THE ROLE OF ATHLETE SUPPORT TEAMS IN THE DEVELOPMENT AND MANAGEMENT OF REDS IN FEMALE UNIVERSITY ENDURANCE ATHLETES

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Abstract

Objective: Relative energy deficiency in sports (REDs) results from chronically low energy availability (when calories consumed cannot support calories expended) and is known to affect athletes' health and performance – particularly female athletes in endurance and aesthetic sports. University programs and support staff (coaches, physiotherapist, dietitians etc.) can profoundly impact athlete health behaviours both positively and negatively. Therefore, it is critical to examine how support staff may impact the development and management of REDs, specifically in high-risk populations.

Methodology: This study employed a mixed-method design (network analysis followed by qualitative interviews) with 20 female USport cross country athletes to explore: 1) what support staff are available for female USports cross country athletes and 2) athletes' perspectives on how their support system relates to the prevention and management of REDs.

Results: Results indicate that culture around REDs is positively shifting, however, there is still a need for greater awareness and open dialogue about REDs and symptoms. Athlete comfort around discussing REDs depends on their relationship with support team members, support staff's expressed openness to discuss REDs, and perceived knowledge and experience of support staff. Additionally, athletes tend to be more comfortable discussing REDs with female staff members - particularly when a strong relationship does not exist. Barriers to athlete disclosure of REDs symptoms include prioritization of immediate performance and stigma associated with disordered eating. University athletic departments should create environments that emphasize interdisciplinary support, and open dialogue around REDs, emphasizing the long-term performance and health detriments associated with it.

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Table of Contents

Abbreviations

REDs	Relative Energy Deficiency in Sport
LEA	Low Energy Availability
EA	Energy Availability
EE	Energy Expenditure
LCA	Low Carbohydrate Availability
AT	Athletic Therapist
S&C	Strength and Conditioning

List of Tables

Chapter 4:

List of Figures

List of Appendices

Chapter 1: Introduction:

This research mapped the support staff network of female university endurance athletes and examined athletes' perspectives on how these support systems relate to experiences of REDs. The results of this research are intended to inform support staff on their role in the development and treatment of REDs in a particularly vulnerable population. REDs is a syndrome characterized by physiological impairments due to low energy availability (LEA): when calories consumed are unable to support calories expended (Logue et al., 2020; Mountjoy et al., 2018). Physiological symptoms of REDs include impaired metabolic rate, endocrine function, menstrual function (in females), bone health, immunity, protein synthesis, cardiovascular health and decreased performance (Mountjoy et al., 2018). Although REDs is primarily defined and identified by physiological impairments due to LEA, there are a wide range of psychological and social factors that relate to the development and treatment of REDs (Ackerman et al., 2018; Mountjoy et al., 2018; Wasserfurth et al., 2020). For instance, while REDs can affect athletes from all competitive levels and disciplines, there is a higher prevalence amongst female athletes, particularly in elite aesthetic, endurance, and weight-dependent sports. These high-risk sports often have high energy output demands and external pressure for leanness that can lead to weight loss that may or may not be intentional (Wassurfurth et al., 2020).

Due to the interacting physiological, psychological and sociological factors relating to REDs, it is difficult to diagnose and treat the disorder. While most research has focused on the prevalence and physiological consequences of REDs, early identification and prevention are key to reducing REDs and accompanying health consequences. Athlete support teams can potentially influence athletes' development of REDs. Support teams often include physiotherapists, massage therapists, coaches, sports scientists, dietitians, psychologists and physicians. Research indicates

that support teams can profoundly influence athletes' health behaviours and weight loss practices (Artioli et al., 2010; Zawila eta al., 2003) and play a key role in identifying symptoms of REDS and disordered eating (Trattner et al., 2005).

However, the influence of athlete support teams has the potential to be both positive and negative. Recent media highlights the severe physical and psychological consequences when support staff are not well educated about REDs or abuse power to pressure athletes to lose weight. In 2019, high-school phenom and professional distance runner Mary Cain, recounted her experience with the Nike Oregon Project (at the time one of the most elite running groups in the US) to the media, claiming "when [she] first arrived, an all-male Nike staff became convinced that in order for [her] to get better, [she] had to be thinner… and thinner… and thinner" (Cain, 2019). This eventually spiraled into long term emotional abuse that led Cain to develop REDs, five broken bones, an eating disorder and suicidal thoughts. (Cain, 2019). At the University level, researchers have found that the use of body shaming, excessive weigh-ins and body composition measurements utilized by support staff at the University of Oregon and University of Colorado lead to disordered eating among female track and field athletes (Goe, 2021; Steinbach, 2023).

There is currently no research that examines what support is tangibly available for Canadian University athletes and very little research on the nature of athlete and support staff communication regarding topics such as REDs, and energy availability (EA). REDs can significantly impact athletes' physical, social and psychological development, and understanding the availability and value of the resources to athletes could provide an avenue for identifying gaps and potential improvements to the current system. Advancements in these social support systems can extend athletes' careers, and allow them to stay healthy, and perform optimally.

This research utilized a two-phased explanatory sequential mixed method design. Phase one of this research included a simple network analysis of support available for female university cross-country athletes. An individual ego-centric network was then created for each participant capturing the following:

1. Which support staff roles are represented in the athlete's sport environment network?
2. With which members of their support team (if any) have athletes had conversations about REDs and LEA with?
3. With which members of their support team (if any) would athletes be comfortable having conversations about REDs and LEA?

Phase two included qualitative interviews, allowing a more in-depth look at the athlete's experience with their support staff network with respect to REDs and EA. The network analyses examined the existing social structures and guided the qualitative interviews. Interviews with each athlete provided an opportunity for further investigation of athletes' individual experiences regarding REDs, whether athletes felt they had the support needed, and why they did or did not feel comfortable having conversations about REDs with certain support team members more than others. This research adds to the existing literature by examining the perspective of those most affected by REDs (the athletes) and allows for a better understanding of the role social structures play in the development and management of REDs. Investigating REDs from this unique perspective will allow University Cross Country programs to understand better what social resources athletes might be missing, which support staff members might significantly influence the development and treatment of REDS, and how support staff may positively or negatively impact the athlete's perceived experience of REDS.

Chapter 2: Literature Review

2.1 What is REDS/ How is it assessed?

The term REDs was developed in 2014 to expand on what was previously known as the female athlete triad (also referred to as *the triad*), characterized by disordered eating, menstrual dysfunction and poor bone health in female athletes (Mountjoy et al., 2014) A consensus statement on REDs by the IOC (2018) notes that, unlike the triad, REDs can occur among females and males and includes a wide range of symptoms ranging from physiological to social and psychological impairments. LEA, the primary etiology of REDs is expressed as a number based on energy availability (EA) and is calculated by measuring energy intake (EI) (kcal) minus energy expenditure (EE) (kcal), divided by fat-free body mass (kg) (Mountjoy et al., 2018). Research has found that the threshold for healthy EA levels is approximately 45 kcal/kg FFM/day, and under 30kcal/kg/FFM/day can lead to negative health implications after only five days (Loucks & Heath, 1994; Loucks & Thuma, 2003). Furthermore, only 1-2 weeks of LEA may be detrimental to athlete's health and performance (Vardardottir et al., 2024) and recent research indicates that even 3 days of LEA can result in detriments to bone formation (Papageorgiou et al., 2018). However, the threshold for what EA is required to have a regular menstrual cycle varies widely among females, and it is extremely challenging to measure energy intake and expenditure accurately (Mountjoy et al., 2018).

Adding to the complexity of REDs etiology; LEA can may result from intentional or unintentional inadequate EI, or excessive EE. Unintentional EE can be extremely common, particularly in endurance sports where athletes are engaging in high training volumes, often 20+ hours/week of high energy demanding cardiovascular training (Mountjoy et al., 2023). Additionally, recent research highlights the role of low carbohydrate availability (LCA) plays in

the development of REDs symptoms, and studies have demonstrated instances where athletes with LCA experience REDs symptoms, even with adequate overall EA (Fensham et al., 2022; Hammond et al., 2019; Hyashi et al., 2022; McKay et al., 2022;). This may occur in instances where athletes overemphasize protein or adopt low carb diets with the intention to lower body fat composition (Heikura et al., 2019; Mountjoy et al., 2023). The effects of LCA are particularly concerning for endurance athletes who depend on carbohydrates as primary fuel for endurance training. Athletes participating in high energy expending sports must be particularly careful to avoid LEA and LCA.

Due to the complex nature and recent development of the term REDs, a vast body of research examining the triad, LEA, and disordered eating will be relevant to the current literature review. For this literature review, it is to be noted that LEA, being the primary underlying cause of REDs will be used interchangeably with REDs. Because REDs is a recent term, research on the triad will also be included in this literature review. The triad refers to female athletes experiencing disordered eating, menstrual dysfunction and poor bone health – common signs of REDs and therefore relevant to the proposed study.

REDs occurs on a broad spectrum and is often (but not always) accompanied by disordered eating behaviours. REDs can result from excessive exercise or purposeful restriction of calories, but can also occur unintentionally when an athlete is not fueling appropriately for the high energy expenditure demands of their sport (Mountjoy et al., 2018; Ackerman et al., 2018; Wasserfurth et al., 2020). Research indicates that assessing endocrine-related risk factors, such as menstrual cycle in females and hematology tests in female and male athletes, is a more objective indicator of energy availability (Heikura et al., 2017). Amenorrhea (loss or disruption of the menstrual cycle) continues to be one of the key indicators of REDs. Numerous studies have

found amenorrhea to be extremely common among female athletes, with upwards of 40-50% of female high school, university, and elite athletes having experienced amenorrhea (Brown et al., 2014; Heikura et al., 2017; Jesus et al., 2021).

Although amenorrhea is a common symptom of REDs, it is possible to maintain a regular menstrual cycle while still experiencing LEA. Research examining active females showed that up to 20% of active females with a regular menstrual cycle are not ovulating, as determined by luteinizing hormone levels (De Souza et al., 1998; Prior et al., 1990), indicating that ovulation testing is a more appropriate test for LEA (Elliot-Sale et al., 2020, 2021; Loucks et al., 1998). Low estradiol and progesterone are also common indicators of LEA (Vanheest et al., 2014), therefore hormone testing via hematology is likely the gold standard of REDs assessment; however, requiring more extensive resources.

Due to inaccessibility of such testing, REDs is frequently identified and diagnosed based on symptoms presented by the athlete. This strategy of diagnosis can become convoluted due to the overlapping symptoms associated with REDs, low carbohydrate availability (LCA), and overtraining syndrome, which cause difficulties in accurately identifying prognosis of symptoms (Stellingwerff et al., 2021). Therefore, support staff members being aware of the complex symptoms and nature of REDs and LEA becomes critical. Much of the current research examines REDs relative risk based on a more accessible measurement; the LEAF-Q – low energy availability in females questionnaire – proven to be an effective screening tool for LEA risk (Melin et al., 2014). The LEAF-Q is often used in research to examine the prevalence and relative risk of REDs among athletes, which is well researched and will be highlighted throughout this literature review. However, it should be noted that the LEAF-Q does not examine social and psychological factors that relate to REDs.

2.2 What are the consequences and outcomes of REDs?

The consequences of LEA expand from performance deficit to serious long-term health repercussions. A cross-sectional study (Ackerman et al., 2018) surveyed 1000 athletes; classified as having either low or adequate EA. Results showed that those with LEA were more likely to experience menstrual dysfunction, poor bone health, metabolic issues, hematological detriments, psychological disorders, cardiovascular impairment, gastrointestinal dysfunction, impaired judgment, decreased training response, concentration, endurance performance and coordination, and increased irritability and depression.

LEA can cause performance detriments through missed training due to increased injury or illness. LEA is linked to poor bone health and early osteoporosis (particularly in women) by way of lower bone mass and altered bone mass metabolism (Ackerman et al., 2011; Goolsby & Boniquit, 2017; Papageorgiou et al., 2017). Consequently, bone injuries (such as stress fractures) are widespread in athletes with REDs (Tenforde et al., 2016) and athletes experiencing secondary amenorrhea are significantly more likely to report injury, pain, and notably - having had injury contribute to the end of their athletic careers (Ravi et al., 2023). LEA is also associated with fatigue, disrupted sleep (Woods et al., 2017) and increased illness (Drew et al., 2017, 2018; Heikura, 2018). Research has shown that athletes at risk of LEA miss training three times more due to illness than those not at risk (Logue et al., 2019).

Additionally, LEA can directly impact sport performance measures. Research has shown that amenorrhea is negatively associated with muscular strength, endurance, and neuromuscular performance (Tornberg et al., 2017), physical skills that are key for all athletes. Adequate EA is associated with positive adaptation to training overload, and LEA is significantly associated with non-functional overreaching – the inability to recover from a bout of intense training (Heikura et

al., 2017; Schaal et al., 2021). Finally, LEA can also be associated with subjective increased fatigue and decreased motivation and vigor, which may also lead to decreased performance (Woods et al., 2017). These direct health and performance implications demonstrate why REDs should be a top priority for athlete support teams.

2.3 Who does it affect?

A variety of factors influence athletes' risk of developing REDs. Although REDs can occur in athletes of all sexes and athletic abilities, it is most common in female athletes participating in elite sports (Ackerman et al., 2018). Additionally, athletes competing in aesthetic, endurance and weight-dependent sports are at the most significant risk of LEA (Mountjoy et al., 2014). Recent research has highlighted the prevalence and severity of REDs amongst athletes in such high-risk sports. A cross-sectional study examining LEA in European elite female endurance athletes showed that 65% were at risk for LEA, and 21% exhibited disordered eating traits (Fahrenholtz et al., 2022). Comparable results were found in a study assessing LEA in European Cross country athletes (Jesus, 2021), where 64% of athletes were at high risk of LEA (79.5% of females and 54% of males).

Sport-specific factors are key to understanding the development and progression of REDs. A cohort analytic study examined if triad risk was associated with illness and injury in collegiate athletes (Tenforde et al., 2016). Results showed gymnastics had the highest portion of athletes at a moderate-high risk of the triad at 56%, followed closely by lacrosse (50%), cross country (48.9%), and swimming/diving (42.9%). Athletes with moderate triad risk were twice as likely to sustain a bone stress injury as low-risk athletes when controlling for age and sport. However, cross-country runners accounted for 64% of total bone stress injuries, suggesting that

symptoms of LEA may be expressed differently in different athletes and sport-specific factors (such as ground impact in distance running) may lead to different health impairments.

Energy demands and perceived performance advantages also vary across different sports and play a role in athlete's development of REDs. For example, endurance sports often involve extremely high caloric output for training, and even slight unintentional under-fueling can compound over time and lead to energy deficiency. On the other hand, aesthetic sports such as dance, gymnastics or figure skating involve an artistic presentation component, where athletes are often judged on their appearance and may experience perceived pressure for leanness, leading to disordered eating.

Athletes often experience initial success with weight loss in sports that favour leanness, which leads them to strive for continued weight loss that eventually becomes maladaptive and develops into disordered eating behaviours (Rodriquez et al., 2009). Athletes may come to believe that lighter weight will result in better performances and body appearance and weight-loss remains a primary consideration for athlete's nutrition choices (Zawila et al., 2003). This belief can be initiated or reinforced by teammates, coaches, or other social pressures (Wassurfurth et al., 2020). A case-control study (Krentz & Warschburger, 2011) examining eating disorders in German elite aesthetic sport athletes showed that the athletes reported higher rates of eating disorder symptoms than matched non-athlete controls – however, the two groups did not differ in terms of body image dissatisfaction. The primary predictor for disordered eating in the athletes was a drive for leanness to improve sports performance. This performance drive further emphasizes the need for preventative measures against disordered eating and REDs, specifically among high-performance athletes.

2.4 Psychological factors that relate to the development and treatment of REDs

In addition to the severe physiological and performance determinants, several psychological consequences are associated with REDs. LEA is linked to increased irritability, mood disturbance, anxiety and depression (Ackerman et al., 2018; Charlton et al., 2022; Woods et al., 2017). It is important to note, however, that psychological factors may be a consequence of REDs or a predisposing factor influencing the development of REDs. For example, anxiety, perceived stress, and perfectionism can cause an athlete to want to alter their body for performance, leading to LEA (Schofield & Sims, 2020). In a systematic review and meta-analysis, depression, anxiety, eating attitudes and drive for thinness were significantly associated with functional hypothalamic amenorrhea (Bonazza et al., 2023). Low self-esteem, perfectionism, drive for achievement, and desire for control have also been linked to the onset of eating disorders in female collegiate athletes (Arthur-Cameselle & Quatromoni, 2011). Psychological drive for thinness is associated with excessive energy expenditure in exercising women (De Souza et al., 2007), and trait anxiety has been shown to mediate the relationship between disordered eating modeling and compulsive exercise (Scott et al., 2020). Psychological factors may also worsen symptoms and delay or prevent treatment of REDs (Langbein et al., 2021).

