Prevalence and Type of Psychopathology in Ultra Endurance Athletes

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A Thesis in the Field of Psychology

for the Degree of Master of Liberal Arts in Extension Studies

Harvard University

May 2021

Abstract

This study examined the prevalence and type of mental health disorders present in a population of ultra endurance athletes. Historically, most formal research into this population has centered on physiological implications of participation, but not on the psychological implications. 523 endurance athletes, between the ages of 19 and 73, participated in a general mental health survey to ascertain any prior diagnosis and answered a full Patient Health Questionnaire, as well as the Eating Attitudes Test. Participants were recruited through numerous online endurance athlete communities, clubs, and podcasts. The study hypothesized that there would be a greater incidence of mental disorder whether diagnosed or undiagnosed, in the population of ultra endurance athletes versus the general population in the United States. This research study found that there is a greater prevalence of mental disorder in this population as a whole, and a positive correlation between incidence of mental disorder and volume of training per week. Anxiety, depression, and alcohol abuse were found to be the most prevalent, though there is evidence of a wide variety of psychopathology in the population including, but not limited to, bipolar disorder, eating disorder, obsessive compulsive disorder (OCD), and post traumatic stress disorder (PTSD). Given the scarcity of available research on mental disorder in ultra endurance athletes, this study aims to bridge the current lack of information and provide evidence that there is a need for support and guidance surrounding the recognition and management of mental health concerns in this population.

Dedication

I dedicate this thesis to my parents, Elaine F. and Thomas D. Puleo, to whom it never occurred that I would ever fail.

Acknowledgments

I would like to express deep appreciation to Dr. Andrew Engelward, Dr. Jonathan Jenkins, and Dr. Dante Spetter for believing in my vision for this project and helping me to be successful despite the many challenges.

Special thanks to Jason Pappas for Qualtrics mastery.

Special, special thanks to Kelly Zuromski for fairy godmother services.

I send a huge thank you to Bryon Powell of irunfar.com, Eric Schranz of ultrarunnerpodcast.com, and Alison Wade of the Fast Women Newsletter. The success of the survey relied heavily on their incredible generosity.

This project, as well as my education at Harvard, would not have happened without the unwavering support of my parents, Thomas and Elaine Puleo. I cannot thank them enough for the hours of FaceTime chats, early morning rides to the train station, and yes, the other half of the tuition.

I am truly grateful for my husband, Mauro Colangelo, who provided constant encouragement and love. Sei la cosa più bella che mi sia mai capitata.

And to Tulip: thank you for being a most excellent writing buddy. Ti meriti tutti gli spaghettoni.

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Chapter I

Introduction

Participation rates in ultra endurance sports such as triathlon, ultramarathon, and long distance cycling are increasing, though the psychological and physiological effects of high volume training are not well understood (Scheer, 2019). Despite evidence that exercise is beneficial to mental health, several recent studies have noted a tendency toward increased prevalence of mental disorder in ultra endurance athletes. In contrast to the idea that ever-increasing volumes of exercise would offer ever-increasing mental health benefits, there may be a U-shaped relationship between benefits of participation and training volume as outlined by the largely abandoned Mental Health Model in Sports Psychology, pioneered by William Morgan in the 1980s (Onate, 2019). This truth potentially leaves ultra endurance athletes vulnerable to increased risk of psychopathology due to their high training volume and grueling training regimen.

There has been observation of an increasing amount of discussion of mental disorder in the ultra endurance athlete community. Mental disorder is acknowledged in the community and perhaps disturbingly, accepted or even expected as part of the training (Finn, 2019). There does not appear to be any other sport with this association, therefore it is important to begin an inquiry into if there is more mental disorder in this particular population and eventually, why this would be true.

The goal of the current research is to understand the prevalence of psychopathology in ultra endurance athletes. This research also aims to gain insight into the possible relationship between endurance training and mental health disorders, by examining the

timing of the onset of mental disorder and whether athletes with mental disorder are particularly attracted to endurance sport (ie: diagnosis pre-participation). In addition, the study investigates whether athletes who participate in endurance sport are prone to develop mental disorder (ie: diagnosis during/after participation) either as a consequence of the endurance athlete culture or due to the direct effects of high intensity training.

The next chapter gives an overview of what is currently known about mental disorders in ultra endurance athletes and the gaps in mental health research on this population. The chapter will provide some insight as to why and how this population has been overlooked, as well as provide context for the serious consequences of this lack of research.

It is important to understand whether and how ultra endurance training is related to increased risk for mental disorder because there are currently no guidelines for or warnings about psychological implications, though the physical implications of very intense training are well defined. There are also no protocols for screening, diagnosis, or treatment for mental disorder associated with high training volumes. Insight into actual types and prevalence of psychopathology in this population may lead to further study and research into appropriate guidelines for awareness and support.

Mental Health in Ultra Endurance Athletes is Often Overlooked

Participation in endurance sports, particularly ultramarathon, has surged in the last 25 years (Scheer, 2019). Despite this fact, there is a dearth of current research on this sport and the participant population. In particular, there is limited research on either the benefits or the risks associated with this level of high training volume and competition among recreational and amateur athletes, specifically with regard to psychopathology.

The limited research has focused on the physical implications of training and participation in UES, yet there is almost no research on the potential mental health implications of these demanding activities in either an elite or recreational population. Extensive research of articles about UEAs from the past 20 years in leading sports journals such as International Journal of Sport and Exercise Psychology, the American Journal of Sports Medicine, and the British Journal of Sports Medicine does not reveal any studies that focus on UES and the high-performing, non-elite athlete.

The 2018 results from the National Survey on Drug Use and Health concluded that almost 48 million adults had a mental disorder diagnosis in the previous twelve months, over 11 million had a serious mental disorder, and that this number is growing steadily (SAMHSA, 2019). Many people with and without diagnosed mental health disorders are looking for ways to cope with uncomfortable emotions and manage mental health and have therefore turned to physical activity. The link between a moderate amount of exercise and improved mental health outcomes is well established in scientific literature. In a 2018 study, 104 young adults who engaged in a 30-minute exercise protocol, followed by a stressful speech test, the exercise session was found to have a positive effect on their ability to cope with stress and regulate emotions via self-report (Bernstein & McNally, 2018). A 2003 study on 5877 of people aged 15-54 found that regular exercise was associated with a significant decreased incidence of depression and anxiety, as well as other mental health disorders including major depression (OR = 0.75 (0.6,0.94)), agoraphobia (OR = 0.64 (0.43, 0.94)), social phobia (OR = 0.65 (0.53, 0.8)), panic attacks (OR = 0.73 (0.56, 0.96)) (Goodwin, 2003). A 2018 position statement from the European Psychiatric Association concluded that moderate to vigorous exercise, 2-3

times per week should be included as part of therapeutic interventions for severe mental disorder such as major depressive disorder, schizophrenia, and bipolar disorder due to what they found to be clearly observable ameliorative effects (Stubbs et al., 2018). Their current list of clinical recommendations is based on this meta-analysis of over 20 review articles and includes directives such as, “Physical activity should be used as a treatment for mild-moderate depression to improve symptoms and physical fitness” and “Physical activity should be utilized as an adjunctive treatment for schizophrenia-spectrum disorders, to improve symptoms, cognition and quality of life” (Stubbs et al., 2018).

