in short and shallow breathing and respiratory complications (Mehler & Anderson, 2017). 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 Sport Medicine, 2018) may contraindicate exercise engagement.

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 (McArdle, 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 (McArdle, 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 of individuals with an ED, metabolic alkalosis and acidosis were higher than their non-ED counterparts (Hundemer et al., 2022).

Biomedical Function Markers

Temperature: Hypothermia and Hyperthermia

Hypothermia can occur as a direct result of malnutrition and hypoglycaemia (Nishita et al., 1985), yet it can also persist beyond weight restoration (Luck & Wakeling, 1982). 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). Well before clinical hypothermia occurs, patients with LEA, regardless of body size, may develop acrocyanosis or cool/dusky-appearing hands and feet. In more advanced states, this coolness to touch may progress up the limb toward the trunk. While not dangerous in and of itself, acrocyanosis of malnutrition should be used as a proxy of LEA and a guide toward readiness for increased movement.

Conversely, hyperthermia can result from failed thermoregulation, 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 (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.

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). 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).

Transaminase

Transaminase, a type of enzyme, is 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 Click or tap here to enter text.(American Academy of Family Physicians. & Hustead, 1970; Gaudiani, 2018a; Hanachi et al., 2013; Voderholzer et al., 2020). For individuals with an ED, 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) or due to the reduction of blood flow through the organs due to myocardial dysfunction (Mehler & Brown, 2015), and can indicate vital organ failure (De Caprio et al., 2006). During exercise, a significant increase in the rate of amino acid catabolism occurs, placing higher functional demands on the already compromised liver

(Henriksson, 1991). Thus, exercising with elevated transaminase levels (most often seen in AN) may cause additional harm and exercise should be modified accordingly.

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). The presence of hypoglycemia can trigger a breakdown of both fat mass and FFM (i.e. muscle, bone, organs, etc.) in attempts to provide the brain with vital energy (Gaudiani, 2018). Exercising while hypoglycaemic harms the delivery of energy to the organs including the brain and working muscles (Mcardle et al., 2015). Exercise can also worsen hypoglycaemia and its' effects due to the high metabolic demand for glucose as energy during exercise (Mcardle et al., 2015). The exacerbation of hypoglycaemia 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 hyperglycaemia or elevated blood glucose (Canadian Diabetic Association, 2022) Exercise engagement, especially high intensity or anaerobic exercise, can exacerbate hyperglycaemia, increase the risk of ketosis, or cause insulin dysregulation (Lumb, 2014). Indications for how to manage exercise prescriptions based on glucose levels in individuals with DM type 1 and 2 are available (Lumb, 2014), however, there is a lack of research examining hyperglycaemia in individuals with ED.

Dehydration (Hypohydration)

Moderate exercise engagement over a one-hour period 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; Mehler & Anderson, 2017). Mountjoy et al. (2014) note that dehydration-induced haemodynamic instability can contraindicate any sport engagement (Mountjoy et al., 2014).

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 above 30kcal/kg of FFM/day, 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

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). Women 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).

Box 9: Functional hypothalamic amenorrhea: definition and causes

Amenorrhea:

- Menstrual cycle interval persistently >45 days and/or amenorrhea is present for ≥90 days (*regardless* of weight change or athlete / non-athlete).

Caused by:

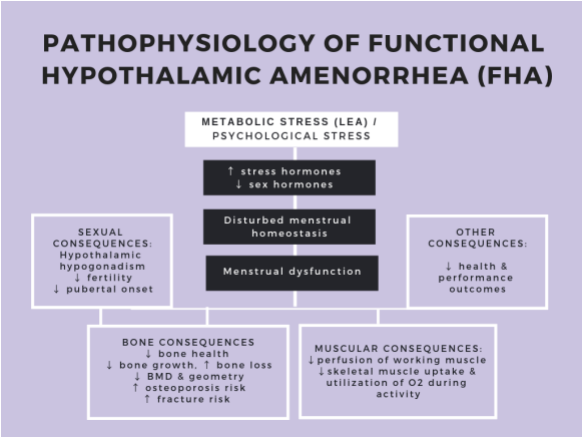
- **Metabolic stress** (LEA of ≤30 kcal/kg FFM/day (≤125 kJ/kg FFM/day) (*subclinical presentations can occur both above and below this threshold)
- **Psychological stress**