Alternatively, even unintentional LEA can disrupt the endocrine system and elevate stress hormones in athletes, increasing perceived stress and anxiety (Mountjoy et al., 2014; Schofield & Sims, 2020). A longitudinal study (Shanmugam et al., 2014) of 122 athletes found that scores on a depression subscale positively correlated with eating psychopathology when controlling for baseline depression scores, and athletes' initial levels of eating psychopathology predicted depressive symptoms six months later. These results indicate that long-term disordered eating patterns may be a significant risk factor for developing mental illness. Research also indicates

that LEA can lead to increased cortisol levels, which is associated with an increased risk of anxiety and depression (Melin, 2019). However, it is not clear whether caloric restriction is the primary cause of elevated cortisol levels.

Qualitative research aids in addressing the difficulty of identifying psychological impairments as a risk factor or symptom of REDs (Langbein et al., 2021; Schofield & Sims, 2020) and emphasizes the complex interactions of psychological and social consequences of REDs. In-depth interviews of twelve endurance athletes with past or current REDs revealed that every athlete reported experiencing significant psychological distress associated with LEA (Langbein et al., 2021). In some instances, athletes described pre-existing disordered eating behaviours. In contrast, for many athletes, the onset of REDs occurred alongside perceived psychological mechanisms such as low self-confidence, perfectionist tendencies, high-achieving traits, and need for control. Similar results were found in a qualitative study on current or former lightweight rowers who experienced symptoms of REDs, reflecting on their experience with cutting weight for their sport (Gilbanks et al., 2022). Participants described a wide range of physiological and psychological impairments resulting from LEA – many that continued after the end of their sporting careers. Common themes described by the athletes associated with cutting weight included mood disturbance, disordered eating, social withdrawal, poor emotional regulation, negative body image, and guilt and anxiety around eating behaviours. Of the six retired athletes who participated in the study, 100% reported a continued damaged relationship with food and body image after retirement.

The research highlighting complicated psychological implications associated with REDs and EA is consistent with research on eating disorders in sports. It is theorized that psychological traits often associated with successful athletes, such as high achievement orientation,

perfectionism, persistence and obsessive-compulsive tendencies, are also common in those with eating disorders (Bratland-Sanda & Sundgot-Borgen, 2013). The overlap of LEA, disordered eating and poor psychological well-being accentuate the importance of prioritizing psychological health in athletes to ensure that the traits that make athletes successful do not become maladaptive. Identifying whether psychological symptoms are predisposing or symptoms of REDs remains a challenge; however, efforts to prevent and treat early signs of REDs – psychological or physical – can only conversely benefit both the athletes' physical and psychological well-being.

2.5 Social factors that relate to the development and treatment of REDs

2.5.1 Motivational climate and athlete health/development

Teammate, coach and support staff influences can profoundly affect athlete health and optimal development (Hamer et al., 2021; Charlton et al., 2022). Athletes are often in a situation where their teammates and coaches are the people they spend the most time with, significantly influencing their development. Motivational climate and team dynamics have been linked to health-compromising behaviors in athletes and play a significant role in whether athletes thrive in sport or experience negative social and psychological outcomes (Appleton & Duda, 2016; Duda, 2013; Waldron & Krane, 2005). For example, Duda (2013) emphasizes the importance of a coach creating an empowering motivational climate. An empowering motivational climate involves coaches creating a social and psychological atmosphere emphasizing effort, team growth, athletes' feelings and perspectives, and empathetic social support for athletes, allowing them to feel valued as people outside of sport. This environment is positively associated with athletes' overall enjoyment and self-esteem and negatively associated with devaluation, reduced accomplishment and physical symptoms of ill health (Appleton & Duda, 2016). The alternative –

a disempowering motivational climate – was also positively associated with burnout. Duda and Kim (1997) found that a perceived ego-oriented climate (where winning and athlete vs. athlete competition is prioritized over development) was associated with poor body image, self-esteem, and physique anxiety in female gymnasts. Creating a more task-involving climate – which involves more cooperative activities emphasizing development over winning and has been linked to athletes feeling greater closeness with coaches (Olympiou et al., 2008) – may effectively reduce body image concerns amongst athletes. Additionally, recent research demonstrates that mature coach-athlete relationships which put emphasis on trust and open communication can serve as a preventative factor to the development of ED's and D.E behaviour (Limstrand et al., 2024). These results indicate that the social environment, often dictated by coaches, can profoundly affect athletes' physical and mental health.

2.5.2 Teammate influence

Along with coaches, teammates can also influence team motivational climate. Teammates can positively or negatively influence eating psychopathology (Aruthur-Cameselle et al., 2017; Engel et al., 2003), and research suggests that teammates significantly influence athletes' perceived pressure for weight loss (Reel et al., 2013). Qualitative interviews with female collegiate athletes reveal teammate pressure and modelling to significantly influence the development of eating disorders, particularly when coupled with sport-specific factors, including pressure to perform and team-sanctioned weigh-ins. Psychological traits may also interact with teammate modeling of disordered eating behaviors to influence prognosis. For example, perceived teammate eating disorder modeling and weight pressure is positively correlated with athlete anxiety, depression and exercise psychopathology (Scott et al., 2019).

2.5.3. Coach and support staff influence

Coaches critically influence athletes' physiological and psychological health (Wassurfurth et al., 2020; Appleton & Duda, 2016; Beckner & Record, 2016; Stirling & Kerr, 2013). Research has shown that athletes look to coaches as a primary source of guidance for health and nutrition information (Zawila et al., 2003), and in some instances, trust their coaches on advice around weight loss more than parents, dieticians or physicians (Artioli et al., 2010). Coaches' interpersonal communication with female athletes can heavily influence athletes' body image and health choices (Beckner & Record, 2016).

Initial weight loss can often be associated with short term positive results for the athlete, therefore, approval or positive reinforcement from coaches with such results may unintentionally reinforce disordered eating behaviors (Langbein et al., 2021). When coupled with a sport culture that overemphasizes short term results, this may put athletes at particular risk for developing disordered eating tendencies. An ideal coach-athlete relationship should enforce high performance *and* health; however, there are cases where coaches abuse power and emphasize short-term success over long-term health and performance (Wasserfurth et al., 2020). Alternatively negative comments regarding athletes' bodies and weight can lead to athletes feeling pressure to alter their bodies and is associated with negative body image and disordered eating behaviors (Coppola et al., 2014; Kerr, Berman & De Souza, 2006; Muscat & Long, 2008).

Coaches' influence can range from positive to highly negative – bordering abuse. For example, in recent New York Times articles – *I Was the Fastest Girl in America Until I Joined Nike*, and *Female College Athletes Say Pressure to Cut Body Fat is Toxic* – athletes of collegiate and elite teams recount instances where coaches utilized body shaming, public revealing of body composition test results, and direct pressure on athletes to lose weight and sacrifice health for athletic performance (Cain, 2019; Thames & Abrams, 2022). This type of perceived emotional

abuse from coaches is associated with profound psychological, emotional and performance detriments (Stirling & Kerr, 2013). Apart from cases highlighted in the media, a study examining body image and disordered eating among female Australian athletes in both "leanness and non-leanness" sports found that 60% of elite athletes from leanness-focused sports have felt pressure from coaches to alter their body shape (Kong & Harris, 2013). Examples of pressure from coaches concerning weight loss emphasize the importance of having a breadth of different support personnel available for athletes and a system where a single coach is not the sole holder of power and influence over athletes.

However, it is essential to note that coaches may not be deliberately causing harm to athletes but may lack the knowledge to provide sound advice on fueling and energy availability. A review by Charlton et al. (2022) stresses the importance of coaches' knowledge of REDs, theorizing that the high prevalence of REDs may primarily be due to coaches' lack of knowledge. A knowledge gap has been identified among elite, collegiate and high school coaches. At the elite sport level, a scoping review and qualitative interviews revealed that of 5 Australian national sporting organizations, only one organization (rowing) had formal education for coaches (Hamer et al., 2021). Several studies have assessed high school coaches' knowledge of the triad, revealing that over 75% of high school coaches have not heard of the triad (Brown et al., 2014; Pantano, 2016).

Coaches– particularly male – may feel apprehensive to discuss sensitive topics such as body image with athletes out of fear of being inappropriate, or simply lacking guidance on how to discuss these topics without causing additional harm (Plateau et al., 2014; Sabiston et al., 2020). Athletes and coaches report a lack of open conversation around issues of weight loss and performance, and often coaches may not consider topics of disordered eating their responsibility

to address (Limstrand et al., 2024). This barrier may be further exasperated by coaches' preconceived notions of what an eating disorder might 'look like', where they do not suspect disordered eating behaviors unless it is visible (Plateau et al., 2014). In some cases, this may lead coaches to doing more harm than good; potentially commenting on athletes' bodies, assuming disordered eating cannot be present for athletes they perceive as not fitting into the lean sport ideal (Plateau et al., 2014; Engel et al., 2003).

Outside of coaches, other support staff can also play a critical role in identifying and treating REDs. Tenforde et al. (2020) assessed knowledge of the triad and REDs among physicians and health professionals at a sports medicine conference. Of the 163 participants, 76% were aware of the triad, whereas only 29% were aware of REDs, and 13% reported being comfortable treating REDs. These results suggest that many healthcare professionals need to become more familiar with current research and guidelines around LEA, seeing as REDs is a more recent and inclusive term. It also indicates that healthcare professionals working with athletes must be educated on REDs to increase treatment comfort.

Athletic therapists (ATs) are often primary sources of injury and health-related issues treatment among athletes at the collegiate level, are more likely to have training on health specific issues, such as REDs (Lodge et al., 2021), and are therefore able to share knowledge and experience with athletes. However, there is still a need for more formal education on REDs for ATs. A cross-sectional study assessing AT knowledge of the triad and REDs (Kroshus et al., 2018) found that almost all 285 participants reported having heard of the triad, but only 32.98% had heard of REDs. Additionally, if a female athlete reported not having a regular menstrual cycle, 47.85% of respondents indicated that they would refer the athlete to a sports medicine physician. However, only 29.45% indicated that the athlete would be screened for disordered

eating, indicating that there may be general guidelines for female athletes having a disrupted menstrual cycle. However, support staff such as ATs should be better educated on REDs and its consequences to prevent or treat REDs.

2.6. Potential for positive influence

Support staff can also play an active role in preventing REDs in athletes. Qualitative interviews with elite female endurance coaches suggest that effective communication and proactive approaches can prevent REDs (Schofield et al., 2022). The effectiveness of these strategies requires support staff to have increased knowledge of REDs and for both athletes and support staff to be comfortable discussing REDs and LEA. Research indicates that underreporting of athletes' menstrual irregularities could contribute to REDs being left untreated (Miller et al.). A qualitative focus group (Verhoef, 2021) examined reasons female athletes may not report menstrual irregularities. Results revealed the normalization of amenorrhea, shame, and prioritization of sport performance as the primary reasons for not reporting amenorrhea. The authors suggest that having athletes, coaches, trainers, and doctors better informed and willing to discuss topics such as menstrual cycles may help to reduce the taboo around the topic.

The physical, psychological and social determinants of REDs have been well-researched. It is evident that REDs is highly prevalent and has severe consequences. Coaches are often viewed as those with the most influence over athletes' health behaviors. Research is beginning to examine how the structure of athlete support networks can affect athlete health outcomes. At the Olympic level, having an integrated support team is key to reducing injury and illness. Research indicates that key elements of a successful support team include; regular communication among support staff and athletes, proactive treatment, the presence of an overarching team leader (physician), and a clear organizational hierarchy (Dijkstra et al., 2014; Dijkstra & Pollock., 2014, Sporer &

Windt., 2018). This research discipline primarily examines instances of injury and illness at the elite level. At the University level, however, there is no research indicating what support staff are available for these athletes. Additionally, with university athletes being particularly vulnerable to developing REDs, athletes' access to and communication with support staff could play a critical role in developing and treating REDs. It is important to consider the role of the wider support staff network for athletes, particularly in instances where coaches may be abusing power.

Chapter 3: Methods:

3.1 Participants

Participants for this research included 20 female USport varsity cross-country athletes. With the intention of having as many USports programs represented as possible, athletes for this study came from 17 different Usports schools that had athletes participating at the 2023 Usports Cross Country Championships. Elite female endurance athletes are at elevated risk of developing REDs. University athletes are particularly vulnerable as athletes competing at an elite level but at a critical stage of development. University athletics are the foundation for elite and national team development, and the experiences athletes have at this time can heavily influence their future in elite sport. These athletes are also at a stage when they often live away from home for the first time, with social circles significantly compromised by their teammates and coaches. At this stage of development, athletes heavily rely on guidance from coaches and other support staff.

Usports – the primary sports league for Canadian University athletes – currently includes 56 schools and over 14,000 student-athletes (USports, 2021). Of the sports identified as high risk for developing REDs, cross-country remains the most commonly available through Usports, hosting over twenty active female USports cross-country programs. Due to the size and spectrum of Usports, athlete's competitive levels vary greatly. For the current research, higher performing USports athletes based on their qualification and participation in the Usports Championships were prioritized. Participants were recruited through purposeful and theoretical sampling, utilizing the researcher's personal networks within USPORTS. Emails were sent to current Usports cross country coaches to pass along to the female cross-country team. Additionally, athletes were messaged personally from several different schools to maximize the number of different schools represented in this research.

3.2 Paradigm

An explanatory sequential mixed methods design was utilized, backed with a pragmatic and critical realist paradigm. Critical realism assumes that an objective reality does exist – for this research, an existing network of university support staff for athletes and their tangible influence on athletes' training and competition environments. However, this reality was studied/observed through the lens of those experiencing it, which is subjective and context-dependent (Oliver, 2012). This research examined the support network available to university athletes and how that network relates to the development and treatment of REDs, assuming that athletes hold a critical perspective to answer the research question and are the primary beneficiaries of this research. A mixed methods design effectively captured the objective reality regarding support available for athletes and their perceived effectiveness of that support.

3.3 Design

This research applied a two-phased explanatory sequential mixed methods design, where quantitative data was collected first and analyzed, which informed the qualitative data collection (Fetters et al., 2013). This design differs from other mixed methods designs such as exploratory sequential (where qualitative data is collected first) or congruent (where qualitative and quantitative data are collected and analyzed within the same time frame). The chosen mixed method design allowed for an initial objective analysis, as well as a more comprehensive analysis through qualitative means. Phase one included an ego-centric network analysis (Borgatti et al., 2018), mapping each individual athlete's support staff network. The ego-centric network involved one primary ego (the athlete), multiple nodes (support staff) and ties connecting the athlete (their connections). For each participant, an ego-centered network analysis was created (see appendix A for examples). Phase two comprised of qualitative interviews with each athlete,

based off their own ego-centered network. Any questions that arose after the initial analysis were addressed through qualitative interviews; primarily addressing the nature of conversations athletes have had with support staff and reason for comfort discussing REDs with some support staff opposed to others.

3.3.1 Phase 1 data collection

The individual ego-centric network analyses for each athlete were based on their responses to three primary questions, addressed via Qualtrics: Who is in the athlete's support network, have athletes had conversations about REDs and LEA with the members of their support teams, and would athletes feel comfortable having conversations about REDs and LEA with members of their support team? It was, first and foremost, important to tangibly know what support staff is available for athletes. Second, the current nature of communication between support staff and athletes was examined, which identified whether support staff are currently having discussions about REDs with athletes. Finally, examining an athlete's comfort in having conversations in the future with support staff was critical to guide future directions for interventions.

The questionnaire first asked if the participant had heard of REDs or LEA, and then provided comprehensive list of potential support team members (primary coach, assistant coach, strength coach, athletic therapist, dietitian/nutritionist, sport psychologist, physiotherapist, massage therapist, exercise physiologist, or other; please list) and athletes selected an option (yes/no/NA) for each of the three questions in regards to that specific team member (I.e. Please select the support staff members you have access to, of these support staff members you have access to, please select which members you have had conversations with about REDs/LEA, of the support staff members you have access to, please select which members you would you feel

comfortable having conversations with them about REDs/LEA). REDs and LEA were defined for athletes at the beginning of the survey. For simplicity's sake, no differentiation was made between dietitians and nutritionists. It should be noted that although there is a significant difference between qualifications of a dietitian versus a nutritionist, most athletes used the terms interchangeably or reported not knowing the difference. Because this research is examining the athlete's perspective, the differentiation between the two positions was not deemed significant for this research.

3.3.2 Phase 1 analysis

The survey results were presented using a centralized network analysis -- a visual display of members of a social network and their relationships (Hambrick, 2017). Network analyses, while commonly used in sociology, are not often utilized in sport psychology but have great potential to examine further social interaction and the power of social networks in sports (Nixon, 1993). Each participant served as the central node of the network, with their existing support network displayed as additional nodes (i.e., circles) surrounding the athlete. Edges (lines) connecting the athlete to their surrounding support network will identify whether they have had, or would have conversations about REDs/LEA. Two different colored lines differentiated the two scenarios (blue solid indicating they have had conversations with that support staff member and red dashed indicating they would be comfortable doing so). The final result displays a visual, case-study-like representation of the range of support staff available and the communication patterns connecting them, from each athlete's perspective.