In Raglin’s 1990 review of research utilizing both acute and chronic exercise for the treatment of mental disorder, it was found that especially in clinical samples, exercise had as favorable an outcome as psychotherapy, even without the use of pharmaceuticals (Raglin, 1990). In particular, he references a study in which 28 subjects with a diagnosis of clinical depression who engaged in a regular running routine experienced a similar reduction in symptoms as compared to those who engaged in regular psychotherapy, as measured by the Symptom Checklist 90 (SCL-90) (Greist, et al., 1979). The SCL-90, similar to the PHQ used in this research, is a general mental health assessment that one might encounter in a clinical setting. However, most of this research is based on participating in aerobic activity more in line with a typical fitness routine; even in chronic applications, exercise was relegated to a duration of between 20-40 minutes, three times per week (Greist et al., 1979).

Regardless of these results, there is very little research on ultra endurance athletes, in general, and even less on potential psychopathology in this population. One of the most comprehensive studies on UEAs, the ULTRA study (Hoffman, 2011), assessed the

physical health of over 1,200 ultrarunners but did not address mental health (Hoffman & Krishnan, 2014). The researchers concluded that, overall, ultrarunners were healthier and missed fewer days of work compared to the general population (Hoffman & Krishnan, 2014). The focus on physical health does not address overall health and wellness of the individual, a fact echoed by professional organizations such as the Centers for Disease Control (CDC, 2018). The CDC clearly states that a combination of physical and mental health is necessary for disease prevention and health promotion (CDC, 2018). The ULTRA study omitted mental health in their outcomes measures, focusing instead on physical injury, illnesses, missed days of work or school, and the onset of chronic diseases like heart disease and diabetes, among other physiological signs of health (Hoffman & Krishnan, 2014). It is possible that the study missed an opportunity to gain a deeper perspective on these athletes due to the lack of mental health inquiry.

A 2018 literature review of the research on the physiology and pathophysiology of ultramarathon runners highlighted the wide variety of body systems and structures that are adversely affected by participation in ultramarathons further suggesting that Hoffman's work may not have captured the full picture (Knechtle & Nikolaidis, 2018). However, while highlighting physiological issues such as musculoskeletal overtraining injuries, hyponatremia, and rhabdomyolysis, these authors also failed to address mental health except to report that many of the runners stated they would not stop participating despite knowing about the higher incidence of physical injury (Knechtle & Nikolaidis, 2018). Similarly, a 2016 study acknowledged the psychological demands of UEAs, yet only focused on mindsets that would be conducive to improved performance (McCormick, Meijen & Marcora, 2016). Semi-structured interviews were conducted

among thirty recreational UEAs to enumerate the psychological demands that they experienced, but only as they related to performance leading up to and upon participation in competitive events (McCormick, Meijen & Marcora, 2016) The concerns of these athletes were focused, therefore, on aspects of performance such as fear of being overtaken in a race, concerns over not having enough time to train, and worries about muscle pain and fatigue (McCormick, Meijen & Marcora, 2016). This study did not discuss psychological concerns of these athletes as they would pertain to their overall mental health and acknowledges in the Limitations section that it did not address aspects of emotion, appraisal, and coping (McCormick, Meijen & Marcora, 2016)

Origins of Research in the Ultra Endurance Population: "Staleness" and the Morgan-Raglin Studies

It is important to explore the psychological aspects of participation, particularly, whether the relationship between exercise and mental health is curved or linear. Are correlations between exercise and mental health expected to continue rising indefinitely with the addition of more exercise? Or is there a point, beyond which, increasing volumes of exercise are inversely correlated to mental health? It may be easy to understand that dose response has limitations in discussions of pharmaceutical interventions for mental health. It is well understood that 20mg of Prozac might work well for treating depression, but 200,000 mg will likely incur serious medical consequences. Yet, the same logic is not currently applied to exercise as a potential therapeutic intervention. Unfortunately, "there is no such thing as unmitigated good," according to the Yerkes-Dodson principle which states that there will come a point where the upward arc of benefit reaches its apex, only to curve downward into detriment (Grant & Schwartz, 2011). This principle reminds us

that everything that is seen as positive may, in fact, become negative at high volumes (Grant & Schwartz, 2011). It would seem that even one's favorite exercise may not be immune to this concept.

There is very little research that attempts to examine a dose-response effect of exercise on mental health, however the existing research does point to a potential inverse relationship between mental health and training volume. In a 1987 study of twelve swimmers who were forced into a period of high volume training (4000 meters/day to 9000 meters/day) for a ten day period, wellbeing significantly decreased as the study progressed as measured by the 7-point Likert scale Profile of Mood States (POMS) (Morgan, Costill, Flynn, Raglin & O'Connor, 1988). The increased volume was associated with significant (p.05) increases in depression, anger, and fatigue, and overall decrease in wellbeing, assessed on a 7-point Likert scale by athletes during and after the training block. (Morgan, Costill, Flynn, Raglin & O'Connor, 1988). Based on this work, a ten-year study of 400 swimmers at the University of Wisconsin-Madison similarly used the POMS to assess moods at monthly intervals during annual training schedules that varied from 3,000 to 11,000 yards per day (Morgan, Brown, Raglin, O'Connor & Ellickson, 1987). Across all ten years of the study, the highest level of mood disturbances were found at the time of the highest volume training block, in January (Morgan, Brown, Raglin, O'Connor & Ellickson, 1987). Additionally, in eight companion studies conducted to assess mood state in this same population, higher training volumes were associated with increased fatigue (P<.01) and decreased vigor (P<.01), increased depression and anger (P<.01), and a return to baseline mood upon decrease in training

volume (Morgan, Brown, Raglin, O'Connor & Ellickson, 1987). Mood states improved as volume decreased again (Morgan, Brown, Raglin, O'Connor & Ellickson, 1987).

Raglin's 2001 review article is based on this body of research and discusses other studies that reference the Mental Health Model for sport in which an athlete's performance will improve as their mental health improves and decline as their mental health declines (Raglin, 2001). Longitudinal inquiries into this model clearly detail that there is, in fact, a dose response relationship between training volume and mental health such that, as training volume increases, mental health declines for many athletes (Raglin, 2001). Multiple studies involving over 500 participants conducted in the 1970s and 1980s by Dr. William P. Morgan, founder of the Exercise and Sport Psychology division of the American Psychological Association, support this conclusion (Raglin, 2001). A hypothesis is that the implications of this research have been somewhat obfuscated by the fact that this theory was intended to predict athletic performance, not mental health. Morgan, himself, in his 1984 review of the Mental Health Model, reports that it has limited applicability, but while not necessarily predictive of performance outcomes, the research still robustly connects poor mental health with increased training volumes (Morgan, 1984).

Morgan's model was originally intended to be used in athlete selection (Raglin, 2001). Likely, it fell into disuse when it proved not to be useful for this purpose. Nonetheless, it may serve as a basis for the concept that increased training volume is not always better for overall health.

The concept that high volume may be related to poor mental health is also addressed in a position paper published in *Endurance in Sport* where it was recognized

that long distance swimmers and runners seemed to show more mood disturbances with more intense training (Shephard & Åstrand, 2008). However, it seems that this finding has largely been ignored because athletes seem to have difficulty believing that there could be an onset of negative mental health symptoms with increased training, an activity that they closely associated with mental wellness, and researchers have yet to delve deeper into this topic. In the absence of further inquiry, especially in the population of self-selecting, recreational athletes, refusal to accept the hypothesis that increased training will lead to increased benefits in mental health will begin to have negative consequences as athletes continue to push the boundaries of endurance in UES.