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; Gordon et al., 2017; Kandemir et al., 2018; Silveira, 2002). Increasing energy availability and consistent weight gain can improve metabolic hormone profiles rapidly; however, exercise engagement must proceed cautiously while hormone profiles normalize (Mountjoy et al., 2014).

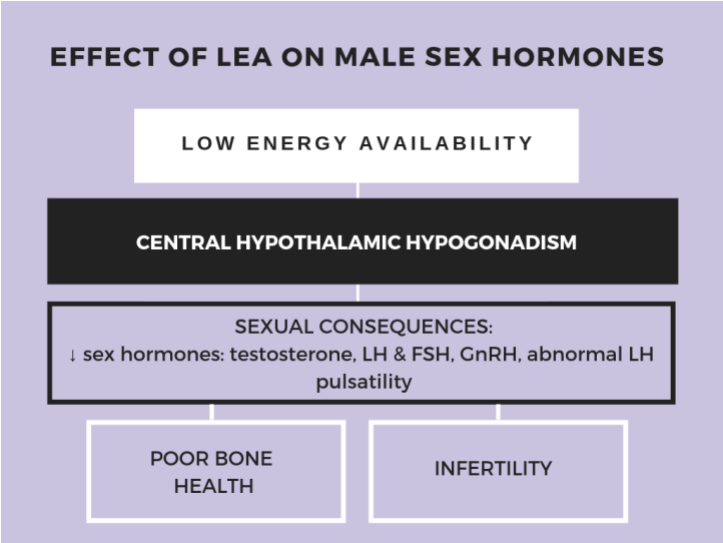
Box 10. Pathophysiology of functional hypothalamic amenorrhea



Male Sex Hormones

Sex hormones in males can be negatively affected in ED due to starvation-induced central hypothalamic hypogonadism (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 women, men 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).

Box 11. Effect of low energy availability on male sex hormones



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). BMI cannot solely or accurately depict health status; indeed, some individuals' 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 individuals with an ED, and a BMI <75% of median values for age, sex, and height is suggested to indicate hospitalization (Geller, Goodrich, Chan, Cockell, & Srikameswaran, 2012). Engaging in intense endurance or strength training exercise with a BMI <13.5kg/m^2 is 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;2023). Engaging in high impact activity <16kg/m^2 (Howgate et al., 2013), is suggested to be avoided due to the detrimental and widespread effects of LEA, and in fact anyone with this low a BMI should be very actively supported and overseen with any movement to be sure their weight is progressing toward normalization through appropriate nutritional intake.

Appropriate exercise engagement may also be determined via 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 weight loss of 5–10% in one month may contraindicate 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 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).

Box 13: BMI and health status

BMI and health status:

- BMI does not depict health status
- Some individual's weight is not affected at any stage of their ED
- This highlights the need to evaluate medical and psychological parameters of a person's health for appropriate information.

Low Bone Mineral Density

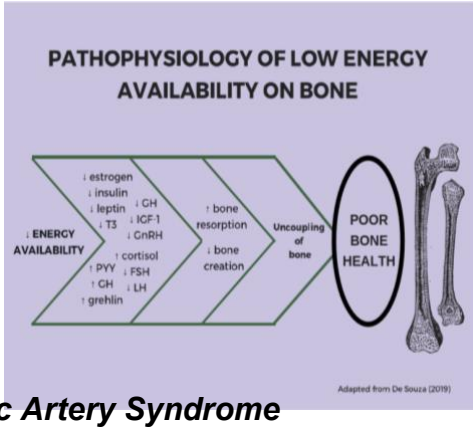
Bone mineral density (BMD) is the amount of mineral density, particularly calcium and phosphorous, present in a volume of bone. Low BMD occurs when chronic LEA triggers a physiological adaptation within the bone to conserve energy for the vital organ systems (De Souza, 2019). Bone adaptations in the 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).