3.3.3 Phase 2 data collection

Stage two of the research design utilized qualitative interviews to get a more in-depth view of the athlete's experience. A preliminary analysis of the network analysis served as a

partial guide for interviews. Interviews addressed questions such as*: Do you have personal experience with REDs or LEA? You indicated you discussed REDs with this member of your support team - was the conversation initiated by yourself or the team member? Why or why did you not indicate you would be comfortable discussing REDs with certain support team members? What might make you more or less comfortable discussing these topics? From your perspective, what can support team members do to help prevent or treat REDs? Are you missing any support that you believe might help to prevent or treat REDs?*

3.3.4 Analysis

Immediately after each interview, the researcher engaged in reflexive memoing, identifying what themes from each interview stood out to the researcher and why, as well any questions that arose and might be addressed in future interviews. Following each interview and memoing session, audio recordings were transcribed via Descript. Each audio recording and transcription was reviewed by the researcher, serving as an initial analysis. After the transcription and initial listening of each interview, a table (created to track and organize data into categories) was filled out by the researcher. Examples of categories include reasons for athlete comfort, when the athlete first heard about REDs, and what conversations they've had about REDs). This table and the researcher's memos served as a key tool in creating initial codes and ensuring rigorous multiple layered of data analysis.

Thematic analysis – involving researchers immersement in data, generating of codes which lead to themes, reviewing and naming of themes, and re-analysis of text for specific themes (Braun & Clarke, 2006) – was used to find patterns among participant responses. Themes were identified by the prevalence of participants who speak to a certain topic and its relation to the research question. Following creation of initial themes, the researcher engaged in

line-by-line coding for the first 10 interviews completed. Among these themes was a category for "other" - that which the researcher deemed as important but did not fall within the initial categories.

Upon completion of coding for the first 10 interviews, themes were re-evaluated to ensure they reflected the data, and new themes were created based on the 'other' categories. Some themes were changed based on the data within them, and in some cases multiple themes were combined into a single theme, or a single theme divided into two separate themes due to the wide range of variance seen within. For example, the initial theme "Awareness of REDs" was separated into two separate themes; Athlete's awareness and experience with REDs, and support staffs' awareness and openness to discuss REDs. This came to fruition when it was apparent that support staffs' awareness of REDs was a major contributor to athlete's comfort discussing REDs. For the remainder of the coding process, through 20 interviews, the constant comparison method was used to ensure the themes were capturing the range of experiences among athletes, and names and description of themes were altered all the way up until the final writing process. The primary researcher also utilized their academic supervisor as a critical friend to ensure a level of objectivity and an additional perspective was being taken to account throughout the analysis.

In alignment with best practices for mixed methods, theoretical integration was utilized to merge data from stages 1 and 2 (Fetters et al., 2013), and results from network analyses and interviews are analyzed and presented concurrently using visuals and quotations to connect the data from the questionnaire with athletes' thoughts and experiences. This integration of data served as a final stage of analysis, creating case-study-like profiles for each athlete (appendix A). In alignment with the critical realist paradigm, the completion of these profiles, along with the

presentation of overall themes highlight the importance of understanding each athlete's unique experience in addition to recognizing common themes which may be more practically applied.

The primary results of this study include presentation of four themes, with fourteen subthemes, which can be pragmatically used to develop guidelines for support staff regarding the prevention and management of REDs. The strength of this research lies within the mixed method design where the network analysis highlights the importance of social networks and ties, and qualitative interviews provide an in-depth examination of underlying mechanisms – *how* does the athlete's existing network influence their experiences and perceptions of REDs?

The current research examines what social support is currently available for university athletes and how that support relates to the development of REDs, a highly prevalent syndrome known to significantly impact athletes' health and performance. Current literature demonstrates the severe physiological and psychological implications of REDs. However, there is a need for more transdisciplinary research on REDs due to the complex nature of diagnosis and treatment (Schofield & Sims, 2020). To effectively prevent and treat REDs among high-risk university athletes, it is key to first examine what the current multidisciplinary support system encompasses and how the athletes might utilize it to prevent and treat REDs. The implications of this research expand beyond performance implications and allow universities to better understand how their current support system might be helping or hindering the development of REDs in athletes. Understanding the gaps in the current system and how athletes are affected will have a broad range of positive implications for athletes' long-term physical and psychological health and well-being.

Chapter 4: Results

4.1 Overview

Results from phase 1: network analyses were used as guides for phase 2: semi-structured qualitative interviews. The two phases were then analyzed concurrently, where each participant in this study demonstrated a unique experience relating to support staff available, conversations they have had (or lack thereof) about REDs, and with whom they are comfortable discussing REDs, and why. Results will be presented, beginning with an overview of results from the network analyses, followed by themes found in qualitative interviews. However, rather than a strict distinction, integration of both qualitative and quantitative results will be utilized throughout, to demonstrate the connection between each athlete's network and their experiences described in qualitative interviews.

4.2 Phase 1: Network analyses

The results from the network analysis varied greatly, ranging from instances where athletes had extensive support resources and several conversations with multiple support staff about REDs to those with limited support resources and little to no conversations about REDs or related topics. Table 1 displays each athlete's network size (number of support staff available to them, provided by their university athletic department), the number of support staff they have had conversations with about REDs, and the number of support staff they would be comfortable having conversations with about REDs.

Table 1:

Size of athlete support network, number of conversations about REDs, and number of support staff each athlete is comfortable having conversations with.

Athlete	Total network size	Total conversations had	% Staff Having Conversations with	Total comfortable with	% Comfortable with
1	5	1	20.00%	3	33.33%
2	6	1	16.67%	3	33.33%
3	6	1	16.67%	2	50.00%
4	7	0	0.00%	3	0.00%
5	7	3	42.86%	4	75.00%
6	5	0	0.00%	3	0.00%
7	6	2	33.33%	5	40.00%
8	6	3	50.00%	3	100.00%
9	6	3	50.00%	3	100.00%
10	6	2	33.33%	5	40.00%
11	6	1	16.67%	6	16.67%
12	3	2	66.67%	2	100.00%
13	4	0	0.00%	2	0.00%
14	8	2	25.00%	6	33.33%
15	4	1	25.00%	3	33.33%
16	3	1	33.33%	2	50.00%
17	8	2	25.00%	2	100.00%
18	5	0	0.00%	3	0.00%
19	7	2	28.57%	4	50.00%
20	5	1	20.00%	2	50.00%

Average	5.65	1.4	25.15%	3.3	45.25%

Table 2:

Support Staff athletes have access to, have discussed REDs/LEA with, are comfortable discussing REDs/LEA with, and percentage of support staff athletes are comfortable with which athletes have been utilized to have discussions about REDs/LEA.

Support Staff	% Having access to	% Having talked to	% Comfortable Talking to	% Comfortable being utilized
Coach	100.00%	45.00%	70.00%	64.29%
Assistant Coach	80.00%	43.75%	81.25%	53.85%
Strength & Conditioning Coach	85.00%	0.00%	35.29%	0.00%
Dietitian/Nutritionist	65.00%	53.85%	100.00%	53.85%
Sport Psychologist	70.00%	28.57%	64.29%	44.44%
Athletic Therapist	65.00%	0.00%	38.46%	0.00%
Massage Therapist	35.00%	0.00%	0.00%	0.00%
Physiotherapist	65.00%	7.69%	46.15%	16.67%

4.2.1 Who is in the support staff network?

On average, each athlete has a support network of five to six team members - ranging from three to eight. Most athletes described their resources and number of support staff as adequate. Table 2 displays which type of support staff roles are commonly present for athletes, with primary coach being the most common (100% of athletes having access to) and massage

therapist being the least common at 35%. At least 80% of athletes had access to a primary coach, assistant coach, S&C coach, and some injury support personnel (only one athlete did not have access to either an AT, physio or massage therapist).

Dietitian/nutritionist and sports psychologist were both positions where athletes who did not have access to these support staff indicated that they were lacking. For example, Athlete 12, who only has access to a primary coach, S&C coach, and sport psychologist, indicated that "[she] would definitely say a nutritionist or a dietician…one that the team trusts" would be a valuable resource. Athlete 16, on the other hand, has access to a primary coach, assistant coach, and athletic therapist, and discussed how she believes a sport psychologist would be a good resource "because they're usually good at having those awkward conversations".

Several athletes described accessing an external physician (sports medicine or family) who was not formally part of their team support staff through the University or other connections. A physician was the most common support resource that athletes indicated they were missing on their team. As will be discussed further in themes, the value of a physician was less related to their formal education or title and more related to their degree of sport-specific knowledge and holistic approach, which will be discussed further as an emerging theme.

4.2.2 Actual vs. possible conversations

Figure 2 displays which support staff roles are commonly present for athletes, and of those who have access to each type of support staff, what percent of athletes have had conversations about REDs with that support staff member, and what percent are comfortable doing so. For example, 65% of athletes have access to a dietitian, and of those who have access, 53% have discussed REDs with their dietitian, but 100% would feel comfortable doing so. Of this 53% who discussed REDs with their dietitian (n=6), 67% had experienced REDs or

symptoms of REDs, and 33% had reported never having symptoms of REDs. However, of the 65% of athletes who had access to a dietitian (n=13), there were four athletes who reported having had symptoms of REDs, but never discussing REDS/LEA with their dietitian. This further indicates a gap where resources can be utilized for athletes who may be more vulnerable to having or developing REDs.

With the wide range of support staff available for athletes, a similar trend can be seen with the number of support staff athletes have had conversations with and the number of support staff they feel comfortable talking to. Four athletes reported having never had any conversations with support staff about REDs, whereas two athletes indicated they have had conversations with 50% of their support staff - this being the highest rate. Overall, dietitians/nutritionists, primary coaches, and assistant coaches were the support staff members with whom athletes reported having had the most conversations about REDs (54%, 45% and 44%, respectively). Similarly, dietitians/nutritionists were consistently reported as support staff that athletes would be comfortable discussing REDs with, closely followed by assistant coaches and primary coaches at 81% and 70%, respectively.

A more detailed look at varying support staff (Table 2) shows that athletes are more comfortable talking to certain support staff than others. For example, 100% would be comfortable talking about REDs to their dietitian, whereas 0% would be comfortable discussing REDs with their massage therapist, further emphasizing the importance of understanding what causes an athlete to be comfortable discussing REDs. However, in many instances - such as with team dietitians/nutritionists or assistant coaches- the lack of conversations is often not because of athlete discomfort discussing the topic.

Figures 1 and 2 indicate a gap between the amount of support staff athletes are comfortable discussing REDs with and the amount they have had conversations about REDs. On average, athletes indicate feeling comfortable talking about REDs to 45% of their support staff; however, they only have these conversations with 25%. This gap indicates an area for improvement, where support staff are not utilizing the position, they are in to have important conversations about REDs. Closing this gap might be particularly important for certain support staff members. For example, there is a large gap between the number of athletes who are comfortable talking to their sport psychologist, and the number of athletes who have talked to their sport psychologist. This may be critical, because athletes who had discussions with their support staff about REDs noted the benefits of talking to someone who understands the complex psychological undermining of REDs and disordered eating. Athlete 20 describes her conversation with her sport psychologist about REDs which involved "addressing that high energy expenditure" and "insecurities about not training as much as other people" (Athlete 20).

Alternatively, some support staff such as S&C coaches and massage therapists may not play as crucial a role when it comes to identifying and managing REDs. Although there may be benefits to any support staff who have a strong relationship with athlete (as will be indicated in phase 2 results) discussing REDs with athletes, results indicate that these are not typically the support staff athletes are having discussions or seeking to have discussions about REDs with. However, one athlete indicated that they had discussed REDs with their physiotherapist. The conversation was initiated when the athlete " was having a hard time recovering from an injury…[the physiotherapist was] asking more about my eating plans... and they're like, okay, maybe you should speak to a dietician..." (Athlete 8). This conversation highlights the importance of support staff who work with injured athletes being able to identify the signs and

symptoms of REDs, communicate and integrate with other support staff members, and connect athletes with further help if needed.

4.3 Phase 2: Qualitative interviews

Within each athlete's unique experience, five themes emerged from the qualitative interviews, exploring the athlete's experience and reasons for comfort in discussing REDs while still acknowledging the individuality of each experience. These themes are: 1) athlete experience and awareness, 2) nature of conversations, 3) factors influencing comfort, 4) barriers to disclosure, and 5) proactive and interdisciplinary care regarding REDs.

4.3.1 Theme 1: Athlete experience and awareness of REDs

Throughout the interviews, athletes discussed: 1) varying levels of awareness of REDs and LEA, 2) their personal experiences with REDS, and 3) the role of sport culture. Along with increased literature on REDs in recent years, participants report a recent increase in awareness of REDs in themselves, their teammates, and their support staff, with still much room for greater awareness.

4.3.1.1 Athlete experiences:

Throughout the qualitative interviews, athletes described their struggles with REDs, with 50% of participants identifying as having had REDs at some point and 20% being unsure but believing they have experienced some symptoms of REDs, leaving only 30% as identifying as never having had REDs. These results further emphasize the spectrum of which REDs can occur. For example, Athlete 9 describes how she previously had REDs and believes she is still on the "borderline of REDs." Athlete 11 experienced REDs in high school and is still cautious about staying in energy balance: "I've gone through phases where… I've never had any explicit symptoms, but I've just noticed I've had a serious increase in mileage. So I've been sometimes…

I'll notice a little late [referring to her menstrual cycle].... Like, oh, I need to be eating more. I need to be resting more". These examples demonstrate that REDs is not a syndrome - as described by participants- where "you either have it or you don't… there's a lot of stages in between" (Athlete 4).

Of those participants who identified as experiencing REDs, a wide range of perceived underlying mechanisms existed. Athlete 20, for example, believes she developed REDs through unintentional overtraining: "During COVID I didn't have anything to do…. I was probably doing, I don't know, running 80 to 100k per week, but also skiing, and also on the trainer bike. So maybe I was doing 15 to 20 hours of training a week, which was a lot more than I used to, and I got a stress fracture". Alternatively, Athlete 7 does not believe she "got to the point where [she] had an eating disorder, but definitely some disordered habits". Within the 32% of athletes who had not experienced REDs to their knowledge, there was still significant mention of how difficult it can be as an athlete to remain in energy balance:

> "I know I definitely, as a female runner, have to keep track and make sure that I'm eating enough every day. I have had teammates and people who are quite close to me experience symptoms similar to REDS, for sure. And I definitely think it's a condition that's very prominent in our sport" (Athlete 6).

In addition to the high prevalence of REDs that was reported, participants asserted how common REDs is among their teammates: "I definitely know of a few that have been actually diagnosed. But basically everyone, every female athlete, that I've been a teammate within cross country specifically has had at least symptoms of it".

Participants described the challenge of identifying signs and symptoms of REDs. When asked if she had ever experienced REDs, Athlete 12 responded:

> "I honestly don't know, I don't think so, but, I know that I have to work on fueling and eating enough, so it's kind of hard to tell. The symptoms aren't always - other than just like losing your period. That's the main… that's the most obvious for me. But other than that, I don't really know what to look for" (Athlete 12).

Amenorrhea was the most common symptom of REDs athletes discussed experiencing, presumably because it may be easier to identify than other more subtle symptoms that can occur outside of REDs, such as injuries, illness, or increased fatigue. For example, when asked about their experience with REDs, participants tended to respond whether they had experienced amenorrhea. Athlete 19 describes her experience with primary amenorrhea and how she "didn't get [her] period until [she] was 20-21" which was her only known symptom of REDs. In contrast, other athletes reported losing their period throughout high school or university, and many also reported oligomenorrhea described as "period fluctuations" (Athlete 17).

4.3.1.2 Awareness

The difficulties in identifying REDs emphasize the importance of both athletes and support staff having greater awareness of all the signs and symptoms of REDs and being able to appreciate the nuances of symptoms. Overall, participants discussed how awareness of REDs has increased in recent years- particularly compared to their high school years. A common theme amongst athletes was a lack of awareness in high school: "I didn't know what REDs was until university when people started talking about it. In high school and stuff, I was also running a bunch, but I wouldn't have any clue about what it really is" (Athlete 17). When discussing their experience with REDs, many participants experienced REDs in high school with inadequate knowledge and resources: "I would say now I have the appropriate support. I think that there was

definitely a long time where I didn't have those resources. And I think that's kind of the main reasons why I experienced it for so long" (Athlete 1).

However, participants discussed an increase in knowledge and awareness among university athletes. Athlete 7 describes how athletes are more open to discussing REDs presently than in the past: "The door has really been opened and most people are quite comfortable… I do feel like the conversation has changed quite a lot, even just in the last five or so years". Every participant in this study reported having heard of REDs before participating in this research. However, it should be noted that there was a panel discussion held at the 2023 USports cross-country championships. Two participants had not heard about REDs until that panel: "it was a little like alarming… to realize how present it is and also realize that it was the first time I was putting it together and really hearing about it" (Athlete 13). The need for greater awareness still was echoed among participants, particularly for athletes – as reflected in their network analyses – who have not had many conversations with support staff about REDs. For example, Athlete 2 describes how it would be helpful to have more education for athletes and coaches:

> "I feel like, It's not very talked about at all, like I haven't had any of them actually ask me specifically about [REDs], but I think also just more education on knowing…how to tell if you have it or, or the symptoms of it would be really helpful because I think a lot of people don't link their symptoms to that necessarily".

It was also stressed that with support staff increasing their awareness of REDs, it is also essential that they understand the nuances of the disorder: "I feel like it's important that the person I'm talking to doesn't automatically categorize me… because it's kind of a spectrum. I think everyone who does distance running has an intense personality and wants to be doing more. So the line is really not that clear" (Athlete 20). Participants repeatedly described a greater

need for education on REDs symptoms for athletes and support staff: "I think also giving awareness to the actual coaches more so, like my head coach, for example, doesn't really have any knowledge on it" (Athlete 8).