If it is plausible that increased training volume could lead to increased mental disorder, inquiry into the community of ultra endurance athletes may provide valuable confirmation of the hypothesis that Morgan alluded to.

Mental Disorder is Observed in the Ultra Endurance Sport Community

Observers of the UEA community have begun to notice some disturbing trends in mental disorder in this population, despite the lack of research into a possible association between negative mood states and participation in ultra-endurance sports. Onate noted an increased risk of depression and suicide in ultramarathoners in his recent review of current research on mental health of endurance athletes (Onate, 2019). Onate worked with Nikki Kimbal and Rob Krar, two elite-level UEAs, who have openly spoken of their battles with severe depression. In his review, Onate wrote that diagnosis in this group of athletes is often overlooked as sufferers do not “look” as though they need treatment (Onate, 2019). Similarly, in a study of 98 ultrarunners using the Patient Health Questionnaire-2, symptoms that strongly correlate with a diagnosis of depression were

found in 20% of participants (Buck, Spittler, Reed & Khodaee, 2018). Runners were also found to be at risk for exercise addiction (18.2%), feeling depressed (18.6%), and not finding pleasure or having interest in activities (21.6%). The authors suggest that mood disturbances may have been previously overlooked because of these athletes' "healthy" appearance (Buck, Spittler, Reed & Khodaee, 2018). The authors did not provide a definition for what physical attributes would present as "healthy" in a clinical setting, but it was clear that they did not believe that mental health could be recognized by appearance alone (Buck, Spittler, Reed & Khodaee, 2018). DSM-V criteria for depression include diminished interest in physical activities, loss of energy, and a decreased desire to engage in interests like sport, therefore health care providers could miss a mental health crisis in athletes who continue to train and seem to have the desire to do so (American Psychiatric Association, 2013). Similarly, mental health clinicians who are accustomed to encouraging their patients to start exercising may be overlooking a tendency of endurance athletes to use training as a maladaptive coping mechanism, possibly suffering additional mental and physical consequences as a result of abusing or mismanaging high volume training.

Much of prior research on mental health disorders in athletes has focused on eating disorders, particularly in collegiate sports and in elite athletes, however very little of this research has been directed at the population of UEAs. A recent study measured the prevalence of disordered eating in 162 non-professional, multi-sport endurance athletes using both Food Frequency Questionnaire and the Eating Attitudes Test (Mongrain, Masson, Bégin & Lamarche, 2018). Researchers did not find a higher incidence of disordered eating (EAT Total= 6.5 +/- 0.5 on a scale of 0 to 78) in this population, though

it did find that athletes who participated in more competitive events that require a higher volume of training, such as the half-Ironman 70.3 mile distance event (EAT 70.3= 9.1 +/- 0.8), were more likely to self-report symptoms associated with disordered eating (Mongrain, Masson, Bégin & Lamarche, 2018). A study of 583 triathletes competing at a variety of distances (mean age=36) found that 28% of females and 11% of males showed possible evidence of disordered eating by scoring below the midpoint range in the Eating Attitudes Test in the categories of "Preoccupation with Food and Weight", and "Calorie Control" (DeBate, Wethington & Sargent, 2002). It is important to note that 60% of the athletes scored below the midpoint for the Eating Attitudes Test in the category of Food Restriction, indicating a tendency toward under-eating, and only 25% of the athletes were consuming enough carbohydrates to support their caloric needs (DeBate, Wethington & Sargent, 2002). Scores such as these indicate active caloric restriction which is linked to the onset of eating disorders (DeBate, Wethington & Sargent, 2002). One hundred percent of the participants in DeBate's study reported being dissatisfied with their body size as indicated with a high amount of dissatisfaction with actual BMI versus desired BMI, and actively engaged in restriction to control their weight (DeBate, Wethington & Sargent, 2002).

Another study assessed 87 ultrarunners using the Eating Attitudes Test, Exercise Identity Scale, and Body Alienation Scale. It was hypothesized that this population might be characterized by disordered eating, a high pain tolerance, and a strong personal association with the ultramarathoner (Lantz, Rhea & Mesnier, 2004). It was found that in general, the more the athlete closely associated with the identity of being an ultramarathoner, the more likely they would be to have unhealthy eating attitudes and that

females, in particular, who identify strongly with the idea of being an ultramarathoner, may have an increased risk for developing an eating disorder (EAT mean=12 for High Exercise Identity Rank) (Lantz, Rhea & Mesnier, 2004).

PTSD is another mental disorder that may be over-represented in the population of ultra endurance athletes. Exercise can be a part of therapeutic intervention for the treatment of PTSD, though there is little data on the effect of such a high volume of exercise on an individual's treatment for PTSD (Hegberg, Hayes & Hayes, 2019). In a recent narrative review of 19 studies, it was concluded that exercise has a beneficial effect on the management of PTSD symptoms along with the associated anxiety and depression (Hegberg, Hayes & Hayes, 2019). This review included both observational and interventional research in which subjects engaged in normal to moderate amounts of exercise (ie: 30 minutes, three times per week in one; one hour, three times per week in another) but did not mention exercise programs that would be consistent with high-volume endurance training (Hegberg, Hayes & Hayes, 2019). In a meta-analysis of 49 studies measuring the effects of exercise on anxiety, a quadratic, dose-dependent response was found such that subjects experienced greater symptom relief with greater amounts of exercise up to a point of 12.5kcal/kg per week, but then decreased as amounts of exercise increased (Wipfli, Rethorst & Landers, 2008). For the average sized male and female in the US, weighing 89 kg and 77 kg, respectfully, this would mean participating in physical exercise on a weekly basis such that between 600 and 1000 calories would be burned (Centers for Disease Control and Prevention, 2018). It is quite likely that UEA are completing that much exercise in a single session and doing so multiple times per week.

If a person with PTSD believes that endurance exercise is reducing their symptoms, a perception of dose dependency may encourage increased training volumes (Berczik et al., 2012). A meta-analysis of 25 studies aimed to explore exercise addiction in endurance athletes found that as athletes increase the frequency and duration of their training, many will experience a corresponding reduction in psychological symptoms (Nogueira, Molinero, Salguero & Márquez, 2018). With long, intense training they may also experience euphoria, but the powerful mood enhancement of the opioid-like neurotransmitters may produce a chemical dependency, again, resulting in exercise addiction, though the researchers acknowledge that more empirical study is necessary to confirm this assertion (Nogueira, Molinero, Salguero & Márquez, 2018).

The manner in which social media portrays exercise addiction may incur additional risk for mental disorder. Exercise addiction may be glorified in the media and the messages that encourage participation at all costs and without limit were found to cause high to very high distress (43%), as measured by the Kessler 10 Psychological Distress Scale, in 180 consumers of “Fitspiration” posts on social media (Raggatt et al., 2018). Additionally, 17.7% of the subjects habitually viewing such messages were found to be at risk for an eating disorder as measured by the Eating Attitudes Test and 10.3% were at risk for exercise addiction as measured by the Exercise Addiction Inventory (Raggatt et al., 2018)

Ultra Endurance Athletes Risk Developing Addiction

Any discussion of mental disorder in ultra endurance athletes should address exercise addiction due to the fact that these challenges often appear together in the existing literature, although there is no separate diagnostic category currently found in the

Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2013).