Low BMD occurs in men and women, although sex differences may exist (Mehler et al., 2008). For example, one study suggests men with AN may display greater bone loss at the lumbar spine, as well as a faster rate of bone health decline, compared to women, with up to 65% of men experiencing low bone density as a symptom of their ED (Mehler et al., 2008). 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, permanent rounding of the upper back due to micro fractures (kyphosis) and may require the use of a walker aid or pain medications, which can cause dependency and constipation, amongst other negative sequelae (Gaudiani, 2018). LEA prior to puberty may be particularly damaging to bone, as it may directly stunt both vital bone growth, as well as important sexual development that contributes to bone growth (Schneider & Wade, n.d.). 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).

Howgate and colleagues recommend high impact activity 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). Importantly, if low BMD presents in the absence of low BMI, malnutrition, LEA, or sex hormone disturbances. strength training can improve low BMD in men and women (Watson et al., 2019).

Box 12. Pathophysiology of low energy availability on bone



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 seen 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, or due to renal filtration of insulin or due to high levels of carbohydrate consumption (Beumont et al., 1994). Thus, exercise may be contraindicated in the presence of peripheral edema (Beumont et al., 1994).

Comorbid Illnesses

Engaging in exercise with an ED can result in multiple risks, as outlined throughout this section. However, the severity of this risk may be amplified when an individual presents with both an ED and a comorbid condition. For example, despite the original modifications made to exercise for certain ED-related presentations, exercise may be contraindicated whilst the individual is under the influence of alcohol or other drugs (Rhodes, Temple, & Tuokko, 2011). Further, if an individual is living with diabetic retinopathy or severe nonproliferative diabetic retinopathy, certain exercise may be contraindicated (Grunberger, Taylor, Dons, & Gorden, 1983). Additionally, exercise may be contraindicated in the presence of peripheral edema (Beumont et al.,1993).

It is inevitable that some special populations will need further support and must be assessed by a medical team and, where accessible, an accredited exercise professional (see Glossary pp. 69) before recommending an appropriate supervised exercise plan. Please note that this does not preclude these populations from engaging in exercise; however, we encourage that adaptations to the SEES guideline for these populations must be done under the supervision of medical advice specific to their individual requirements. These populations may include (but are not limited to): Athletes, children/adolescents, and individuals with diabetes, osteopenia/osteoporosis, or other existing cardiorespiratory, vascular, metabolic, neurological, psychological or musculoskeletal complications. Finally, whilst purging as a behaviour has not been included as a contraindication to exercise, we encourage practitioners to ensure a thorough and frequent assessment for individuals engaged in vomiting, laxative, or diuretic use and exercise due to the compromising nature of these behaviours.

Exercise Contraindication, Modification, or Caution

Recommendations for exercise modifications and exercise contraindications prior to exercise engagement are summarized in Table 2. Interestingly, some of the medical complications and associated exercise recommendations were documented through non-ED research publications, and research guiding modification of specific times, types, and

intensity of exercise in the presence of each complication or contraindication is lacking. Table 2 highlights important gaps in the research literature on ED and exercise duration, type, intensity, and frequency to be able to provide science-based exercise recommendations.