4.3.1.3. Sport culture:

Along with awareness, participants expressed that the culture around REDs, eating behaviors, and body image has shifted positively in recent years, especially compared to their high school experiences. Several athletes discussed negative experiences regarding REDs while working with support staff. Most of these experiences occurred during high school or early University years, with athletes expressing how recently they've had primarily positive experiences with their support staff. Athlete 1 describes how "in the past [she] definitely had coaches or people kind of make comments about body weight or like things that [athletes] should or shouldn't be eating…but at the moment, things have been really good". Participants described other negative experiences such as coaches calling the athlete "bigger" for a runner (Athlete 11), telling athletes to go on diets or be careful not to gain weight, and nutritionists/dietitians overemphasizing "race weight"(Athlete 12).

Another common theme discussed by athletes was that of support staff or teammates normalizing amenorrhea. Participants had a range of experiences; some described it as something that is normalized; others believed that most people now know that amenorrhea is a serious health problem. Several athletes discussed how, particularly in high school and early University years, they had experiences where doctors and nutritionists would normalize the loss of the menstrual cycle. Athlete 19 describes how in her first year of university, she "knew it wasn't great that [she] hadn't got my period, but doctors and stuff would just say, 'Oh, it's normal if you run a lot'." Athlete 12, emphasizes that athletes tend to have mixed views on this concept; "And

then University… I find that it's sort of mixed. For example, like losing your period, some people think it's almost normal. And then there's others who are like, no, that's not normal" (Athlete 12). On the other hand, some participants described their support staff as being very proactive about enforcing the importance of having a regular menstrual cycle; "Cause he [coach] was really good at like… he would, if anybody kind of like lost their period would really be like, 'Hey, we need to get that back before we ramp up training.'" (Athlete 19).

Following a similar trend as athlete and support staff awareness – there is still room for more significant improvement in sport culture. Participants commented on the general notion that as distance runners, there is a built-in pressure to look a certain way, and it is common for athletes to compare bodies:

> "I know that like just being in long distance sports, definitely seeing your competitors, I think that there's lots of pressure for people to look a certain way. A lot of people think that they need to be slimmer and lighter in order to run longer and faster. So I think I haven't had any like, anybody telling me that I need to lose weight, but I think that something that a lot of people might struggle with is looking at other teammates and competitors and comparing their bodies to theirs" (Athlete 2).

Additionally, athletes commented that there is still often stigma associated with REDs and disordered eating. This concept will be further elaborated on as a significant barrier to athlete disclosure of REDs symptoms.

4.3.2 Theme 2: Factors relating to athlete comfort discussing REDs

Each athlete network analysis binarily examined whether athletes are or are not comfortable discussing REDs with each member of their support staff. However, qualitative

interviews allowed for an in-depth analysis of what level of comfort athletes have with each support staff and why. This theme of athlete comfort can be divided into five sub themes which emerged from qualitative interviews, that describe athletes' primary reasons for comfort discussing REDs with support staff. These themes include: 1) Athlete's relationship with the support staff member, 2) the support staff's awareness and *expressed* openness to discuss REDs, 3) *perceived* knowledge and experience of support staff by the athlete, 4) the support staff's gender, and 5) Athlete's age and experience in USports.

4.3.2.1. Athlete and support staff relationship

One of the most common themes that arose when athletes described their reasons for comfort in discussing REDs was their relationship with the support staff member. The quality of their relationship is partially related to how long they have known the support staff. When discussing relationships with coaches (who are presumably the support staff that athletes have the most daily contact with) first-year athletes or those who recently transferred schools discussed how not having worked with their coach for very long played a role in their comfort discussing REDs: "my coach is new and I don't have that relationship with him yet… I've been with my strength and conditioning coach now for three, four years. So I feel like that's kind of why I would feel more comfortable." (Athlete 2).

Athletes described being more comfortable with support staff they visit more frequently. Strength of relationship was particularly critical for comfort when referring to support staff who might not have specific areas of expertise relating to REDs, such as coaches, physiotherapists, massage therapists, S&C coaches, and ATs: "I would say I have like a more personal relationship with my coach and athletic trainer. We spend more time with them, so they know a little bit more

about how we work as an individual and what our personalities are like outside of training" (Athlete 1).

Of support staff whom athletes did have the opportunity to spend adequate time with, and therefore develop a relationship, personality factors and the perceived closeness of relationship played a role in athlete's comfort level: "His personality; he seems like he would be someone who's receptive and, you know, every time we go in, even if it's not our assigned time, if we go in on a different time, he'll come up, talk to us, address us by name, be like, 'anything bugging you?', whatever" (Athlete 11). It is also critical that athletes feel they have a relationship with the support staff members where they can discuss issues outside of running. For example, Athlete 20 describes how her coach does not express openness to discuss more complex, emotional topics: "He's a good coach, but he's a coach that's really focused on training plans and race goals and stuff. And when someone has a bad race - he's been getting better- but he's just someone that's not super good at talking to people when they're having difficulties. Like he tries, but it's just, he's not really like an open person that you feel like you can talk to about anything". Athletes who described having a closer relationship with their coach highlighted personality traits such as trustworthiness, approachability, and compassion: "You can notice people's empathy and compassion…I think I'd go to certain people who I felt were would be more compassionate and want to listen about it" (Athlete 5).

The age of the support staff was an additional factor that athletes discussed when describing their relationship with their support staff members. Although being close in age was not mandatory, several athletes discussed how having a good relationship with a support staff because they were close in age, or previously an athlete, and someone they could relate to: "I think she was like two years out of grad school and we related on so many levels… she was

super, super helpful in all like her physio treatment. And I just know that the way she went about things would have been really supportive if [REDs] had ever come up (Athlete 13).

4.3.2.2. Support awareness and expressed openness

Closely interlacing with the relationship and communication between athletes and support staff, athletes described how their comfort discussing REDs increased when support staff deliberately expressed their openness to discuss REDs and demonstrated it was a topic that they are aware of and care about. This theme is well exemplified by Athlete 4, who describes how her coach was someone she initially might not have been comfortable discussing REDs with; however, when he encouraged the team to attend the USports panel on REDs, this shifted the athlete's perception of her coaches' priorities and openness to discuss REDs:

> "My coach, he's male and a lot older than me...that already just doesn't immediately make me feel comfortable about that. But the fact that he was the one who said 'hey, there's this panelist that you should go see and we should all go see this and I'm interested in this too'. I think that kind of just opened the door of like, oh, okay, maybe he could be somebody safe to talk about this with, just because he's already willing to learn about it … he seems like somebody who would very much care about that and be willing to like change training if something's happening".

Several athletes discussed the idea of a coach "opening the door." Regardless of the coach's age, gender, or formal education on REDs, Athletes described feeling appreciative of their coach's active effort to learn more about REDs and start conversations:

"The fact that they're even aware about it, so the fact that I hear from them means that they are aware and they're knowledgeable and, they wouldn't be like, 'Oh no, like, that's not true'" - Athlete 9. Athletes believe that by starting a conversation about REDs, support staff are showing

that it is, at the very least, something they know exists, therefore demonstrating knowledge – another theme influencing athletes' comfort.

Within this theme, coaches were described as having a pivotal role in opening the door to having conversations about REDs and therefore changing team culture. Athlete 11 describes how there was a shift in team culture when a new coach came into the program and started initiating conversations about REDs with the team:

> "It became very normal for us to talk about it.... If you gave me the name of a girl on my team, I could tell you exactly when she got her period first, when she lost it...how it is now...The previous coach and the previous team, there was a lot bigger issue ...we had a few girls from that coach coming to our team and they had all had some really serious problems with ... under fueling and things like that" .

Although this theme of support staff awareness was discussed in relation to multiple different support staff members, athletes found this factor to be critically important in increasing comfort discussing REDs with coaches, particularly because coaches often lacked formal education on REDs.

4.3.2.3. Perceived knowledge and experience

Athletes discussed support staff knowledge of REDs as a critical factor influencing their comfort. However, when referencing knowledge, it is important to examine who athletes perceive as knowledgeable and why. For many athletes, having personal experience as a female athlete or experience working with other athletes with REDs was an indicator that they would be knowledgeable.

Formal education was discussed as an asset, particularly when aligned with sport-specific knowledge and awareness of REDs. Dietitians/nutritionists were the support staff members with

whom athletes were most commonly comfortable talking about REDs. Comfort discussing REDs with dietitians/nutritionists predominantly attributed to their knowledge and education. Athlete 10 describes her reason for comfort in discussing REDs with her team nutritionist/dietitian: "I think just expertise in the field, I'm assuming if they're qualified to do this, and especially if they've worked with athletes in the past, or they themselves are an athlete. I think for me, it kind of indicates that they're doing something right". This quote exemplifies the importance of formal education, expertise, and sport-specific knowledge. However, as previously discussed in *sport culture*, athletes noted that being educated in nutrition does not necessarily mean they are well-educated about REDs.

Of the athletes with access to a dietitian/nutritionist, 54% had discussed REDs with them – all of whom had positive or neutral experiences doing so. Although 100% of athletes described being comfortable discussing REDs with their team dietitian/nutritionist, some athletes described their nutritionist/dietitian's knowledge of REDs as trivial. For example, Athlete 3 recalls how their team nutritionist discussed amenorrhea in a team meeting without really providing many practical details: "She was just talking about how like your period is your canary or whatever…you don't want to kill your canary basically was how she said it. I feel like I already kind of knew a little bit about it at that point…. I don't think it was super detailed...'. Athlete 1 describes how "in the past [she has] worked with nutritionists that were not as sports specific and [she] found that a little bit more challenging to feel like [she] was finding like the right advice that [she] needed".

Athlete 10 emphasizes the significant difference between a nutritionist/dietitian who is well educated in REDs, versus one who is not: "The first time you go to a nutritionist or dietitian, cause you're not exactly sure what they're going to say. And in the past, I have had experiences

where there'll be like, 'Oh, you can gain weight now, but when you need to lose weight let me know'. And I don't like that kind of environment, personally". There is also potential for nutritionists/dietitians to harm athletes if they don't understand the high caloric demands of specific sports: "We do have dietitian students that are with us for the year and they do little capsules, but I feel like they're disconnected from the sport, because, well, most of them don't come from the sports world, but most of the things they post could be really triggering to people who are trying to eat healthy, because all they post is, like, really, really healthy things…and it promotes counting calories and nutrients and stuff like that".

The need for specific knowledge among medical professionals is further emphasized by athletes discussing their experiences working with physicians. In addition to some doctors normalizing loss of menstrual cycles, athletes described how family doctors are often ill-informed about how to treat REDs: "I went to my family doctor, but they're not always the best and knowing exactly what is right to do for athletes"- Athlete 10. Athlete 14 describes an experience when she had low iron (which can be a symptom of REDs, but is also commonly seen in endurance sport athletes) and was referred to a doctor at the university health center: "I felt like she heard that I was on the cross country team and that like I was struggling with my iron and immediately went, 'Oh, you have like an eating disorder you need to fix all of these things'. And it's very aggressive towards me… I felt like it was really weird. And also, if I did have an issue, I definitely wouldn't have wanted to tell her". This instance exemplifies the need for health professionals to be capable of understanding the complexities and spectrum nature of REDs. Further, it highlights the importance of support staff showing compassion and knowledge when working with athletes, or they may close the door to future conversations.

Although one might presume support staff without a formal background in nutrition would have less knowledge about REDs, athletes described support staff members with elite running experience as being more likely to be knowledgeable about REDs and, therefore, someone with whom they would be comfortable discussing REDs. Athlete 19 describes why she would be comfortable talking to her assistant coach:

> "I don't know her super well at this point, but I think she's someone who I respect a lot… she's like extremely hardworking, talented, successful runner… I'm sure that she like has experienced to some extent, like conversation about [REDs]... she's gone through the collegiate running program and is now more in the pro world… I'm sure she's come across it at some point, if not, like maybe even experienced it herself. So I feel like she would be someone who would have quite a bit of knowledge… she's someone who I would trust".

While discussing various support staff members, from coaches to athletics trainers, athletes described those who had experience in competitive running as being more knowledgeable. However, support staff experience did not have to be first-hand to make athletes feel comfortable. For example, Athlete 11 describes how her coach has "dealt with a lot of athletes who have had [REDs], not just on [her] team but on previous teams of his... he's told [athletes] that he has resources or access to resources if [they] need anything". This quote further exemplifies the previously discussed theme of support staff awareness and openness to discuss REDs, as athletes tend to perceive the support staff who have initiated conversations about REDs as more knowledgeable.

4.3.2.4. Gender

Participants predominantly expressed that they would likely feel more comfortable discussing REDs with a female support staff member than a male, particularly when it comes to discussing menstrual cycles: "I think I would have a harder time if my coach was male, talking about menstrual cycles and stuff like that, and just… even if they were really great and personable, I think I would struggle a bit" (Athlete 5). However, gender was rarely the deciding factor of whether athletes would be comfortable discussing REDs with their support staff. Athletes expressed that if a male support staff member embodied traits outlined in previous themes (had a strong relationship with the athlete, expressed openness to discuss REDs, or were knowledgeable about REDs), then athletes were comfortable discussing REDs with them.

Athlete 8, for example, describes her perspective on gender: "I guess, female does help, but I am open. I think males, if they're experienced in that area, then I don't see a problem talking to them about it". Athlete 15 describes how her view on male coaches changed when her coach started talking about REDs: "Before I thought I would be more comfortable talking to a woman, but since my coach talked to us about it, and he kept informed about it… I think both are kind of equal, because if you show that you care, it doesn't matter". Additionally, participants noted that just because a support staff member is female does not necessarily mean they are comfortable talking to them: "But like, even though they're female, because you don't really have that personal relationship, still probably wouldn't, wouldn't go to them".

Some athletes felt entirely indifferent to gender, and some believed gender played a critical role in determining their comfort. For example, Athlete 10 states: "If I'm talking to a female versus male, I personally don't care who I am speaking with". Some athletes expressed apparent discomfort talking to male support staff. Their reasoning for discomfort was described as male support staff not being knowledgeable about REDs: "They are both males as well. So I

think that definitely influenced my decision. And I think also, I make the assumption that they have less education about it because they are male" - Athlete 6. Athlete 3 describes how "a female coach knows a bit more about it, especially if they ran and like went through it themselves," however, she also feels she "probably would talk to a man about [REDs] too" and that she has had "male doctors and stuff like that, and [she is] perfectly fine talking to them."

4.3.2.5. Age of athlete

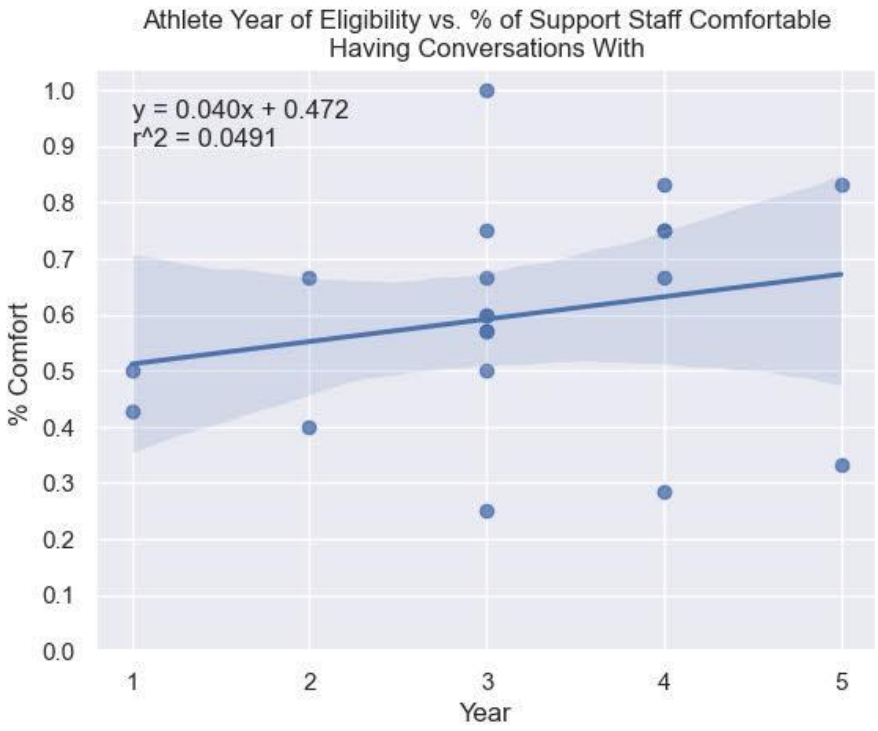
A final factor influencing athlete's comfort in discussing REDs is the athlete's age and time spent in USports. Figure 1 displays the athlete's year of eligibility (one through five) relating to the percentage of their support staff members with whom they feel comfortable discussing REDs. A general trend occurs with more experienced athletes having a higher percentage of support staff members with whom they feel comfortable discussing REDs. Notably, this relationship was non-significant and conducted with a small sample size (n=20). Additionally, the athlete's year in USports might not reflect their actual age, as some athletes may have a taken red shirt year (a year without competition which does not count towards the athlete's five years of eligibility) or had a gap in their eligibility due to the Covid-19 pandemic.