While the DSM-V does not list specific diagnostic guidelines or include exercise addiction as a diagnosis, a 2015 meta-analysis showed the criteria utilized in the Exercise Addiction Inventory were a valid and reliable measure of exercise addiction (Griffiths et al., 2015). The six statements in the Exercise Addiction Inventory correspond to the behavioral characteristics of addiction such as salience, conflict, mood modification, tolerance, withdrawal, and relapse, and reveal the athletes' risk or tendency toward exercise addiction (Griffiths et al., 2015). In 1987, Veale and de Coverly identified two types of exercise addiction: Primary and Secondary (Veale & de Coverly, 1987). Primary exercise addiction occurs when the person becomes addicted to the physical activity component in and of itself, while Secondary exercise addiction occurs when the person is compelled to exercise in efforts to control their body weight or size (Veale & de Coverly, 1987). The difference between regular participation and exercise addiction is the compulsive and obsessive nature with which the person approaches training, as well as the development of a dependence (Berczik et al., 2012). People who exercise to this degree feel that they are compelled or obliged to participate; that they must somehow attain the relief that the act of exercising brings them (Berczik et al., 2012). This is not a new phenomenon. In a 1970 study, researchers struggled to recruit regular exercisers who would be willing to suspend their training programs to study the effects of deprivation, even when offered money to do so, because it was intolerable for them to think of stopping (Baekeland, 1970).

The connection between endurance sports and exercise addiction is clear in a 2018 meta-analysis of 25 peer reviewed studies published since 2010, in which it was concluded that excessive amounts of exercise may cause serious health complications as a result of addictive behaviors (Nogueira, Molinero, Salguero & Márquez, 2018). According to the meta-analysis, athletes who suffer from exercise addiction may not be compelled to stop despite having significant injuries, medical conditions, or life commitments that are not conducive to continued training (Nogueira, Molinero, Salguero & Márquez, 2018). The authors point out that despite the many mental and physical health concerns created by exercise addiction, it is not currently recognized in the DSM-V (Nogueira, Molinero, Salguero & Márquez, 2018). A 2019 systematic meta-analysis of 48 cross-sectional, observational studies found that those who participate in endurance sports are at the highest risk for developing exercise addiction (Di Lodovico, Poulnais & Gorwood, 2019). Studies using the Exercise Addiction Inventory, Exercise Dependence Scale, and the Exercise Dependence Scale-Revised were analyzed and a chi-square test was utilized to summarize prevalence in five different athlete subgroups (Di Lodovico, Poulnais & Gorwood, 2019). Endurance athletes, those participating in long-distance running, marathon, cycling, swimming and triathlon were found to have a 14.2% chance of developing exercise addiction (Di Lodovico, Poulnais & Gorwood, 2019).

Exercise addiction has been implicated in the development of Overtraining Syndrome (OTS), an extreme condition that develops when athletes consistently train without adequate recovery, resulting in deterioration across multiple body systems due to inadequate recovery from abnormal physical demand and resulting endocrine dysfunction (Armstrong & VanHeest, 2002). Those that are addicted to exercise are less likely to take

rest days and engage in the periodization of training necessary to avoid burnout, declining performance, and poor overall health (Armstrong & VanHeest, 2002). In a 2016 opinion paper and literature review, it was found that Overreaching, the condition the precedes OTS, has a prevalence of up to 60% in athletes (Kreher, 2016). Overreaching and subsequent OTS negatively affect endocrine, immune and neurological systems, and negatively impact the musculoskeletal and psychological health of the athlete, having the potential to represent a significant public health risk (Kreher, 2016).

People who are addicted to exercise suffer the same types of consequences as those suffering from substance addiction; salience, mood modification, tolerance, withdrawal, and relapse (Chen, 2016). Noting this, it would be important to understand whether or not there is comorbidity between the two conditions and a possible increased prevalence of substance abuse in UES. In a systematic literature review of the prevalence of addictions in the United States, researchers note that exercise is a process addiction resulting from a group of behaviors that serve to control mood and achieve pleasure, but can result in dependency (Sussman, Lisha & Griffiths, 2010). Researchers contend that both process addictions and substance addictions have similar functions and suggest that there could be a significant co-occurrence between the two, though there are not enough studies to confirm this (Sussman, Lisha & Griffiths, 2010).

Similarly, there is little discussion about DSM-recognized substance abuse and drug and alcohol addiction in the ultra endurance community. In a literature review of eleven studies of the effects of exercise in alcohol addiction, researchers acknowledged that exercise is often included as an adjunct therapy for people being treated for substance abuse, but were unable to make distinct conclusions about efficacy (Manthou et al.,

2016). However, the authors pointed to the fact that both exercise and alcohol use increase B-endorphin in the brain, resulting in similar euphoria, pain modulation, reward, and reinforcement (Manthou et al., 2016). Researchers conclude that the activation of this opioid system may result in substituting exercise for alcohol consumption and point to the need for future study on appropriate dosing of exercise to bring about the desired effect of abstaining from alcohol use (Manthou et al., 2016). There has been limited research addressing whether people in substance abuse recovery are at increased risk for exercise addiction, though it would be logical to assume that there could be a higher risk due to the tendency of the both the person abusing alcohol/drug and the person abusing exercise to achieve ever-increasing tolerance in the dose of their chosen substance.

There is a Lack of Research on Prevalence and Type of Mental Disorder in Ultra Endurance Athletes

Beyond PTSD, eating disorders, and substance abuse, there is very little data on types of mental disorder or prevalence thereof, in endurance athletes. Most of the available data is based on research on athletes in general (mixing leisure athletes and weekend warriors with more dedicated athletes), or elite, professional, and collegiate athletes. Though some of these literature reviews of psychopathology are a positive step in recognizing a gap in knowledge, it is not appropriate to extrapolate results from this type of review to UEAs because their demographics are quite different. UEAs tend to be older (average age 36-44), train at higher volumes, train more slowly, train by choice and for recreation, have a higher pain tolerance, and have different motivations to participate in their sports, compared with elite and collegiate athletes (Knechtle & Nikolaidis, 2018).

Twenty years ago, Schwenk wrote about similar issues of underdiagnosing and undertreating athletes, in general, in the British Journal of Sports Medicine (Schwenk, 2000). He noted that the manner in which mental health was being addressed in athletes was based on stigma, denial, and an unfortunate separation of physical and mental health (Schwenk, 2000). This situation does not seem to have improved. In fact, a group of experts on mental health in sport, research, and policy from ten countries met in Dublin in 2019 to discuss the need for evidence-based mental health guidance for athletes, specifically those in the non-elite category (Henriksen et al., 2019). The resulting consensus statement included six recommendations focusing on awareness, removal of stigma, and implementation of screening and treatment programs, though it missed the opportunity to include endurance athletes, specifically (Henriksen et al., 2019). Researchers at the University of Wisconsin posit that there is a difference between sport psychology, which focuses on performance enhancement and sports psychiatry, which focuses on the diagnosis and treatment of psychopathology in athletes (Reardon & Factor, 2010) In their systematic literature review of 103 papers on psychiatric illness in collegiate and elite athletes, they point out that although there is data on mood disorders, eating disorders, attention deficit disorder, and addictive disorders in athletes, groups such as females and recreational athletes are underrepresented and much more research is needed to understand both prevalence and risk factors (Reardon & Factor, 2010). They also acknowledge the lack of inquiry into the mental health of athletes, in general, and cite both stigma and an assumption that athletes are generally healthy as reasons for the dearth of information (Reardon & Factor, 2010).