Table 2. Summary of Exercise Recommendations for Adults

SYMPTOM	RECOMMENDATION	POPULATION
ENERGY AVAILABILITY		
Low Energy Availability	MODIFY	ED
Starvation	* H/I A & AN CONTRAINDICATED ON DAYS WHEN MEALS ARE SKIPPED	ED
Purging	*CONTRAINDICATED WHEN HYPOVOLEMIA IS PRESENT	GEN
CARDIOVASCULAR HEALTH		
Bradycardia	*ONLY SUPERVISED EXERCISE & WITH CAUTION	GEN
Tachycardia	INVESTIGATE CAUSE PRIOR TO ENGAGEMENT	GEN
Postural Tachycardia	MODIFY	ED
Orthostatic Hypotension	UNKNOWN	UNKNOWN
Hypotension	MODIFY UNTIL RESOLVED	ED
Hypertension	H/I & Vol CONTRAINDICATED	GEN
Prolonged QT	UNKNOWN	ED
ELECTROLYTE ABNORMALITIES		
Hypokalaemia	UNKNOWN	ED
Hypophosphatemia	CONTRAINDICATED	ED
Hypomagnesemia	UNKNOWN	ED
Hypercarbia	CONTRAINDICATED	GEN
Hyponatremia	CORRECT PRIOR	ED
BIOMEDICAL FUNCTION MARKERS		
Hypothermia	MODIFY	GEN
Hyperthermia	CONTRAINDICATED	GEN
Blood Urea Nitrogen & Urine Specific Gravity	*STRENGTH TRAINING ONLY WHEN NITROGEN LEVELS ARE NORMALIZED	ED
Transaminase	MODIFY	GEN
Hypoglycaemia	CONTRAINDICATED	GEN
Hyperglycaemia	EXERCISE WITH CAUTION CONTRAINDICATED when >250 mg/dl	GEN
Hypohydration	CONTRAINDICATED	ED
SEX HORMONES		
Amenorrhea/Functional Hypothalamic Amenorrhea (FHA)	MODIFY *HIGH IMPACT EXERCISE IS CONTRAINDICATED IN THOSE WITH FHA	ED
Low Female Sex Hormones	EXERCISE WITH CAUTION	ED
Low Male Sex Hormones	EXERCISE WITH CAUTION	ED
BODY COMPOSITION		
Body Mass Index (kg/m^2)	MODIFY *HIGH IMPACT EXERCISE IS CONTRAINDICATED WHEN BMI < 16KG/M^2 *CONTRAINDICATED WHEN BMI < 13.5KG/M^2	ED
Bone Mineral Density	ACTIVITY DEPENDENT	ED
Superior Mesenteric Artery Syndrome	ACTIVITY DEPENDENT	ED
Peripheral Edema	CONTRAINDICATED	ED

Note: ED: eating disorder sample; GEN: general population; *specific recommendations; H/I A& AN: High intensity aerobic and anaerobic exercise; H/I & Vol – High intensity and volume

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/metre² (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, similar to AN, is also 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).

Eating Disorder Not Otherwise Specified (EDNOS): A psychiatric diagnosis to encompass disorders of eating that do not meet the criteria for a specific eating disorder (Grilo & Mitchell, 2011).

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.

Healthy: An adjective that denotes that a behaviour (e.g., eating, exercise) is life enhancing, and beneficial to mental and physical wellbeing by objective, evidence based standards.

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).

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Appendices

Appendix 1. Assessment Form

The following is an assessment form that will determine a patient's safety to engage in movement throughout their time in treatment. Step 1. should be complete at the start of treatment with a team.

Please note that there is some overlap among Table 1, 2, and 3. However, the purpose of Table 1 is for treatment planning and gathering adequate information for assessing current exercise/activity engagement; whilst the purpose of Table 3 is to quantify the patient's relationship with movement.

Step 1. Initial Assessment

"I am going to ask you questions about your engagement in and relationship with activity. To start, we are going to define a few terms. *Exercise* is movement that is intentional and repeated, like going to the gym, or doing a yoga class. *Incidental activity*, which is when you are doing activity that part of everyday life like walking at the store, or to the bus stop."