Athletes did, however, mention throughout the interviews that comfort discussing REDs might vary greatly depending on the age of the athlete and how long athletes have been in USports. Athlete 19 describes the importance of initiating conversations about REDs with younger athletes who might be less inclined to do so themselves: "I think a lot of it does have to do with age and stuff, too. People are maybe less comfortable when they first enter university, and we have a very young team… especially with younger athletes, I think you probably need the support staff to at least kind of make it clear there's like an open-door policy when it comes to these sorts of things". Athlete 9 also expresses the importance of educating younger athletes:

"Opening up the conversation to prevent athletes, especially like younger athletes who might not know about it to get educated and catch it before it's too late".

Figure 1:

Athlete year in USports (1-5) and portion of support staff they are comfortable having discussions about REDs with



4.3.3. Theme 3: Barriers to disclosure

With athlete awareness of REDs continuing to increase and being of utmost importance, it is also critical that athletes are comfortable enough to disclose to support staff if they are experiencing symptoms. While the previous theme addresses factors relating to general comfort discussing REDs, there were also several barriers athletes confided might prevent an athlete from coming forward if they were experiencing symptoms of REDs. These barriers include: 1) Athletes' concern that disclosure will have negative implications on their training and

performance, 2) Support staff prioritization of short-term performance over athlete health, 3) Shame associated with REDs - particularly disordered eating, and 4) Concerns of confidentiality.

4.3.3.1. Perceived training and performance implications

Athletes described perceived training and performance implications as barriers to disclosing REDs symptoms to support staff members. Possible implications include a training reduction or, in more severe cases, missing competitions or entire seasons. Athletes described concerns that if they expressed to their coach that they might be struggling with REDs, they would miss out on training and competition: "It's going to impact running, which I would say that would make it harder for me to go because I would just be worried that… I don't want to stop running. I don't want to adjust things"- Athlete 12. Participants emphasized that this may particularly be a barrier if the athlete is currently competing well: "I think it's hard if an athlete is experiencing REDs, but they're performing really well because someone could tell them, 'oh, you need to gain weight to be healthier. You need to lower your training load'. And they're like, 'well, it's working now. Like, why, why would I change that'? But I think that performance is a barrier". - Athlete 10. Athlete 17 further emphasizes that many athletes only "seek help when things are really tanking", which, as Athlete 10 describes, is waiting to "seek support until maybe it's too late".

The power dynamic between athletes and coaches can further accentuate this challenge. Because coaches are in a position of authority, it can be difficult for the athlete to disclose their difficulties with REDs if it makes them feel like their training and the future of their athletic career is in the control of someone else: "I feel like it's always like tricky when you're… it's just like a weird dynamic when they are in positions of authority… I think that's always something that's kind of like in the back of your mind, like they do have a lot of control over what your

season looks like. And maybe there's a fear that if you do say 'okay, I've been experiencing this' maybe that they would be like, ‘Oh, actually, like, I think you should take the season off and like not run’." - Athlete 18. Disclosure to authority figures such as coaches might also put athletes in a position where they feel as though they are disappointing or letting down their coach:

> "I think one of the reasons to with like my head coach is… I know that a lot of the time when someone is experiencing [REDs] they might have to back away from competition and that kind of thing. So I think maybe fear out of disappointing, or kind of having to cut back on training time or that kind of thing… kind of almost admitting defeat would be harder for someone who is depending on you to compete…"- Athlete 2.

Overall, team dynamics and norms surrounding performance also factor in how athletes view disclosure of REDs symptoms may relate to their performance. For example, if athletes within a team are highly competitive with each other, athletes might be more inclined to ignore and continue to push through REDs symptoms in order to not fall behind teammates "I feel like if there was like a team emphasis on performance and a lot of competition between teammates and that kind of thing, I think that might make it harder for an athlete to go see their coach if they know their one teammate is doing this and it's working for them" - Athlete 10.

4.3.3.2. Support staff prioritization of immediate performance

Coaches can also play a role in team norms around performance, and athletes described coaches prioritizing short-term performance over long-term health as a barrier to disclosing REDs symptoms. There are several parallels between athletes' and coaches' views of performance being a barrier. For instance, coaches may be inclined to ignore REDs symptoms if

an athlete is performing well: "Sometimes coaches are reassured by the fact that the runners are running fast, so that's all they care about, and they don't really… and if we talk about them, about the fact that their athletes are a little bit more injured than others and stuff like that, they will often close their eyes because the performance shows otherwise" Athlete 15. In cases such as these, coaches might ignore or be ignorant of the long-term detriments of REDs: "I don't know. The fact that they are ignorant could lead to some judgments and sometimes all they care about is performance. So it's, even though it's a part of performance to have REDs, I don't think it's a part of performance they would like to consider, because if it includes rest and not racing or adapting the workouts. So it goes against the culture of the sport, I guess." - Athlete 15. This athlete further emphasizes that sport culture can affect how coaches and athletes view REDs and gauge the importance of addressing REDs symptoms. This prioritization of the athlete's immediate performance also emphasizes the importance of utilizing support staff who are not as invested in immediate results, but more so have the professional goal of supporting long term athlete health and development (e.g. dietitians, sport psychologists), which will discussed below as *Theme 4: Proactive and Multidisciplinary Care.*

4.3.3.3. Shame associated with disordered eating

Although (as discussed previously) there seems to be a positive shift in how athletes view and talk about REDs, there is still an element of shame associated with REDs, particularly if an eating disorder or disordered eating behaviours are involved. Athlete 19 describes REDs and discussion of menstrual cycles as still not being considered normal on all teams: "I think there's still a lot of stigma around it, especially with- whether eating disorders, disordered eating- whether that's like a part of it. And same thing with menstrual cycles. I feel like that's a little taboo to talk about".

Participants discuss normalizing these topics as key to allowing athletes to feel comfortable disclosing symptoms. Part of this normalization includes a better understanding of REDs occurring on a broad spectrum, which most athletes experience in some capacity. Participants described how the stigma associated with REDs might come from fear of being labeled as having an eating disorder: "I think it'd be good if they talked about it more in a more open way. I feel like. I don't know. As soon as someone has like two stress fractures, then they're labeled on the team as being anorexic and it's kind of more complicated than that" - Athlete 20. Increasing knowledge and awareness of REDs among athletes and support staff might help eliminate the stigma surrounding REDs and disordered eating.

Another element of eliminating the stigma and shame around REDs includes openly discussing how common REDs can be. Athlete 12 discusses how even though REDs is extremely common, athletes may still feel shame surrounding REDs: "I don't think it should be embarrassing, but I know that it can feel embarrassing, or almost shameful, like, 'how did I let this happen to me? You know, better'… Cause I think it probably is quite common." - Athlete 12

4.3.3.4. Confidentiality

A final barrier athletes describe when disclosing REDs symptoms is feeling that the information they disclose will be confidential. Athletes discussed instances where they did not feel their coach was trustworthy, and this would make them hesitate to share with their coach if they were struggling with REDs:

> "I've been in conversations with my head coach where he's shared something about another athlete, like on the team, maybe more in a negative sense. And it kind of made me consider like… 'I wonder if they are okay with you saying that, or if that's something that you guys talked about in confidence now that you're just kind of sharing with the

team as a general comment'. And then that makes me feel like, okay, I don't want you to do that with me"- Athlete 18.

Whether intentional or not, the way support staff talk about other athletes may have a profound effect on whether athletes view them as a safe person to confide in:

"Also, the confidentiality piece. I think that's really, really big. Yeah, I think one of the most negative things I've seen from coaches is when they talk down about other athletes. Even if they're not… that's not their intention. I think it has really detrimental effects on the team and just like perspective on it too. If you hear a coach kind of shaming an athlete who's struggling with an eating disorder, how are you going to go and talk to them about what you're thinking of"? - Athlete 7.

Athletes described the benefit of discussing REDs with support staff who are required to uphold confidentiality: "It's more like confidential, like [sport psych] won't, um, it's not going to be related to your coach unless it's something that's like, um, a very like serious matter" - Athlete 14. Additionally, having access to a private space to discuss personal topics can be a challenge when confiding in specific support staff:

"One thing which, like, I totally understand is with SafeSport and, you know, needing to, like, meet with your coach in an interruptible space. Every meeting I have with my coach is in the - there's a hallway of all of the high performance coaches-, and all their doors are just open, so anything I go to talk to my coach about, other coaches are probably hearing too. Anyone from my team could just walk up and like, not know I'm in there. Um, or something. And so, the times I've gone to talk to him before, I've been like a little worried… These are personal issues" - Athlete 11.

4.3.4. Theme 4: Proactive and multidisciplinary care

A final theme from the qualitative interviews was the athletes' need for more proactive care among support staff of several disciplines. Athletes felt that support staff ought to take measures to prevent REDs or identify signs of REDs before severe health determinants occur. Preventative measures involve support staff initiating conversations about REDs and employing mandatory screening for REDs. Additionally, athletes discussed the benefits of having different support staff involved in preventing and treating REDs or a support staff member with a holistic perspective.

4.3.4.1. Conversation initiation

Athletes expressed being more comfortable with support staff initiating conversations about REDs rather than waiting for athletes to come forward and start conversations. Athlete 16 describes how support staff initiating conversations about REDs "shows professionalism and shows that it's something that everyone needs to be talking about". Particularly in instances where athletes might feel shame around disordered eating - a barrier to disclosure - athletes emphasized a need for support staff to take the initial step of starting a conversation: "If someone is sort of restricting what they're eating or feels like they don't think they're eating enough… you know, you want to fix it, but sometimes you need…someone needs to put their foot down…"- Athlete 12. Athlete 15 emphasizes: "Even though it's often kind of a delicate subject, and it's hard to reach out to people…I think it's easier for people who are giving help rather [than those coming to get help]" - Athlete 15.

Athletes also believe these conversations should be initiated early in the season to focus on prevention. Athlete 13 describes that "if [REDs] was constant - if it was a conversation that [she'd] heard initiated more, it wouldn't feel so hard to initiate it as the athlete". Athletes

proposed a group setting as the best place to start conversations about REDs: "just having more team-based seminars where everyone has to go. I think that is essential because if there's going to be an optional seminar, most people aren't going to go, even if they benefit from it"- Athlete 10. Athlete 1 describes how having "team meetings at the beginning of the season" can give the athletes "a path to be able to talk".

A further benefit of group sessions discussing REDs is that they avoid singling athletes out or putting athletes on the spot. Although there are instances where it is essential for support staff to intervene, Athlete 19 describes an instance where an athlete on her team felt singled out when a coach approached her about REDs, which she believed was based on her body type:

> "A girl on the team did say that [our coach] asked her if she was getting her period, and she was a very, kind of like small build, like very small person. So I think at the time she was a little thrown off by the question because she didn't really know why, like she was getting asked specifically. But, so yeah, I don't know if that's the best way to do it either".

Athlete 19 suggested that these discussions start in a group session or that mandatory screening should occur for all athletes to reinforce prevention without singling athletes out. Athlete 7 further emphasizes that "the dialogue around it…needs to be done in a tactful and conscientious way that makes athletes feel kind of empowered".

Several athletes further asserted the benefits of mandatory screenings or check-ins with support staff: "I think it's better to be structured because I find that now that it is casual, it's only really when a problem comes up. Like if someone is starting to get injured, it's like, ‘oh, do you... are you eating enough’? But it could have been prevented if they were asking everyone, even at

the start of the season or something" -Athlete 16. Some athletes described having these screenings in place on their team. For example, Athlete 5 describes how her coach "always recommends getting an iron test every year… cause that's a big indicator" and to "try tracking our menstrual cycles". However, most athletes described this as something they were lacking: "I think there are also things that can be put into place like, for example, I wanted to get my hormones checked. I asked the doctors here on campus if I can get a blood test and they said that they don't do blood tests unless something is wrong" - Athlete 10.

It is also critical that these pre-screenings be accompanied by guidance for athletes. Athlete 19 describes how her team did pre-screening for REDs without appropriate follow through: "I remember on our pre-screening questionnaire for getting medical clearance in first year, you had to… they had definitely questions about menstrual history and I remember answering them thinking like, 'oh this is probably going to get flagged that I'm saying I've never had my period'. Um, and nothing ever came of that". Furthermore, Athlete 13 describes the need to have a clear path for athletes: "I feel like like having a designated person on the team and saying, 'if you or your teammate, or you're worried about your teammate… the person to reach out to is like this person' and then being like, 'if you're not comfortable reaching out to that person, this person', and giving like four options of different names or people you can go to". This athlete's opinion further exemplifies the need for more accessible resources for athletes and support staff, such as coaches, connecting athletes to such resources.

4.3.4.2. Holistic, multidisciplinary care

Among such resources needed by athletes is holistic care from support staff with different expertise. Athletes described their best resources concerning REDs as someone who understood

the issue holistically. In some cases, as discussed in *knowledge and experience*, this came from a support staff member such as a dietitian/nutritionist, who also had knowledge and experience in elite sport. However, many athletes described their best resources as someone who was not necessarily formally a part of their university support team. In some instances, athletes felt as though they stumbled upon these resources by happenstance: "I had a really awesome doctor who I went to about, unrelated to running, and I would have felt super comfortable opening up to her about anything. Although I can't say the same for any healthcare workers that I've had in [my province]... I kind of felt like I struck a gold mine with just that one specific doctor who was so supportive in her approach and everything" - Athlete 13. Other examples include athletes who had access to doctors who specialize in female health:

> "[Coach's] partner has been doing some stuff for the team. She's a family doc, but she is more specialized in women's health…So that's nice. And I know that she isn't like the team doctor necessarily, maybe not in a more formal sense… She'll come on runs with us… she'll like get bombarded by questions from everyone" -Athlete 14.

Similarly, Athlete 11 describes the benefits of previously having an assistant coach who was also a med student: "We had another assistant coach at one point…she was just kind of held a coach role, but then trained with us too. She was a med student. So she was also a really great resource".

For athletes who might not have access to such holistic support, having access to support staff from different disciplines was considered advantageous. Athlete 6 believes "there could definitely be room for more… another professional role who sort of supports athletes in this field, whether it be a sports psychologist or someone who sort of bridges the role of holistic… a

dietician who doesn't just look at diet, but also looks at all the other factors that are involved in REDs as well". Although dietitians/nutritionists and coaches (primary and assistant) were the support staff members with whom athletes were most likely to have conversations about REDs, athletes who did utilize other support staff members commented on the benefits of doing so. Athlete 12 describes the benefit of talking to a sport psychologist about REDs and related issues: "I think so much of it is mental, so being able just to also talk to someone who's not really associated with the team is really good… I enjoyed being able to talk to someone who was quite like a very clear third party". Athlete 9 describes how when she was dealing with REDS and repeated injury, her athletic therapist fulfilled that role of holistic support:

"When I was kind of going in and out, or on and off the injury cycle, I saw them so much that it was - I saw them probably more for emotional support at times, too, so, I feel like it got close with them or like, was able to open up about a lot of things… So it was really helpful, as they were kind of helping me rehab physically to also help me rehab like mentally and like also get my nutrition, right".

Chapter 5: Discussion

5.1 Alignment with current literature

The present study examines USports cross country athletes' perspectives on what resources are available regarding REDs prevention and management, if and how they communicate with their support staff about REDs, and what factors allow them to feel comfortable doing so. This research aims to examine the current climate and provide practical guidelines for support staff to better communicate with their athletes about REDs. This research further emphasizes the complex nature of identifying REDs symptoms and providing athletes with proper care. Further, this research identifies gaps in current resources and how support staff can allow athletes to feel comfortable discussing REDs. Results indicate that further emphasis should be put on education on REDs symptoms and encouraging support staff to initiate conversations about REDs; regardless of the support staff's gender or primary expertise. Throughout this discussion, tangible guidelines will be provided for university support staff, recognizing the limitations of this research and highlighting future directions.

The results from the present study align with previous research on the prevalence and spectrum nature of REDs. Of the 20 participants in this research, 50% identified as having had REDs and 20% were unsure but believed they may have had symptoms. The primary symptom discussed was amenorrhea. The high prevalence observed in this research aligns with previous research that indicates the high prevalence of REDs and amenorrhea among female endurance athletes (Brown et al., 2014; Fahrenholtz et al., 2022; Heikura et al., 2017; Jesus et al., 2021). Athletes also discussed difficulties identifying REDs symptoms and knowing if they experienced REDs, further emphasizing the spectrum nature of REDs discussed in the 2023 consensus statement on REDs (Mountjoy et al., 2023).

There are, however, several problems associated with amenorrhea being the primary means for REDs identification. Not only does amenorrhea not serve as an indicator of REDs in male athletes, but it is still possible for female athletes to have REDs while still having a regular menstrual cycle (De Souza et al., 1998; Prior et al., 1990). Additionally, athletes on hormonal birth control are not able to use their menstrual cycle as a reliable indicator of energy availability. These complications further emphasize the need for athletes and support staff to be aware of and able to identify other symptoms of REDs. Additional resources such as access to hematology testing (identified by Athlete 10 as a missing resource) may also help fill this gap, as several biomarkers may indicate REDs, even if an athlete is eumenorrheic.