The overall lack of information on mental disorder in UEAs means that there is also no information about the causal links between UEAs and mental disorder. There is no current examination of whether mental disorder develops before participation, suggesting that some people might be drawn to this kind of activity for some ameliorative effect, versus a development of mental disorder after participation, as a psychological or physiological response to high training volume.

Regardless of "which comes first," the high volume of endurance exercise involves the dysfunction of the Hypothalamic Pituitary Adrenal (HPA) Axis since it is eventually unable to manage the overwhelming, chronic stress response in the body (Cadegiani & Kater, 2017). The resulting dysfunction of the HPA axis affects the endocrine system in its entirety, having devastating effects on sex hormone production, metabolism, cortisol sensitivity, energy levels, etc. (Cadegiani & Kater, 2017). Dysfunction of the HPA axis may also be implicated in the development of depression and other mood disorders (Keller et al., 2016). It is not known if an athlete can actually trigger depression as increasing training volumes disrupt HPA axis functionality. Therefore, it is important to gain insight into the timing of the onset of mental disorder in UEAs so that further studies can be directed toward both prevention and therapeutic intervention.

The hypothesis of this research is that there is an overrepresentation of psychopathology in the population of UEAs. Given the lack of information on mental disorder in UES and the strong, though overlooked, connection between large training volumes and poor mental health as outlined by Morgan, Raglin, and others, the goal of this thesis was to find out exactly what kinds of conditions may be present in this population and in what quantities. Additionally, gaining an understanding of the timing of

the onset of mental disorder in this population may point to the importance of further research into a possible causal relationship between UES and resulting pathology from the large volume of training.

Chapter II

Research Method

This chapter will describe the details of the study undertaken for this thesis project. The recruitment and demographics of the participant will be discussed, as well as the study method, tools, and procedures used to carry out the research.

Participants

Participants were recruited via websites and online communities aimed at endurance athletes. The groups that promoted the online survey were ultrarunnerpodcast.com, irunfar.com, Trail Animals Running Club, Ultrarunning Community (an online Facebook group), Donner Party Mountain Runners, Dirtbag Runners, the Fast Women newsletter, and Ultrarunning Magazine. People of all genders, aged 18 and up, were invited to participate. Inclusion criteria was based on self-identification as an ultra endurance athlete. Additionally, for a person to be considered for the study, the individual had to exhibit two of the following three characteristics: at least ten weekly hours of training, participation in an ultra endurance event over the previous 12 months, and/or an expression of intent to participate in an ultra endurance event in the next 12 months.

648 responses were collected initially, and 125 responses were excluded due to the participant not finishing the survey. The final group consisted of 214 women 40.84% and

311 men (59.35%). Zero people identified as “other” gender, though the choice was provided. Participants ranged in age from 19 to 73 with an average age of 42. The vast majority of the sample identified as White or Caucasian (93.13%), with the remaining 6.68% identifying as Black/African American (.76%), Asian or Pacific Islander (1.53%), Hispanic/Latino (1.91%), Multiracial/Biracial (1.53%), or another ethnicity not listed (.95%).

The candidates of the study listed their participation in several ultra endurance sports, including adventure racing, alpine climbing, backcountry skiing, biathlon, cross country skiing, cycling, duathlon, fastpacking, hiking, ice climbing, kayaking, mountaineering, mountain biking, mountain running, racewalking, rock climbing, running, skiing, snowshoeing, stand up paddleboarding, swimming, swim-run (also known as otillo), triathlon, and ultrarunning.

Measures

An online survey was administered through Qualtrics, a well-established online survey platform. Subjects were recruited using advertisements placed on websites and within podcasts that are known to be popular with the ultra endurance athlete community in the United States as described previously. Participation was open to adults over the age of 18 who train for and participate in ultra endurance events, and participation was both voluntary and anonymous. After reading and signing a consent form attesting to their comprehension of the potential risks associated with answering questions that would assess their mental health, participants began the series of survey questions.

The survey began with basic demographic questions about age, race, and gender. The racial identification question was sourced from the current version of the United

States Census Bureau (US Census Bureau, 2020). Four options for gender were offered; Male, Female, Other, Prefer Not to Say. Participants were asked what ultra endurance sports they train for, whether or not they participated in or planned to participate in an ultra endurance event in the previous twelve months, and whether or not they planned to participate in an ultra endurance event in the next twelve months. They were also asked how many hours per week they train, whether they had ever received a diagnosis of mental health disorder, and the name of the disorder. Additionally, participants were asked if they were in recovery from substance abuse. Finally, participants were asked whether they had received the diagnosis prior to their training for ultra endurance events or subsequent to their participation in training. 648 responses were collected initially, and 125 responses were excluded due to the participant not finishing the survey.

Next, the subjects were asked to complete a full Patient Health Questionnaire. The Patient Health Questionnaire (PHQ) was the primary instrument of assessment of psychopathology. The PHQ consists of 26 questions and screens for five different types of common mental health disorders: depression, anxiety, somatoform disorders, alcohol abuse, and eating disorder (Spitzer, Kroenke & Williams, 1999). It was developed as a self-administered version of The Primary Care Evaluation of Mental Disorders (PRIME-MD) and has been found to have a high degree of validity (Spitzer, Kroenke & Williams, 1999). Specifically, when compared to clinical diagnosis, the PHQ has been shown to have an accuracy rate of 85%; a sensitivity rate of 75%, and a specificity rate of 90% in 585 patients who were given the PRIME-MD within 48 hours of taking the PHQ (Spitzer, Kroenke & Williams, 1999). The PHQ has been shown to be an efficient way of assessing psychosocial stressors and revealing potential need for mental health care

(Spitzer, Williams, Kroenke, Hornyak & McMurray, 2000). Of particular interest is the ability of the self-administered PHQ to provide insight into undiagnosed cases comparable to the physician administered PRIME-MD (Spitzer, Kroenke & Williams, 1999).

The survey concluded with the Eating Attitudes Test (EAT-26). The EAT-26 is a standardized self-report measure designed to assess risk of eating disorders, including anorexia and bulimia, as well as patterns of disordered eating (Mintz, O'Halloran, Mulholland & Schneider, 1997). Subjects who score 20 or above are said to require further assessment by an eating disorder specialist, however a score of 20 is not always an indicator of eating disorder and those who are eventually diagnosed with eating disorder may show lower scores on the assessment (Mintz, O'Halloran, Mulholland & Schneider, 1997). Based on a 6-point scale, this measure has been shown to have high validity and reliability where the EAT-26 score corresponds to eating disorder diagnosis ($r = 0.87$, $p < 0.01$) in a study of 65 women with anorexia versus control (Garner & Garfinkel, 1979). Women with anorexia who recovered showed lower EAT scores, as well as obese women and men of an average weight (Garner & Garfinkel, 1979).