1. Baseline Movement Engagement	
Type	Over the last **two weeks** what type of exercise have you engaged in? For example, do you go to the gym or attended fitness classes? What about other types of activity like hiking, walking, sports?
Frequency per week	Over the last **two weeks** how often have you engaged in the activities you just told me about?
Time/duration per session	Over the last **two weeks** how long have your activity sessions been on average?
Intensity	Over the last **two weeks** how intense is your usual activity? Are you out of breath? Or could you hold a conversation? Select one: Low Moderate High
Incidental activity	Over the last **two weeks,** do you engage in more "incidental activity," than other people? For example, parking far away to walk further or taking the "long way" to walk more? This may or may not have been a decision to move more, but in reflection would it be distressing/challenging if you weren't allowed to move as much as you have been? Select: Yes / No
Hyperactivity	Over the last **two weeks** do 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?

	Select: Yes / No

2. Movement History	
Exercise history:	Prior to your eating disorder, were you very active? How would you describe your motivations and types of exercise historically?
Sport participation history:	Do you participate in sport? Have you ever?
Previous exercise preferences:	What activities did you enjoy before you experienced difficulties with eating?
2.5 Movement Goal	
Current goals for activity/exercise:	What is your goal for movement once you complete treatment?

3. 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	

*If they are an athlete, ask if they do an hour of activity beyond their training requirements on most days.

4. Maladaptive Movement Presentation		
Subtype	**Question**	**Response**
Vigorous exercise	During the past **6 months,** have you consciously ensured to e.g. regularly run, bike, skate, swim or perform strenuous exercises such as sit-ups or push-ups, despite being underweight or physically weak? Important: Please exclude school sports from your considerations. What forms of exercise do you consciously engage in (e.g., running, cycling, skating, swimming, or perform strenuous exercise such as sit-ups or push-ups)? On how many days per week? How many hours per day/week did you spend exercising? Which rules did exist regarding your daily resp. weekly exercise routine?	
Marked increase in daily movement	During the past **6 months**, have you consciously ensured to e.g. bike to work instead of taking the bus, to take the stairs instead of the elevator, to carry out strenuous housework, to take long walks independent of the weather, or to carry out activities standing instead of sitting? Do you engage in these behaviors more than other people? What would happen if you did not engage in these types of daily movement? Do you continue to do these behaviors whilst injured/unwell? Does engaging in these behaviors affect your occupational/social functioning (e.g., make you late, take an excessive amount of time, affect friendships)? If yes, what types of daily movement do you do? On how many days per week? How many hours per day/week did you consciously increase your daily movement? Which rules did exist regarding your daily movement?	
Motor restlessness	During the past **6 months**, did you struggle to remain still without e.g. moving your arms, fidgeting with your legs, or tensing your abdominal or leg muscles? If yes, in which form did your restlessness appear? On how many days per week? How many hours per day/week were you restless? Which rules did exist regarding your restlessness?	

5. Exercise Profile Summary		
Current Activity Engagement (average across the last two weeks)	**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. Progress Markers

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 the SEES risk assessment, pp.45 . Where red = highest risk associated with exercise (SEES Level A) and green = lowest risk (SEES Level D). Grey = overarching criteria.

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

	Heart rate <60bpm* 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 SEES-2 Table 1. Risk Assessment on pp.45 the Safe Exercise at Every Stage Guideline 2 determine risk level

As of _____ patient _____ is in level _____
Date Name SEES Level

Reassessment is scheduled for _____

This patient has been cleared by safety team for this level of activity:

Signature _____

This has been shared with the treatment team:

Signature _____

Step 3. Movement and Psychological Recommendations

Activity Level _____

1. Movement Recommendations Using SEES-2Table 2. Activity Recommendations on pp.46 the Safe Exericse at Every Stage Guideline 2, 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 Activity Week Summary

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

2a. Overarching Phases of Return to Activity	
Phase 1. Connecting with the Body	**Completed?**
Psychoeducation	
Debriefing	
Phase 2. Expannig	
Challenging unhelpful beliefs	
Developing sense of self	
Phase 3. Expannig	
Addressing specific struggles	
Relapse prevention	
Autonomy development	

2b. Psychological Intervention Recommendations

Using the sub scale score from the Complusive Exercise Test and clinical judgement, determine which psychotherapeutic interventions could be useful to help your patient improve their relationship with movement across treatment. Higher subscale scores indicate greater pathology.