The literature review of this paper discusses the impact support staff – particularly coaches – can have on athletes' body image and health behaviors (Artioli et al., 2010; Beckner & Record, 2016; Coppola et al., 2014; Kerr, Berman & De Souza, 2006; Muscat & Long, 2008). The current research revealed several instances where athletes had negative experiences with their support staff regarding comments on weight or eating behaviours. Most of these experiences occurred in high school or with previous coaches, indicating a culture shift; however, because this study only examined the experience of USports athletes, no conclusive statements can be made without directly comparing current University athletes' experiences with current high school athletes. Additionally, culture may differ when examining other high-stakes athletic environments such as professional sports or NCAA athletics. However, participants in this research indicated a positive shift in support staff and athlete openness to discuss topics such as REDs, with the caveat that further education on identifying symptoms is needed.

The primary strengths of this research lie within the mixed methods design and emphasis on the athlete's perspective. The network analysis visually represents what resources are tangibly

available for athletes and how they are being utilized. Evaluating support resources from the athletes' perspective is critical, as a resource is only as valuable as how it is utilized. The qualitative interviews give each athlete a voice while drawing upon themes consistent throughout many athletes' experiences. Previous literature shows that coaches are hesitant to approach topics such as body image with female athletes (Plateau et al., 2014; Sabiston et al., 2020). With the high prevalence of REDs, support staff must know how to navigate these topics and broach the sometimes-uncomfortable conversations with female athletes. Because no previous research examines why athletes may or may not be comfortable discussing REDs or the barriers to discussing REDs, these themes serve as critical to creating tangible guidelines for support staff.

5.2. Implications

Athletes acknowledged that there seems to be a positive shift in culture; that REDs is more commonly discussed than it was previously, and it is now less common for support staff to discuss diet and weight in a harmful manner. Results also indicate that coaches are often the support staff members that most profoundly dictate team culture. For example, Athlete 11 described how her team experienced a significant, positive culture change with a change in coaching staff, and it was not normal for member of her team to openly discuss their menstrual cycle. Coaches are typically the support staff members who spend the most time with athletes, and therefore hold responsibility in creating a team culture that normalizes discussions of REDs and deemphasizes weight loss pressure. This finding aligns with previous literature which finds coaches to be the primary entity athletes trust for health information (Arioli et al., 2010). The following recommendations for increasing athlete comfort apply to all support staff members, however – due to their profound influence—particularly apply to coaches. Implications of this research include recommendations for coaches and other support staff members on how to

increase athlete comfort in discussing REDs and navigate barriers athletes face in disclosing REDs symptoms.

Participants identified several key factors that influenced their comfort in discussing REDs with their support staff. These include the nature of their relationship with the support staff, the support staff's awareness and willingness to discuss REDs, the perceived knowledge and experience of the support staff, and the gender of the support staff. It is crucial to acknowledge these factors when devising strategies to enhance athlete comfort in discussing REDs.

5.2.1. The role of gender

Although gender was not a critical factor determining athlete comfort, most participants indicated they would be more comfortable discussing REDs with a female support staff member than with a male, particularly when there is not a strong relationship between athlete and support staff. This underscores the importance of having female support staff working with athletes, which has been highlighted as a gap in collegiate athletics (Kidd, 2013; Banwell, Kerr & Sterling 2021). Data from the CCAA (2022) indicates that only 18% of coaches in mixed-gender teams and 26% of coaches in female USports teams are female (Canadian Women in Sport, 2022). With the knowledge that coaches are often the support resource athletes utilize when discussing REDs and that most female athletes are more comfortable discussing REDs with another female, the need for more female coaches is accentuated. Increasing athlete comfort discussing REDs is among the numerous advantages of having female representation in coaching roles.

The call for more female support staff, however, does not diminish the role of male support staff in preventing and managing REDs. It is critical to consider that athletes may be in

programs where most of their support staff is male or be completely comfortable discussing REDs with a male support staff member. As mentioned by Athlete 17, who described her female assistant coach, and nutritionist as being the support staff member who often discusses topics such as REDs, it can be beneficial to have head coaches – regardless of gender – involved in the conversation, as they are primarily in charge of training and competitions which may be affected by REDs symptoms. Therefore, both male and female support staff must be able to initiate conversations about REDs.

5.2.2. Guidelines for conversation initiation

Based on the results of this study, practical guidelines can be set for support staff to initiate conversations about REDs (Figure 2). Recommendations for support staff are as follows: 1) Prioritize relationships and build trust, 2) Increase education and know the signs and symptoms of REDs, and 3) Start conversations in group settings.

Figure 2:

Practical Guidelines for Support Staff to Initiate Conversations with Athletes About REDs

Practical Guidelines for Support Staff	
Prioritize Relationships	Prioritize relationship development with athletes. Demonstrate interest in athlete as a person, beyond their performance. Emphasize the importance of athlete's health and wellbeing.
Increase Education	Learn the signs, symptoms and long-term consequences of REDs. Share with athletes to increase athlete knowledge/awareness and allow athletes to see that you are aware of REDs.

Initiate Conversation	Start conversations in a group setting to increase athlete comfort Show to athletes that you are aware of REDs and open to discussing it. Emphasize prevention
Address Barriers	Understand the performance detriments associated with REDs (share with athletes) Address stigma: Emphasize the spectrum nature of REDs (can affect a majority of athletes w/ or w/o disordered eating). Practice confidentiality: Communicate to athletes that any shared information will be held in confidence. Avoid sharing athlete's personal experiences with other athlete's w/o athlete's permission.

5.2.2.1. Relationship building

Support staff should prioritize building relationships and trust with athletes before initiating conversations about REDs. Participants in this research indicated they would feel uncomfortable in situations where support staff brought up REDs or their menstrual cycle in one-on-one situations when they did not feel they had a strong relationship with support staff, indicating that support staff should prioritize building a relationship with athletes before confronting athletes about these topics. As indicated by several participants, having support staff demonstrate~~s~~ that they are interested in the athlete's well-being beyond performance and that they are open to discussing topics outside of training and competition could increase athlete comfort. These conversations do not necessarily have to be formal or serious but merely a way for support staff with regular contact with athletes to show general support for well-being. These conversations should ideally increase athlete comfort before any potential confrontations about

athletes displaying signs or symptoms of REDs. These relationship-building conversations also increase the chances that athletes come forward to support staff about potential symptoms in cases where symptoms might not be evident to the support staff.

5.2.2.2. Increased knowledge and education

Although participants viewed formal education as an asset, they indicated that having support staff who expressed experience and awareness of REDs increased their comfort in discussing REDs. Several athletes also mentioned that they did not believe their support staff members would know what REDs was or be able to identify symptoms. Although diagnosis of REDs can be difficult, support staff can be aware of signs and symptoms beyond amenorrhea. Examples include increased injury risk, fatigue, weight loss, illness, mood disturbances, or decreased ability to adapt to training. With the ability to identify symptoms, support staff such as coaches or athletic trainers who may have more regular contact with athletes can provide athletes with further resources and connect them to those with experience treating REDs, such as a dietician or doctor. In instances where a relationship has been built, as aforementioned, athletes indicated they would be comfortable having support staff broach these topics in sensitive ways. For example, in cases such as Athlete 14, when experiencing an injury, she was glad that she and her coach discussed the possibility of REDs playing a role, even to rule out the possibility.

5.2.2.3. Group sessions

Participants indicated they often were less comfortable having discussions with support staff with whom they did not have a previous relationship, and many younger athletes may be in positions where they have yet to have the opportunity to build a relationship with many of their support staff. This consideration indicates that it may be most beneficial to first breach the topic of REDs in a group setting, where athletes are less likely to feel singled out. Participants in this

research indicated positive experiences having group sessions on REDs that a coach or dietitian/nutritionist led. However, participants also indicated that these sessions should be mandatory and occur every year so that new athletes are involved – which was not always the case. Starting these conversations in a group setting may serve as a means for support staff to show their openness to discuss topics such as REDs, which is identified as a primary reason for athlete comfort. These meetings can also allow support staff to demonstrate their knowledge of REDs symptoms and share these with athletes. With younger athletes often being less comfortable discussing topics such as REDs, placing these meetings at the start of the year could help eliminate the stigma associated with talking about REDs and set the tone for the season.

5.2.3. Addressing barriers

Participants in this research identified several variables that might prevent them from disclosing REDs symptoms to support staff if they were experiencing them. These barriers are primarily related to prioritization of performance (either by the athlete or support staff member), the stigma associated with REDs and disordered eating, and athletes' perceptions of confidentiality. These barriers suggest an underlying culture of disordered eating and performance that must change for athletes to feel as though the problems they are dealing with will not be stigmatized or overlooked.

5.2.3.1. Performance variables

Prioritizing performance over long-term health indicates an ego-oriented motivational climate -- which is known to be associated with disordered eating (Duda & Kim., 1997). Although no research has examined how motivational climate relates to REDs, current research suggests that an ego-oriented motivational climate may be a barrier to athletes' disclosing RED

symptoms. To eliminate this barrier, it is pertinent that support staff express prioritization of long-term athlete health.

In instances where athletes perceived their support staff – namely coaches – as prioritizing performance over health, they described how a coach may disregard signs of REDs when an athlete is still performing well. This overlooking may be partly due to the motivational climate and the coaches' preoccupation with winning. It could, however, also result from a lack of education on REDs. An increased understanding of how REDs can often lead to short-term performance gains before an athlete experiences performance and health determinants may help eliminate coaches' prioritization of performance as a barrier.

Increased knowledge may also aid athletes' understanding of the severity of REDs – even when performing well. Participants in this research indicated that athletes may struggle to come forward and disclose REDs symptoms if they are still performing well and fear that they may miss practice or competitions, which might leave them further hesitant. Along with further education, support staff should reiterate to athletes the performance *benefits* of being in an energy balance and reframe any potential missed training as an opportunity for growth and better long-term performance. Particularly in endurance sports with high energy expenditure, a better understanding of how adequate fueling can lead to better training adaptations may be beneficial for athletes with or without REDs symptoms. Additionally, the pressure to perform is placed on athletes by themselves and coaches, highlighting the need for more support staff to be involved in conversations about REDs. This idea will be further discussed in the *Interdisciplinary Support* section below.

5.2.3.2. Addressing stigma

Additionally, several participants noted the complex nature of REDs and the commonality of REDs among elite athletes. More discussions about REDs and personal stories from elite athletes may not only make athletes more inclined to come forward to help their long-term performance but also reduce the stigma associated with REDs and disordered eating. Participants in this study described support staff with experience in elite running as beneficial resources regarding REDs, partially because the athletes perceived them to have some experience with REDs. Athletes also described positive conversations about REDs with elite runners (e.g. Assistant coaches, Usports Panelists) who have experienced REDs, or may know athletes who have, therefore eliminating the stigma associated with REDs. By highlighting that the best athletes in the world have experienced REDs and disordered eating, athletes can understand that it is not shameful.

Participants also accentuated eating disorders as being particularly stigmatizing and that athletes might hesitate to come forward with symptoms of REDs, with fear of being labeled as having an eating disorder. To eliminate this stigma, the spectrum nature of REDs must be asserted to support staff and athletes.

This assertion may also help athletes come forward in instances where eating disorders are present, and athletes need clinical support. In all cases – eating disorder or otherwise – support staff should be mindful of how they discuss disordered eating and other athletes who might experience eating disorders. For example, Athlete 7 discussed how she once had a coach who would sometimes label other athletes from other teams as having eating disorders, therefore further stigmatizing and shaming disordered eating. Although this was one athlete's experience, it further emphasizes that how support staff discuss these issues casually can profoundly affect athletes, and support staff, primarily coaches, hold a vital role in destigmatizing these issues.

5.4.3.3 Increasing confidentiality

The preceding example also connects with confidentiality as a barrier for athletes to disclose REDs symptoms. If an athlete hears a support staff member discussing another athlete's private issues, they no longer feel comfortable discussing their private issues. Although increased conversation about REDs can increase athletes' comfort, it is crucial that personal information is not shared and that athletes feel they can trust their support staff. Addressing this barrier requires increased professionalism from the coaching staff and further opportunities for athletes to meet with a sports psychologist or dietitian, with whom athletes can discuss personal matters in a discreet setting.

5.4. Interdisciplinary support

As previously mentioned, coaches and support staff play a pivotal role in shaping team culture and addressing REDs. Primary coaches, assistant coaches, and dietitians/nutritionists were the most active in discussing REDs with athletes. It's encouraging to note that dietitians/nutritionists are generally well-utilized. However, there is room for improvement as some participants had access to a dietitian/nutritionist but did not utilizing them to discuss REDs. It's also important to highlight that athletes who did engage with support staff, such as sports psychologists and physiotherapists, to discuss REDs, found it beneficial. This underscores the significant impact that coaches and support staff can have in this area.

Sports psychologists may serve as beneficial support for athletes in addressing the psychological side of REDs. Participants discussed sports psychologists as being in a unique position to address disordered eating or compulsive exercise tendencies. Sport Psychologists can also help address the confidentiality barrier for athletes disclosing REDs symptoms because their

job requires confidentiality. Physiotherapists and Athletic therapists may also be uniquely positioned to identify and address REDs symptoms such as injury or illness. For example, Athlete 9, described her physiotherapist as a critical resource when she was experiencing REDs and stuck in an injury cycle.

Several participants in this research advocated for the implementation of mandatory screening measures. Some shared how their teams already engage in such practices, while others highlighted the absence of pre-screening as a potential resource that could aid in the early identification of REDs. The use of screening measures, such as blood tests, could also encourage greater utilization of different support team members. For instance, specific biomarkers detected in a blood test, such as low iron, could serve as indicators of REDs, prompting the athlete to be referred to a dietitian. In such cases, having a diverse team of support staff from various disciplines would be instrumental in providing holistic care.

5.3. Recommendations for future research

Results from this research highlight the benefits of having multiple support staff members available for athlete, indicating that an interdisciplinary support team may be beneficial to examine the complex biopsychosocial factors that influence the development and management of REDs. This research indicates the presence of a multidisciplinary team, where most athletes had access to several different resources. However, there was no indication of support staff members working collaboratively to address REDs. Research indicates the benefit of an integrated support team model, which emphasizes the importance of regular communication and collaboration of support team members to proactively balance high-performance goals and the athlete's overall health (Dijkstra et al., 2014; Dijkstra & Pollock., 2014, Sporer & Windt., 2018). Results from

this research indicate that (with proper confidentiality measures in place) an interdisciplinary team may help to prevent and manage REDs effectively. Interdisciplinary support may also further benefit athletes and decrease pressure on coaches to be primary healthcare information providers for athletes. However, the current research did not focus on communication or relationships between different support staff members, and more research is needed to examine if and how interdisciplinary support teams are utilized at the university level.

Additionally, the current research examines the prevention and management of REDs from a interpersonal perspective; highlighting the role of athlete and support staff relationships and communication as critical. Results from this research also emphasize the role of motivational climate promoting a performance first culture vs one that emphasizes athlete's long-term growth and development. As indicated in this research, changes in team culture may stem from support staff taking appropriate measures to initiate positive conversations about REDs. However, future research should examine how motivational climate directly affects the development and management of REDs, and further examine other ways team cultures can experience a positive shift (i.e. systematic changes).

The current research examines REDs in a population that is known to be particularly vulnerable: female endurance athletes. Participants in this research included USports athletes competing at an elite level. Future research should additionally examine athletes' experience at the NCAA level - which may have greater pressure for performance. Although REDs is extremely prevalent in this population, it is also very common in aesthetic and weight dependent sports, which are not typically well represented at the USports level. However, REDs can be experienced by athletes of all sports and genders. Additionally, REDs may be underreported in

male athletes (Mountjoy et al., 2023). Future research should examine whether the guidelines presented for support staff in this research can be generalized to other athlete populations.

5.4. Strengths and limitations

The researcher's positionality is acknowledged as a potential strength and weakness of this research. Being a female competitive runner, athletes may have felt more comfortable discussing sensitive topics with someone in a similar position. The researcher and participants also shared an understanding of elite running culture. However, beginning the research with personal experience with REDs and University athletics, it was critical that the researcher examine their positionality and ensure it did not sway the participants in any direction. Such measures were taken by keeping interview questions open-ended and the researcher engaging in reflexive memoing throughout the research process to reflect on their own experience.

This research examined if and why athletes feel comfortable discussing REDs with their support staff. It should also be acknowledged that athletes who chose to participate in this research may be more inclined to discuss topics such as REDs openly than other athletes. Several participants also mentioned a particular interest in REDs as one of the reasons they chose to participate. Therefore, this sample may not reflect the entirety of the USports Cross Country student-athlete population. This skewed population might affect the prevalence of REDs among participants of this research, and there may be a higher proportion of Athletes who have experienced REDs in this population comparatively. Alternatively, it is also possible that there were athletes who chose not to participate due to their history or experience with REDs.

Regardless, participants in this research were a combination of those who volunteered to participate via mass email response (who may be more likely to have pre-existing interest or

experience with REDs) and those whom the researcher directly contacted because of personal connections or affiliation with a particular school. There is no indication that those participants personally contacted would be any more likely to have previous experience or interest in REDs. Additionally, Athletes described REDs as being very common among teammates. In any case, the strengths of this research lay within the mixed methods approach and in-depth look at the athlete's experience, not within the statistical power or quantitative results.