Procedure

Subjects were told that they were participating in research designed to understand mental health in endurance athletes and that they were going to be asked questions about physical and mental symptoms that they may have experienced recently. They were invited to access a questionnaire online using Qualtrics, an online survey platform.

Because this study involved human subjects, the project was reviewed and approved by the Harvard University Committee on the Use of Human Subjects prior to

providing any other information, participants were asked to read and sign a consent form explaining the study protocol and expressing their informed consent to participate. Participants were allowed to exit if they were unwilling or unable to provide informed consent. A series of questions was then asked about participants' current volume of training and their event participation habits to exclude those not performing at a level consistent with ultra endurance sports. Subjects were invited to answer additional questions about their mental health history and diagnoses, if any. Study participants then completed the PHQ and EAT-26.

Data Analysis

The research yielded two general types of data: parametric (e.g., scores on the PHQ and EAT-26) and nonparametric (e.g., presence vs. absence of "yes" questions, as well as select demographic characteristics such as sex and race of participant). Independent variables included the PHQ t-scores for the 8 disorders assessed, 1) somatoform disorder, 2) major depressive syndrome, 3) other depressive syndrome, 4) panic syndrome, 5) other anxiety syndrome, 6) bulimia nervosa, 7) binge eating disorder, and 8) alcohol abuse. The mean scores of each scale were examined to see which, if any, fell in the clinical range when aggregated across subjects.

Further, the single item measures were collected in a spreadsheet. Diagnoses were grouped in kind and ordered by prevalence. A ranked list of percentages of the various mental disorder diagnoses among the subjects was generated. Independent variables for the EAT-26 include the t-score for the indication of a need to further assess the individual for the presence of an eating disorder. Independent variables also included the

nonparametric variables relating to certain behaviors that would indicate the need for further assessment on the five questions pertaining to eating disorder behaviors.

All data were checked for errors, duplications, and omissions. Two entries were removed due to the subjects' lack of proof that they had been training or intended to train in a way consistent with the targeted population. Open response answers were simplified to include only pertinent data (ie: "I train for many sports such as running, cycling, and swimming." to "running, cycling, swimming") One entry was removed due to the participant responding "I don't really train, I just DO" when asked to provide the number of training hours per week. As the PHQ and the EAT-26 are scored per standardized protocol, any errors were discerned within the framework of the interpretive report and removed from the data pool.

Prevalence of mental disorder data was compared with corresponding data on the general population available from the Centers for Disease Control and Prevention, the National Alliance on Mental Illness, the National Institute of Mental Health, the National Institute of Alcohol Abuse and Alcoholism, and the Substance Abuse and Mental Health Services Administration.

Chapter III

Results

In this chapter a summary of the results is presented. Results are grouped according to prior diagnosis and risk for psychopathology as assessed by the PHQ/EAT-26. Results from trending data across groups, as well as gender pertaining to gender differences will be presented.

Initially, data from the entire subject pool was analyzed and compared to the general population in the US. Upon further analysis, it became clear that the subject pool may reveal certain within-group trends related to gender and training volume. The data was stratified into three categories: those who train under ten hours per week (U-10), those who train ten to twenty hours per week (10-20), and those who train over 20 hours per week (>20). Each volume group was also divided into male and female groups. Demographics of the aggregate results from 523 participants are as follows: 213 women (40.48%) and 310 men (59.35%). Demographics of individual groups are as follows; U-10: 50 women (36.23%), 88 men (63.77%); 10-20: 145 women (40.85%), 210 men (59.15%), and >20: 18 women (60%), 12 men (40%).

Prior Diagnosis of Mental Disorder

In women and men, incidence of prior diagnosis of mental disorder was significantly higher among study participants than in the general population of the United States. 37% of participants reported having been diagnosed with mental disorder at some

time prior to participating in this investigation versus 20% of the general population of the US (NIMH Mental Illness, 2020). Additionally, the incidence of prior diagnosis of mental disorder increased as training volume increased.

Table 1 Prior Diagnosis of Mental Disorder

Mental Disorder	U 10	10-20	>20	All Study Participants	USA
UEA w/ Prior Diagnosis	28.3%	38.9%	56.7%	37%	20%

Note. aNIMH: Mental Illness. (2020). Retrieved 11 August 2020, from https://www.nimh.nih.gov/health/statistics/mental-illness.shtml

There was more incidence of prior diagnosis in females than males overall, however, the risk for mental disorder diagnosis as indicated by the PHQ and EAT-26 assessments was equal for both genders. One possible implication is that there may be more male athletes with mental disorder who are not receiving care.

Table 2 Prior Diagnosis by Gender

Category of Assessment	Female	Male
Prior Diagnosis	47.9%	26.5%
Risk by PHQ/EAT-26	46%	46%

Overall, participants reported having prior diagnosis of depression (105), anxiety (91) eating disorder (42), PTSD (19), OCD (6), bipolar disorder (8), panic disorder (5), and dysthymia (4). Prevalence of mental disorder in the United States is currently at 20% (NAMI, 2019). Overall, members of this sample of UEAs reported significantly higher incidences of prior diagnosed depression at 20.6% of the study population versus 4.7% of the general population of the USA (Centers for Disease Control and Prevention, 2020).

Thirty (30) people, or 5.7% of the study participants, indicated that they were in recovery for alcohol addiction at the time of the study. The percentage of US adults in recovery for alcohol addiction is currently 7.9% ("Alcohol Facts and Statistics | National Institute on Alcohol Abuse and Alcoholism (NIAAA)", 2020).

Some of the prior diagnoses trended upward with training volume. Prior mental disorder diagnosis, overall, trended upward with training volume; 28.26% in the U-10 group, 38.87% in the 10-20 group, and 56.67% in the >20 group. Similarly, prevalence of prior anxiety and eating disorder diagnoses trended up with training volume in the general sample population.

Table 3 Prior Diagnoses in General Sample Population Trending Data

Mental Disorder	U 10	10-20	>20
Anxiety	13%	18.5%	26.7%
ED	1.5%	9.6%	20%

Additionally, this trend of increased prevalence with increasing training volume was found in prior diagnosis of anxiety in females, eating disorder in females, and alcohol recovery in females as depicted in the table below.

Table 4 Prior Diagnoses in Specific Study Populations Trending Data

Mental Disorder	U 10	10-20	>20
Prior Anxiety F	12%	28.8%	39%
Prior ED F	2%	20.7%	33.3%
Alcohol Recovery F	2%	6.9%	11.1%

Risk Analysis: PHQ and EAT-26 Data

The completion of the PHQ and EAT-26 revealed the current risk for various mental disorder for study participants independent of prior diagnosis. Upon assessment by the PHQ and EAT-26, it was found that 46.56% of participants are at risk for possible mental disorder.

Upon analysis of the results of the PHQ and EAT-26 surveys, prevalence of risk for certain mental health symptoms and diagnoses were found to increase with more training volume in the general sample population. These measured symptoms are as follows: depression, panic disorder/anxiety, somatoform disorder, bulimia, binge eating, eating disorder (ED), and disordered eating behavior (DEB).