Rigidity	• Introduce flexibility into routine • Distress tolerance • Behavioural experiments	
Compulsivity	• Habit-based approaches • Increase awareness of physical activity • 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	• Assess exercise goals • Foster joy	

Appendix 2. Fitness Markers

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).

Clinically in EDs, fitness testing may be helpful in gauging cardiovascular health as well as assessing fitness throughout an exercise intervention (McCullum et al., 2006). Research studies have used a handful of laboratory 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 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 and potently 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 a range of important health and wellbeing outcomes such as cellular metabolism, bone density, glucose tolerance, musculotendinous integrity, muscular power, the physical ability to carry out activities of daily living, maintenance of functional independence, quality of life, mental health, immunity, and all-cause risk of mortality (ACSM, 2021). Importantly, muscular fitness can more effectively mitigate the risk of mortality than cardiorespiratory fitness alone (ACSM, 2021).

Muscle function is often 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 the development of 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 as well as the absence of equipment and trained professionals, make these

options very difficult to implement at the clinical level. In clinical settings, trained exercise professionals may opt for tests that are already in place (e.g., Handgrip dynamometry, 5-time sit-to-stand test) (Alcazar et al., 2018; Roberts et al., 2011) or that require little to no equipment (e.g., isometric wall squat test) (Mcintosh, 1998) with normative values. It should be noted that these more user-friendly protocols determine muscular strength only in the upper arm (handgrip dynamometry), but not in the lower extremities where the proposed protocols measure muscular endurance or power. Therefore, if equipment is available, a 6-10 Repetition Maximum protocol might be more beneficial to program exercise routines and assess progression at least in lower extremities (Kraemer & Fleck, 2007).

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 not a straightforward way to evaluate improvements in muscle mass during treatment. It is important to note that even when body weight or BMI has restored to premorbid levels, muscle mass and function remains diminished in some individuals with an ED 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 cheapest method is anthropometry; however, it has some important limitations. It is important the professional is properly trained to minimize technical error (most important in those with AN) (Esparza-Ros et al., 1982). The recommended variables to measure are waist, hip, mid-thigh and mid-arm circumferences, and mid-thigh and triceps skinfolds, which will allow to follow-up on both 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 must be performed, and feedback provided, with consideration of 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, it is important the BIA equipment allows segmental body composition analysis which will provide data on each segment of the body. We do note that these assessments are influenced by hydration, food intake, and time of assessment so should be conducted under standardized conditions. Further, due 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.

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 actually use these in typical clinical practice. In the case of 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 3. Fitness Marker Summary

Fitness Marker	Assessments	Observations
Maximal oxygen consumption	• Laboratory methods: Metabolic Cart & ECG • Field methods: 6-minute walk test or similar	• Often unavailable • Lacks ECG
Cardiac health	• Stress test (ECG) when using field method	• Useful with field tests
Muscle strength ***Muscle power*** ***Muscle endurance***	• 6-10RM • Handgrip dynamometry • Sit-to-Stand 5 times test • Isometric Wall Squat test	• Often unavailable & requires trained professionals. • Easy to apply & normative values available.
Muscle mass & Fat distribution	• Anthropometry: ○ *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. • Problems with very low BMI & following protocols is essential. • Often unavailable

Appendix 3. Movement Recommendations Tools

1. Movement 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				

* A MET (Metabolic Equivalent of Task) value is a unit that estimates the energy cost of physical activities, where 1 MET equals the energy expended at rest. For a list of MET values with corresponding activity examples, see the Compendium link on our website under the Resources tab. (https://www.safeexerciseateverystage.com/additional-resources)

2. Compendium of Physical Activity

The Compendium of Physical Activity can be found here: https://pacompendium.com/