A critical realist perspective supports acknowledging a tangible reality and the importance of each athlete's unique experience. The nature of the semi-structured qualitative interviews allowed athletes, even those with particular interest or experience with REDs, to reflect on their experiences and journeys in learning more about REDs. Several participants in this research reported being graduate students who transferred schools after completing their undergraduate degree. These cases allowed for a unique perspective from athletes who had participated in multiple USports programs, who could compare reasons for comfort in discussing REDs with support staff at two different institutions. Additionally, having a sample of athletes with greater interest and knowledge of REDs allowed for unique perspectives from a participant who is both currently involved in university athletics and has adequate knowledge of REDs and the various signs and symptoms.

Chapter 6: Conclusion

This research examined the role of athlete support teams in the development and treatment of REDs in female Sports Cross Country Athletes. Specifically, it identified what support staff are available to athletes, if athletes have had conversations with their current support staff about REDs, which support staff members they are comfortable discussing REDs with, and what factors relate to their comfort. The results of this research can inform University Athletic Departments on how they can improve resources for athletes relating to the prevention and management of REDs. Recommendations based on the results of this research are as follows: 1) Increase resources; female support staff members, mandatory screening, and improved education for current support staff members, 2) Guidelines for support staff members to start and continue conversations about REDs with athletes, and 3) Areas for future research.

Ensuring athletes have access to support staff who possess adequate knowledge of REDs is a crucial aspect. The focus should be on prevention and early identification, a task that necessitates both support staff and athletes to be capable of recognizing the signs and symptoms of REDs. Pre-screening for REDs should be a priority resource for early symptom identification. It is important to note that while the presence of more female support staff members may enhance athletes' comfort in discussing REDs, it is equally essential for male staff to be well-informed and equipped to initiate conversations about REDs.

Support staff play a pivotal role in initiating conversations about REDs and creating an environment where athletes feel comfortable discussing such issues. It is crucial for support staff to prioritize athlete relationships and demonstrate openness to discuss topics like REDs and other female health issues. Once this initial rapport is established, athletes are more likely to feel at

ease having conversations initiated with them directly, especially if they are displaying symptoms of REDs.

Finally, future research should focus on the potential benefits of an interdisciplinary team that can examine REDs from multiple perspectives. Increasing communication between support staff members may allow athletes to receive more holistic care and for signs of REDs to be identified before causing long-term health and performance deficits. Future research should also examine this issue from the perspective of multiple support staff members, as this research only focused on the needs of the athletes.

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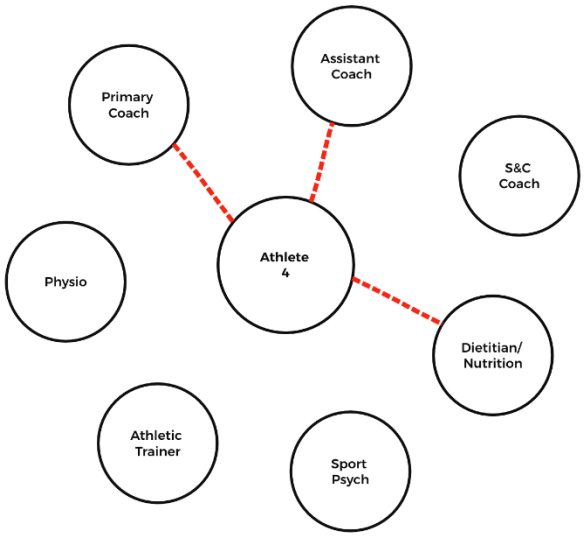
Chapter 7: Appendices

Appendix A: Examples of Integrated Analyses of Individual Athletes Networks

Athlete 4



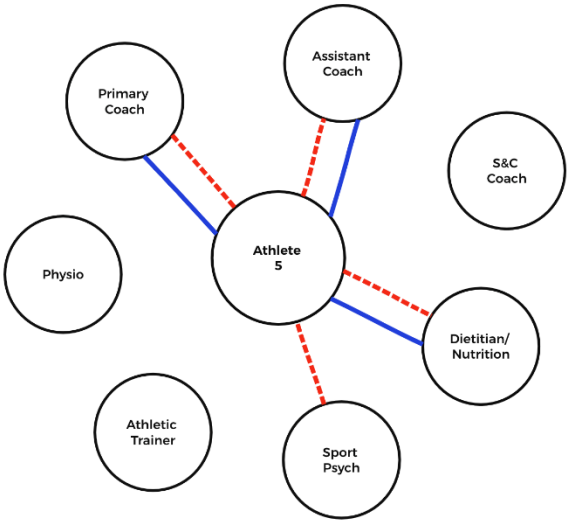
Athlete 4 had never heard of REDs until the panel discussion at USports that year. Currently, this athlete **has never had any conversations about REDs with her current support staff** - noting that she is still in her first year, and since learning about the topic, she recognizes the importance of "bringing more awareness to make it more normal to talk about… it's a part of our sport that people just don't talk about as much". One of the primary reasons for this athlete's comfort discussing REDs with support staff is **whether the support staff member has started the conversation and shown interest and awareness of the topic**. For example, athlete 4 describes how initially she would not have been comfortable talking to her male coach. However, the simple act of him telling the athletes to go to the USports panel on REDs, showed that it was something he prioritized:

> "He's male and a lot older than me and so…that doesn't immediately make me feel comfortable…But the fact that he was the one who said 'hey there's

> this panelist that you should go see, we should all go see this' and 'I'm interested in this too'. I think that kind of just opened the door of like, oh, okay, maybe he could be somebody safe to talk about this, just because he's already willing to learn about it…He seems like somebody who would very much care about that and be willing to change training if something's happening".

The **strength of the support staff/athlete relationship and personality factors** also play a role in this athlete's comfort in discussing REDs. For example, Athlete 4 describes their assistant coach and nutritionist as being more friendly and approachable than other support staff members, with whom she has no relationship or does not feel they are welcoming and approachable.

Athlete 5



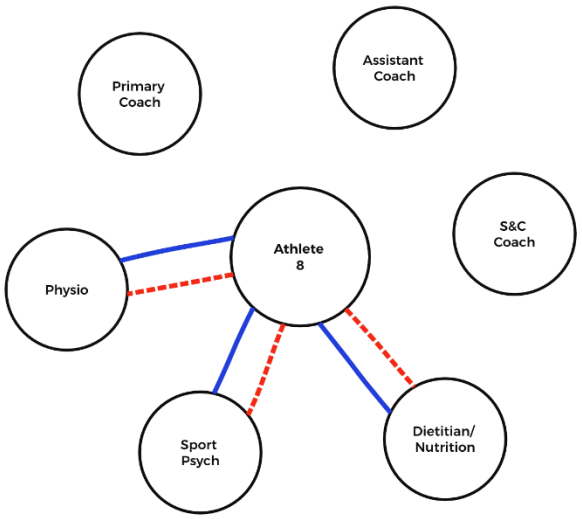
In contrast to many previous athletes, Athlete 5 is part of a team where their coach has connections to researchers specializing in REDs and has done "a really good job of creating a supportive environment" where team members "feel comfortable having those conversations."

This athlete emphasizes that support staff prioritizing **REDS prevention and energy intake optimization** has been beneficial. When describing her experience with the team's nutritionist/dietitian, she describes learning about how to "maximize workouts and prioritizing energy intake," which contrasts her experience in high school:

> "I would always feel dizzy at the end of my workouts, and I didn't know why. And I just thought I was bad at running. So then it would just be like, 'Am I eating too much? Am I not eating enough'? And I just felt like I didn't know where to go".

The support staff that this athlete feels comfortable talking to are those whom she perceives as **approachable and knowledgeable**, noting that if they have talked about REDs or have expressed that they have "gone through something similar", she would perceive them as being more knowledgeable and open to discuss REDs. This athlete also describes the benefits of having a female head coach and several female support staff members, noting she likely **would be uncomfortable talking about her menstrual cycle with male support staff**.

Athlete 8



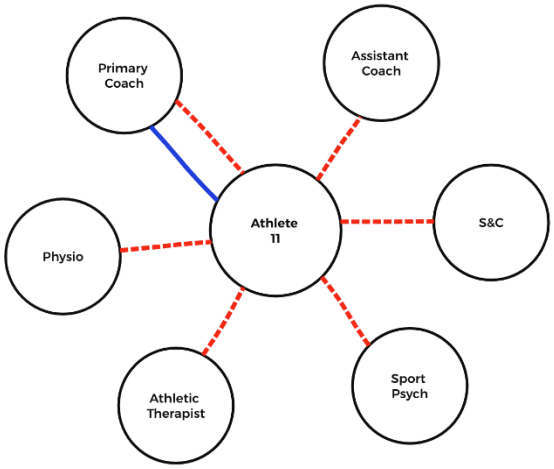
Athlete 8 has **experienced REDs** the previous year and has had teammates who have experienced REDs on a broad spectrum; including severe eating disorders. This athlete resolved REDs by discussing it with a dietitian/nutritionist during a group session with her team. Similarly, the sports psychologist discussed REDs with the team in a group setting, which this athlete believed was beneficial in **increasing awareness and getting a psychological perspective**. This athlete also had conversations with their physio when experiencing an injury, thus further emphasizing the benefits of **interdisciplinary support**: "It was them who kind of said like, 'Hey, have you thought about, you know, your eating and how that might support it'?"

This athlete describes her main reasons for comfort in discussing REDs: whether the support staff has **experience and knowledge** and whether she feels she has a **good relationship** with them or finds them easy to talk to. When describing her relationship with her coach, she explains: "He's very much there to give the

workouts…But he, from my point of view, if I was struggling with things like that, I wouldn't necessarily go to him just because I don't think that he would know".

Her previous coach at the University would ask her about her period "at the track whenever everybody else is around," which she didn't mind, describing herself as "an open person". However, she noted, "some other people, specifically, say... if their period was irregular. That'd be kind of an uncomfortable situation". She also recalls that this same coach had made "**negative comments about [teammates'] weight** if they had an increase that was noticeable."

Athlete 11

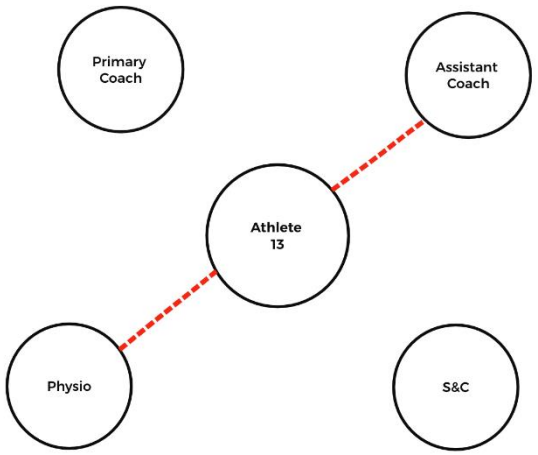


Athlete 11 reports **experiencing amenorrhea** in high school. However, at the time, it "wasn't thought of as being a problem" and "that just happens when you're at a high activity level". She recalls how at the age of fourteen while experiencing an injury, her high school coach "told [her] to 'be careful of what [you] eat so that [you] don't bulk up'." It was not until her second year of University that she heard of the term REDs, but now admits that "basically everyone, every female athlete, that [she's]

been a teammate with - in cross country specifically- has had at least symptoms of [REDs]."

Her primary coach has made an effort to let the team know he is **available to talk about REDs** and related issues: "he'll say these things in an entire team meeting… he'll be like, 'come talk to me about your menstrual cycle'... he showed us informational videos about what REDs can look like in male athletes, too". This athlete describes how having a coach who is **open to talking about these issues** has helped create a **positive shift in the team's culture**: "We make sure that we make it a very normal topic, so that new athletes know that they can talk about it and so that they know that it's not normal if you're having problems because… there's been plenty of other athletes that have come in that didn't realize it was an issue". This athlete describes her primary reason for comfort in discussing REDs with her support staff as the **relationship** she has with them and whether they are **proactive in initiating conversations.**

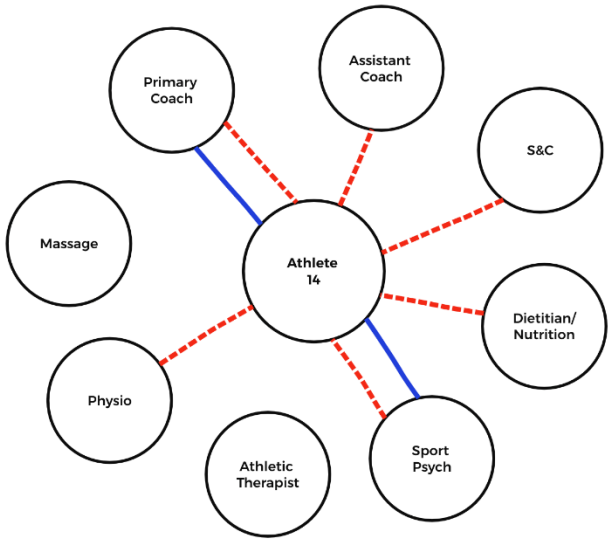
Athlete 13



Athlete 13 (a graduate student) started cross country this year after participating in another endurance sport throughout most of her university career. She **had never heard of REDs** until the USports Cross Country Championships panel. She describes how it was "alarming…to realize how present it is and also realize that it was the first time [she] was putting it together and really hearing about it". Joining the cross-country team recently, she had a significant increase in training. As a more mature athlete, she felt as though she managed this training increase well and that "all of [her] eating, sleeping, so many of [her] habits changed in response". However, she believes that if she "had decided to be a varsity runner six years ago when [she] was in first year" she does not "think [she] would have had that self-regulation or awareness to think that hard about the amount of calories [she's] consuming" and she believes that she "could have been like the perfect candidate for really detrimental REDs".

Her primary reason for comfort discussing REDs with her assistant coach and physio is that they are both **younger female support staff** with whom she has **positive relationships**. She describes her assistant coach as "super approachable" and her physio as being of similar age and very **relatable**. In contrast- her relationship with her primary coach is starkly different. Athlete 13 describes her coach as more socially distant from the athletes- particularly the women's team. Although she knows "REDs is super prevalent and important, it doesn't feel like in his style of communication there's space for that".

Athlete 14

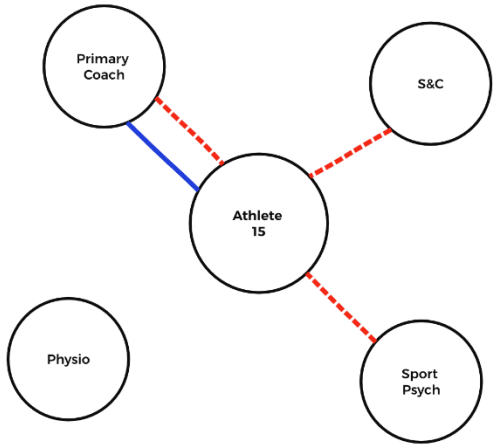


REDs became a topic of conversation between this athlete and her coach after recently experiencing a stress fracture. This athlete initiated the conversation, knowing that an increased risk for bone injuries can be a symptom of REDs. Although she does not believe REDs was the underlying cause of her injury, she believes having this conversation with her coach and ruling out the possibility was helpful. Additionally, her coach and sport psychologist have discussed REDs in team meetings, and her coach's partner is a female doctor and runner, which this athlete describes as an invaluable resource for discussing topics on female health.

This athlete identifies as being very open to discussing REDs. **Her coach encourages them to track their menstrual cycle**: "We have an athlete log, and we're supposed to fill out - I guess if you're not comfortable you probably wouldn't fill it out - but we're supposed to fill out when we get our period….put like a check in one of the boxes". She has found this practice helpful, and to her knowledge, most of her teammates participate in this tracking and are comfortable with it. This athlete is comfortable discussing REDs with her coach because she believes **he would care about anything that might affect training**. Athlete 14 is most comfortable discussing REDs with support staff she has the most **robust**

relationship with. She notes those who were helpful to her when she was diagnosed with her stress fracture as being good resources to discuss other health-related topics.

Athlete 15

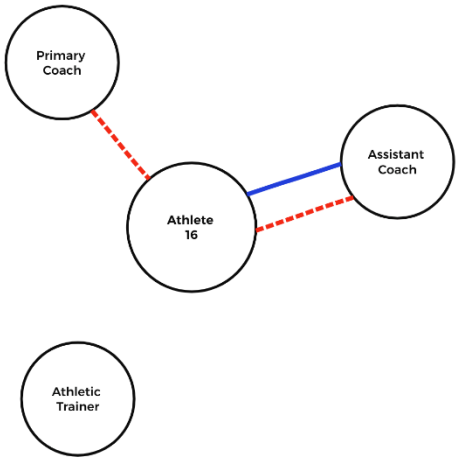


In hindsight, after **learning about REDs in a University class**, Athlete 15 believes that she experienced REDs when she **increased training without adapting her nutrition**. When an injury forced her to rest, she regained energy balance, and she now better understands the relationship between fueling and training, stating: "If I wanna train more, I need to eat more". Athlete 15 also describes how she often initiates conversations about REDs; however, recently, her coach has started discussing it, which she believes is a significant step towards increased awareness.