Table 5 Trending Data for PHQ/EAT-26 Assessed Risks in General Sample Population

Mental Disorder	U 10	10-20	>20
Depression	8%	8.7%	20%
Panic/Anxiety	5.1%	15.2%	20%
Somatoform	0.72%	3.4%	10%
Bulimia	1.5%	3.4%	6.7%
Binge	5.8%	8.2%	10%
ED	8.7%	12.4%	33.3%
DEB	10.9%	16.9%	33.3%

Results from the PHQ and EAT-26 also indicated certain correlations between genders and particular mental health challenges; depression, panic disorder/anxiety, somatoform disorder, eating disorder (ED), and disordered eating behavior (DEB) in females; bulimia, binge eating, and disordered eating behavior in men.

Table 6 Trending Data Depicting Mental Disorder by Gender

Mental Disorder	U 10	10-20	>20
Depression F	6%	9.7%	22.2%
Panic/Anxiety F	8%	19.3%	27.8%
Somatoform F	0	4.8%	16.7%
ED F	12%	18.6%	33.3%
DEB F	16%	20.1%	33.3%
Bulimia M	0	2.9%	8.3%
Binge M	6.8%	9.5%	16.7%
ED M	6.8%	8.1%	33.3%
DEB M	8%	14.3%	33.3%

The PHQ revealed that 24.5% of the study population may be at risk for alcohol abuse. The prevalence of alcohol use disorder is currently at 5.6% of the general population in the United States ("Alcohol Facts and Statistics | National Institute on Alcohol Abuse and Alcoholism (NIAAA)", 2020).

It was found that the group training more than 20 hours per week had a significantly higher incidence of prior diagnosis of depression, anxiety, ED, PTSD, and bipolar disorder than the general US population.

Table 7 Prevalence of Prior Diagnoses in >20 group vs. USA Total

Mental Disorder	>20	USA
Depression	20%	4.7%a
Anxiety	26.7%	19.1%b
Eating Disorder	20%	9%c
PTSD	10%	6.8%d
Bipolar	6.67%	2.8%e

Note.[a]Centers for Disease Control and Prevention. (2020). Early release of selected estimates based on data from the 2019 National Health Interview Survey *(pp. 1-2). US Department of Health and Human Services. Retrieved from https://www.cdc.gov/nchs/data/nhis/earlyrelease/EarlyRelease202009-508.pdf. [b]NIMH: Any Anxiety Disorder. (2020). Retrieved 11 August 2020, from https://www.nimh.nih.gov/health/statistics/any-anxiety-disorder.shtml [c]Eating Disorder Statistics. General & Diversity Stats | ANAD. (2020). Retrieved 11 August 2020, from https://anad.org/education-and-awareness/about-eating-disorders/eating-disorders-statistics/ [d]VA.gov | Veterans Affairs. (2020). Retrieved 11 August 2020, from https://www.ptsd.va.gov/professional/treat/essentials/epidemiology.asp#two [e]NIMH » Bipolar Disorder. (2020). Retrieved 11 August 2020, from https://w ww.nimh.nih.gov/health/statistics/bipolar-disorder.shtml#*

Nonzero Suicide Risk

The Patient Health Questionnaire contains one question that specifically addresses risk for suicide or self-harm; “Over the last 2 weeks, how often have you been bothered by any of the following problems?”. Several symptoms are listed, but option “i” reads as follows, "Thoughts that you would be better off dead or of hurting yourself in some way.” Answers to this question include the following options: not at all, several days, more than half the days, or nearly every day. Any response other than “not at al,” is

considered to be a “non-zero” and therefore indicative of some risk for suicide and/or self-harm (Simon et al., 2013). Sixty-three participants (12%) selected non-zero responses to this question. Although the U-10 and 10-20 groups did not show great variation in the prevalence of non-zero answers (11.59% and 10.7%, respectfully), 30% of the athletes in the >20 group were found to be at risk for suicidal and/or self-harm thoughts. In particular, males (13.9%) indicated more nonzero answers than females (9.39%).

Overall, 23 of the 63 participants (36.5%) who indicated non-zero answers had no prior diagnosis of mental disorder. Of these, more males (44.2%) than females (20%) did not have a prior diagnosis of mental disorder.

Chapter IV

Discussion

In this chapter, the results will be discussed. Additional context and possible hypotheses will be presented to further explain the findings. The limitations of this study will also be presented, including a discussion of the possible influence of COVID-19. Finally, directions for future research will be presented.

The purpose of this study was to examine whether or not there was an increased prevalence of mental health disorder in the population of ultra endurance athletes and, if so, what types are present. The goal of this thesis is to highlight a need for additional research into this niche population who may be prone to mental health challenges. The goal is not to warn against participation in UES or to reverse the assertion that exercise, overall, can provide a benefit for those suffering with mental disorder. Rather, in finding a significant amount of mental disorder in UEAs, the goal is to begin a targeted dialogue about increased awareness of mental health concerns in seemingly "healthy" ultra endurance athletes, the need for therapeutic protocols and education directed specifically toward this population, and perhaps draw attention to the possible need for an inclusion of diagnostic criteria for exercise addiction into the DSM.

Upon analysis of the data from 523 participants, there was a higher prevalence of prior diagnosis of mental disorder in this population versus the general population in the United States. Types of prior diagnosed mental health disorder known to be present include (in order of prevalence) depression, anxiety, eating disorder, alcohol use disorder,

PTSD, Bipolar disorder, obsessive compulsive disorder, and dysthymia. Additionally, when analyzing the outcomes of the PHQ and EAT-26, it was found that there was a higher prevalence of risk for depression, alcohol abuse, bulimia, and binge eating disorder in this group of study participants, as compared to in the general U.S. population.

Some of the more striking results of this study became apparent when the data was stratified by the amount of time spent training. Upon grouping the participant data by number of hours spent training per week, trends of positive correlation emerged. It became clear that both the incidence of prior diagnosis of mental health disorder and assessed risk (by PHQ and EAT-26) of mental health disorder increased as training hours increased, because positive trending data were found in the following areas; overall prior diagnosis, prior diagnosis of anxiety, prior diagnosis of eating disorder, risk for depression, risk for panic disorder/anxiety, risk for somatoform disorder, risk for bulimia, risk for binge eating, risk for eating disorder, and risk for disordered eating behavior. In females, prior diagnosis of anxiety, eating disorder, and alcohol recovery also trended upward with training hours.

Analysis of the >20 UEAs, in and of itself, reveals a need for more mental health support. Over half of the participants in this group had a prior diagnosis of mental disorder (56.7%) and almost two-thirds were found to be potentially at risk for mental disorder based on the study surveys (63.3%). This group's prevalence of prior diagnosis of anxiety, depression, PTSD, and eating disorder were all higher than the prevalence in the general US population.

Table 8 Prevalence of Prior Mental Disorder Diagnosis in >20 vs. USA

Mental Disorder	>20	USA
Depression	26.7%	4.7%a
Anxiety	20%	19.1%b
Eating Disorder	20%	9%c
PTSD	10%	6.8%d

Note. [a]*Centers for Disease Control and Prevention. (2020).* Early release of selected estimates based on data from the 2019 National Health Interview Survey *(pp. 1-2). US Department of Health and Human Services. Retrieved from https://www.cdc.gov/nchs/data/nhis/earlyrelease/EarlyRelease202009-508.pdf.* [b]*NIMH: Any Anxiety Disorder. (2020). Retrieved 11 August 2020, from https://www.nimh.nih.gov/health/statistics/any-anxiety-disorder.shtml* [c]*Eating Disorder Statistics. General & Diversity Stats | ANAD. (2020). Retrieved 11 August 2020, from https://anad.org/education-and-awareness/about-eating-disorders/eating-disorders-statistics/* [d]*VA.gov | Veterans Affairs. (2020). Retrieved 11 August 2020, from https://www.ptsd.va.gov/professional/treat/essentials/epidemiology.asp#two*

Additionally, prevalence of risk for all of the mental disorder, except alcohol abuse, revealed by the PHQ and EAT-26 were higher in >20 UEAs than in any other group individually and also higher than the study population total.