Her male coach recently brought up the topic of REDs, when reading about it in a book. Athlete 15 recounts how this allowed her to feel more comfortable talking to male support staff about REDs: "Before, I thought I would be more comfortable talking to a woman, but since my coach…talked to us about it, and he kept informed about it, I think both are kind of equal, because if you show that you care, it doesn't matter". This athlete is primarily comfortable **talking to support staff who have shown interest in health and performance.** For example, she describes her S&C coach as someone who is "very curious" and someone who cares about how they adapt to training, and therefore would be "open

minded to learn a little more about REDs". This athlete also describes having access to a sport psychologist who is **knowledgeable** about eating disorders, which leads the athlete to believe that they would be interested in discussing REDs as well.

Athlete 16

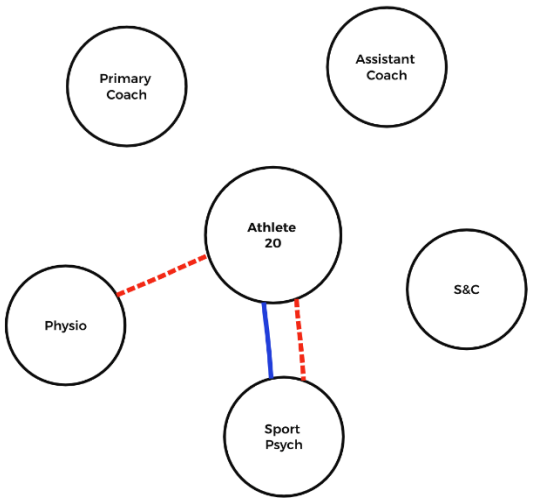


Having transferred Universities for grad school, Athlete 16 has had **minimal conversations with her support staff** at her current University. However, she recalls having several conversations with support staff at her previous school. Although this athlete does not believe she has ever experienced REDs, she had discussions with her support staff when exhibiting potential symptoms (e.g. a stress fracture and instances of passing out during races).

At her previous school, her coach would check in with athletes during individual meetings about whether or not they got a regular period. She describes how, as a young athlete who did not have a super strong relationship with her coach, she was **somewhat uncomfortable in these situations**: "I probably felt intimidated by the coach at the time… 18 years old and not running well either…I definitely didn't feel comfortable even just on the team in general". Now, in hindsight, she can see how it is essential to have those types of conversations: "I remember actually being asked in those meetings, if I get my period regularly and like eating enough. So that was good… coming to [current school], I noticed the head coaches didn't do anything like that, which I was kind of surprised about".

At her current school, her female assistant coach has discussed REDs and topics related to fueling with athletes. This athlete assumes that her male head coach leaves these types of conversations to the female assistant coach. However, she also believes that her head coach should discuss this: " It shows professionalism and shows that it's something that everyone needs to be talking about."

Athlete 20



Athlete 20 describes how she likely **experienced REDs** during the COVID-19 Pandemic when more free time caused her to increase her training volume to the point where she "was doing 15 to 20 hours of training a week, which was a lot more than [she] was used to" which lead to her developing a stress fracture. It was because of this injury and forced time off training that she believes allowed her to regain energy balance. Her primary resource during this time was her physio, who helped her adjust her training volume and, therefore, energy expenditure.

This athlete describes her physio as "easygoing" and s**omeone she can talk to like a friend**, which she believes would allow for comfort in discussing topics such as REDs. Additionally, this athlete has discussed REDs with her sport psychologist, which she believes "challenged [her] view of training" and allowed her to realize the **psychological side of overtraining**: "I feel like I wasn't really conscious of

it. I brought up training and my insecurities about not training as much as other people or trying to bump up my volume and it kind of just like led to a conversation about REDs".

Athlete 20 **does not feel as though she has a good enough relationship** with the remainder of her support staff to feel comfortable discussing REDs. For example, she would not feel comfortable talking to her coach about REDs, describing him as "a good coach, but he's a coach that's really focused on training plans, and race goals and stuff … he's just someone that's not super good at talking to people when they're having difficulties... he's not really an open person that you feel like you can talk to about anything".

Appendix B. Athlete Questionnaire

Informed Consent Form

Study Name: The Role of Athlete and Support Teams in the Development and Treatment of REDS in Female University Endurance Athletes

Researchers:

Erin Teschuk (graduate student supervised by Dr. Erickson) School of Kinesiology and Health Science, York University, Norman Bethune College (rm 223) Toronto, Ontario
erint94@yorku.ca

Dr. Karl Erickson (Supervisor/Assistant Professor) School of Kinesiology and Health Science, York University, Norman Bethune College (rm 343) Toronto, Ontario
kerick@yorku.ca

Purpose of the Research: This research aims to map the support staff network of female university endurance athletes and examine athletes' perspectives on how these support systems relate to experiences of relative energy defciency in sport (REDS). The results of this research are intended to inform support staff on their role in the development and treatment of REDS in female university cross-country athletes.

What You Will Be Asked to Do in the Research: This is a two-phased study. In phase one, you will be asked to complete a survey based on your experience as a university cross-country athlete, regarding your experience working with support staff members and your experience (or lack of) communicating with support staff about REDS. The survey will take an estimated time of 10 minutes to complete. In phase two, you will be asked to complete an interview based on your responses to phase one of this research project. The interview will take an estimated 30-60 minutes.

Risks and Discomforts: For this study you will be asked about your experience as an athlete or support team member. Any time a participant is asked to talk about personal experiences, there is a risk of psychological or emotional discomfort. This may include anxiety, embarrassment or negative feelings when discussing personal experiences. If you feel any psychological or emotional discomfort, you may drop out of the study at any time without consequence. You do not need to share any experiences you are not comfortable discussing.

Benefits of the Research and Benefits to You: This research benefits university athletes by examining their perspective and may inform University Athletic departments on the role social structures play in regards to this syndrome. REDS can significantly impact athletes' physical, social and psychological development, and understanding the resources available to athletes and their impact provides an avenue for identifying gaps and potential improvements to the current system. Advancements in these social support systems may extend athletes' careers and allow

them to stay healthy and perform optimally.

Voluntary Participation and Withdrawal: Your participation in the study is completely voluntary, and you may choose to stop participating at any time. Your decision not to volunteer, to stop participating, or to refuse to answer particular questions will not influence the nature of the ongoing relationship you may have with the researchers or study staff or the nature of your relationship with York University either now, or in the future. Should you wish to withdraw after the study, you will have the option to also withdraw your data up until the analysis is complete.

Confidentiality: Unless you choose otherwise, survey answers will not be associated with identifying information. All information you supply during the research will be held in confidence, and unless you specifically indicate your consent, your name will not appear in any report or publication of the research. Data will be collected via Qualtrics. Your data will be safely stored in a locked facility on a password-protected computer, and only research staff/research team members will have access to this information. The data will be stored indefinitely and remain on a password-protected computer in a locked facility. Confidentiality will be provided to the fullest extent possible by law. The researcher acknowledges that the host of the online survey (Qualtrics) may automatically collect participant data without their knowledge (i.e., IP addresses.) Although this information may be provided or made accessible to the researchers, it will not be used or saved without participant's consent on the researchers system. Further, Because this project employs e-based collection techniques, data may be subject to access by third parties as a result of various security legislation now in place in many countries and thus the confidentiality and privacy of data cannot be guaranteed during web-based transmission.

Questions About the Research? If you have questions about the research in general or about your role in the study, please feel free to contact Dr. Erickson either by e-mail (kerick@yorku.ca), Erin Teschuk (erin.teschuk@gmail.com) or the faculty of kinesiology and health sciences at York University (kahs@yorku.ca). This research has received ethics review and approval by the Human Participants Review Sub-Committee, York University's Ethics Review Board and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines. If you have any questions about this process, or about your rights as a participant in the study, please contact the Director, Research Ethics in the Office of Research Ethics, 3rd Floor, Kaneff Tower, York University (e-mail ore@yorku.ca).

I _____ consent to participate in The Role of Athlete and Support Teams in the Development and Treatment of REDS in Female University Endurance Athletes, conducted by Erin Teschuk. I have understood the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form. Clicking the CONTINUE button below indicates my consent.

Please fill name below

Relevant Terms

For the purpose of this survey the key terms will be defined as follows:

Relative Energy Deficiency in Sport (REDS): A syndrome characterized by physiological impairments due to **low energy availability (LEA):** when calories consumed are not supporting calories expended. Such physiological symptoms include impaired metabolic rate, endocrine function, menstrual function (in females), bone health, immunity, protein synthesis, cardiovascular health and decreased performance.

Support Team: A network of support personnel formally employed by your university athletic department whose job involves supporting the health and performance of athletes.

Before participating in this research, did you know what REDS was?

Yes/ No

Which support staff members do you have access to through your university (select all that apply)?

Primary Coach

Assistant Coach

Strength Coach

Dietitian/Nutritionist

Sport Psychologist

Athletic Trainer

Exercise Physiologist

Massage Therapist

Physiotherapist

Other (Please Indicate)

Of the listed support staff members at your university, which have you had conversations with about REDS or Low Energy Availability? If you do not have access to a support staff member, please select N/A

Primary Coach

Assistant Coach

Strength Coach

Dietitian/Nutritionist

Sport Psychologist

Athletic Trainer

Exercise Physiologist

Massage Therapist

Physiotherapist

Other (Please Indicate)

Of the listed support staff members at your university, which would you feel comfortable having conversations about REDS and low energy availability with? If you do not have access to a support staff member, please select N/A.

Primary Coach

Assistant Coach

Strength Coach

Dietitian/Nutritionist

Sport Psychologist

Athletic Trainer

Exercise Physiologist

Massage Therapist

Physiotherapist

Other (Please Indicate)

Thank you for taking the time to complete the questionnaire. Phase 2 of this study will include participation in a virtual interview (via Zoom) which should last an estimated 30-60 minutes. Please indicate your preferred day and time of day for scheduling and participating in the virtual interview below.

Please indicate preferred days of the week for a zoom interview (select all that apply)

Monday
Tuesday

Wednesday

Thursday

Friday

Saturday

Sunday

Please indicate your preferred time for a zoom interview during weekdays (select all that apply, if any).

Morning (9am-12pm EST)

Afternoon (12-5pm EST)

Evening (5-8pm EST)

Please indicate your preferred time for a zoom interview during the weekend (select all that apply, if any).

Morning (9am-12pm EST)

Afternoon (12-5pm EST)

Evening (5-8pm EST)

Please indicate an email address that you would like to be contacted at to schedule a zoom interview

Appendix C. Semi-Structured Interview Guide

Introduction:

Verbally reconfirm informed consent, remind participant that they can withdraw at any time, provide opportunity to address any questions

Define REDS, LEA, and athlete support teams

Past Experience:

Have you heard of REDS or LEA before?

Do you have personal experience with REDS or LEA?

- Personal experience/ secondary experience (i.e teammate)

Survey Questions Follow Up:

Follow up on every line/ absence of in athlete's network diagram:

- You indicated you discussed REDS with _____ member of your support team - was the conversation initiated by yourself or the team member?
- What was that conversation like?
- Did you feel like the conversation was helpful?
- If you haven't discussed REDS with any support team members, is this something you would want to do?
- Would you be comfortable discussing this with your coach?
- Is there someone else you would prefer?
- Why would you/ would you not feel comfortable talking about REDS with _____ member of your support team

What other factors might contribute to your comfort discussing REDS with certain support team members?

- Gender?
- Knowledge?

Future Recommendations:

What might make you more comfortable discussing these topics with support team members?

- Less comfortable?

From your perspective, what can support team members do to help prevent or treat REDS?

- Would you want support team members to initiate the conversation?

- Can you see yourself wanting to initiate conversations?

Are you missing any support or resources that you believe might help to prevent or treat REDS?

- Support team members

- Quality of support/ knowledge of REDS

- Are there other people outside of the support team provided by the university that you would be more comfortable discussing REDS with?

Appendix D: Informed Consent Form

Date:

Study Name: The Role of Athlete and Support Teams in the Development and Treatment of REDS in Female University Endurance Athletes (PI: Erin Teschuk)

Researchers:

Erin Teschuk (graduate student supervised by Dr. Erickson) School of Kinesiology and Health Science, York University, Norman Bethune College (rm 223)
Toronto, Ontario

erint94@yorku.ca

Dr. Karl Erickson (Supervisor/Assistant Professor) School of Kinesiology and Health Science, York University, Norman Bethune College (rm 343)
Toronto, Ontario
kerick@yorku.ca

Purpose of the Research: This research aims to map the support staff network of female university endurance athletes and examine athletes' perspectives on how these support systems relate to experiences of relative energy deficiency in sport (REDS). The results of this research are intended to inform support staff on their role in the development and treatment of REDS in female university cross-country athletes. This research is intended to be presented and reported in the form of a thesis, report and conference presentation.

What You Will Be Asked to Do in the Research: This is a two-phased study. In phase one, you completed a survey based on your experience as a university cross-country athlete, regarding your experience working with support staff members and your experience (or lack of) communicating with support staff about REDS. In phase two, you will be asked to complete an interview based on your responses to phase one of this research project. The interview will take an estimated 30-60 minutes.

Risks and Discomforts: For this study you will be asked about your experience as an athlete or support team member. Any time a participant is asked to talk about personal experiences, there is a risk of psychological or emotional discomfort. This may include anxiety, embarrassment or negative feelings when discussing personal experiences. If you feel any psychological or emotional discomfort, you may drop out of the study at any time without consequence. You do not need to share any experiences you are not comfortable discussing.

Benefits of the Research and Benefits to You: This research benefits university athletes by examining their perspective and may inform University Athletic departments on the role social structures play in regards to this syndrome. REDS can significantly impact athletes' physical, social and psychological development, and understanding the resources available to athletes and their impact provides an avenue for identifying gaps and potential improvements to the current

system. Advancements in these social support systems may extend athletes' careers and allow them to stay healthy and perform optimally.

Voluntary Participation and Withdrawal: Your participation in the study is completely voluntary, and you may choose to stop participating at any time. Your decision not to volunteer, to stop participating, or to refuse to answer particular questions will not influence the nature of the ongoing relationship you may have with the researchers or study staff or the nature of your relationship with York University either now, or in the future. Should you wish to withdraw after the study, you will have the option to also withdraw your data up until the analysis is complete.

Confidentiality: All interviews will remain confidential. Your interview and recording used for this study will not be associated with any identifying information. All information you supply during the research will be held in confidence and unless you specifically indicate your consent, your name will not appear in any report or publication of the research. All information you supply during the research will be held in confidence and unless you specifically indicate your consent, your name will not appear in any report or publication of the research. Data will be recorded via Zoom. Your data will be safely stored in a locked facility, on a password protected computer, and only staff/research team members will have access to this information. The data will be stored for up to two years, and destroyed by December 31st, 2025. Confidentiality will be provided to the fullest extent possible by law.

This study will use the Zoom to collect data, which is an externally hosted cloud-based service. When information is transmitted over the internet privacy cannot be guaranteed. There is always a risk your responses may be intercepted by a third party (e.g., government agencies, hackers). Further, while York University researchers will not collect or use IP addresses or other information which could link your participation to your computer or electronic devices without informing you, there is a small risk with any platform such as this of data that is collected on external servers falling outside the control of the research team.

The researchers acknowledge that the host of the online platform (e.g., Qualtrics, Survey Monkey etc.) may automatically collect participant data without their knowledge (i.e., IP addresses.) Although this information may be provided or made accessible to the researchers, it will not be used or saved without participant's consent on the researchers system. Further, because this project employs e-based collection techniques, data may be subject to access by third parties as a result of various security legislation now in place in many countries and thus the confidentiality and privacy of data cannot be guaranteed during web-based transmission.

If you are concerned about this, we would be happy to make alternative arrangements (where possible) for you to participate, perhaps via telephone. Please contact Erin Teschuk or Dr. Erickson for further information.

Recordings (audio/video) will be saved in a password protected file to research team members' local computer, not the cloud-based service.

Please note that it is the expectation that participants agree not to make any unauthorized recordings of the content of a meeting / data collection session.

Questions About the Research? If you have questions about the research in general or about your role in the study, please feel free to contact Dr. Erickson either by e-mail (kerick@yorku.ca), Erin Teschuk (erint.94@yorku.ca) or the faculty of kinesiology and health sciences at York University (kahs@yorku.ca). This research has received ethics review and approval by the Human Participants Review Sub-Committee, York University's Ethics Review Board and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines. If you have any questions about this process, or about your rights as a participant in the study, please contact the Director, Research Ethics in the Office of Research Ethics, 3rd Floor, Kaneff Tower, York University (e-mail ore@yorku.ca).

Legal Rights and Signatures:

I_____, consent to participate in *The Role of Athlete and Support Teams in the Development and Treatment of REDS in Female University Endurance Athletes* conducted by Erin Teschuk. I have understood the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form. My signature below indicates my consent.

Signature Date

Participant

Signature Date

Principal Investigator

Additional consent (where applicable)

1. Audio recording

☐ I consent to the audio-recording of my interview(s).

2. **Video recording**

I _____consent to the video recording of my interview, but that only typed transcripts of my interview (not any images of me or my environment) will be used in the analysis and presentation of results

1. Consent to use of quotes

I _____consent to the use of quotations in any final reports/ publications of the research. Quotes will remain anonymous.