As outlined by Morgan and Raglin many years ago, it would appear that there is a connection between training at a higher volume and mental health disorder. Answers as to why this is the case may lie in the answers to the question that was asked in this research, “Were you diagnosed before you began participating in ultra endurance sports or during/after your participation in ultra endurance sports?” Of the participants with a known diagnosis of mental health disorder, 63.4% reported having been diagnosed before

participation and 31.96% reported having been diagnosed during/after participation. As discussed previously, a potential hypothesis could be that those who previously suffered from mental disorder are drawn to ultra endurance sport as a method of managing mental health concerns. The perception of psychological benefit and physiological/neurological effects of training may be compelling for those who are in need of coping mechanisms. However, it is possible that participation may afford athletes with the additional benefits of engaging in social behavior, spending time outdoors, possible weight management, and gaining a sense of accomplishment from their efforts.

This research is not conclusive as to whether or not participation in UES is a net positive in helping athletes manage their mental health. If ultra endurance training truly did have as significant an ameliorative effect on the experience of mental disorder as athletes perceive, we might expect to see less risk for these conditions as assessed by the PHQ and EAT-26. If the two-thirds of the population with a known diagnosis of mental disorder were actually experiencing coping benefits from their participation in ultra endurance sports, we might expect to find less present-day risk for mental disorder. This was not found to be the case because current risk for depression, panic disorder, eating disorder, and alcohol abuse remained high as assessed in this research. It is also important to note that although risk is high in the population as a whole, it becomes even higher in the >20 group, suggesting that dose responsive amelioration is nonexistent.

Still, athletes are apparently not deterred from training despite inconclusive evidence of successful management of mental disorder. As mentioned previously in Knechtle & Nikolaidis, athletes may be aware of the limited benefits or even aware of increased risk, but are still unwilling to stop their participation (Knechtle & Nikolaidis,

2018). These athletes found perceived health benefits, a realization of their personal goals, and psychological coping through ultramarathon and could not imagine giving it up (Knechtle & Nikolaidis, 2018). This possible paradox is compounded by the fact that as athletes increase their training volume, they increase the risk for physical injury and breakdown ((Knechtle & Nikolaidis, 2018). With this pattern of behavior, it becomes necessary to discuss the possibility of exercise addiction.

It cannot be said that only athletes seeking to manage mental health are drawn to this type of training. Many different types of people, including those who may be interested in the sport for reasons not related to mental health management, may become eager participants in UES. Yet, the possibility of exercise addiction must be raised again in the 31.96% of athletes who were diagnosed with mental disorder after or during their participation in UES. Therefore, it is entirely feasible that a person would find themselves in declining physical or mental health, only *after* a period of time spent training at this level. As mentioned previously, the very nature of UES requires ever-increasing volumes, potentially inciting an influx of and subsequent need for the opioid-like neurotransmitters that are released with exercise (Nogueira, Molinero, Salguero & Márquez, 2018). For example, it is possible to imagine that an athlete who becomes curious about ultramarathons and begins to increase training hours, comes to find that she feels terrible on the days that she does not run. She may find it intolerable to stop, despite fatigue or work commitments, and find her mood declining as she feels pressure to prioritize training above all other activities or restful moments in her life.

The potential for injury and other physiological complications as training volume increases cannot be ignored. Physiological injury, no doubt, contributes to the experience

of mental disorder in the ultra endurance athlete population. Injury that inhibits participation is a known factor in athlete mood disturbance (Newcomer Appaneal, Rockhill Levine, Perna & Roh, 2009). In a study of 164 male and female athletes, self-report mood assessments revealed not only an immediate increase in depression right after injury, but elevated depression symptoms one month later (Newcomer Appaneal, Rockhill Levine, Perna & Roh, 2009). While it is not necessarily true that those who train for UES have an increased risk of musculoskeletal injury, they do have an increased risk for overuse injuries which can be just as devastating. (Knechtle & Nikolaidis, 2018). It is well known that the experience of overtraining syndrome includes symptoms of depression and anxiety (Armstrong & VanHeest, 2002). This may contribute to the overall mental health profile of those who participate in UES, whether or not they have prior experience of mental disorder. Despite the fact that sports physiology protocols for therapy, healing, and return-to-play exist in abundance, there is very little awareness of the fact that mental disorder in sport requires similar protocols. Awareness of the existence of Overtraining Syndrome is lacking and symptom recognition, diagnostic guidelines, and treatment protocols have yet to be confirmed. A 2013 consensus statement by the European College of Sport Science and the American College of Sports Medicine noted that the purpose of their work was to provide guidance since there was a lack of evidence necessary to provide definitive guidelines for recognition and treatment (Meeusen et al., 2013). Even in 2016, Kreher could only offer an opinion for methods of educating athletes and healthcare practitioners about the details of Overtraining Syndrome (Kreher, 2016). Therefore, it is entirely possible that a UEA may experience

more and more psychological distress with increased training, but not recognize or receive care for their condition.

Currently, healthcare practitioners tend to have a monolithic view of exercise participation due to the fact that 80% of United States adults and children are in need of more physical activity, not less (Piercy, Troiano & Ballard, 2018). CDC guidelines even state that although the current guidelines of 150 minutes of moderate-intensity exercise is good, the more someone exercises, the better it will be for them ("Move More; Sit Less", 2020). It seems that if a patient engages in physical exercise, it is always considered to be a positive attribute to their overall health profile. Healthcare practitioners do not typically ask how much training a patient might be engaging in and, even if they did ask, they may not have been trained to assign meaning to differing amounts. While healthcare practitioners in the US may be able to agree that zero physical activity contributes to poorer health outcomes and a certain amount of physical activity is consistent with general health, they have not yet recognized the fact that a significantly elevated amount of physical activity may signal disorder. Of course, this research in no way implies causality, only that the variables of training hours and mental health disorder are correlated. An extreme amount of weekly training may indicate the need for further inquiry on a variety of mental health parameters instead of being interpreted as a sign of health from a healthcare practitioner unaware of these possible correlations.

Of critical interest is the increased suicide and self-harm risk assessed in this population. Risk in the aggregated group is high at about 12%, but fully one third of the >20 group has thought about suicide or self-harm in the last six weeks. The suicide risk is rising in the United States with an increase of over 33% in the last twenty years (Weir,

2020). NIMH data from 2018 states that suicide is the fourth leading cause of death for people aged 35-54, an important statistic for this study where the average age of participants is 42 (Weir, 2020). This research also reveals the fact that many (36.92%) of the people who may be at risk for suicide have never had a diagnosis of mental disorder. If for no other reason, this research proves an urgent need to direct additional mental health efforts to educate and support athletes in this population.

This research may also reveal interesting trends among another important group in need of care and awareness–those who are at risk for substance abuse disorders. The data show that the number of people in recovery from substance abuse increases with the number of training hours, however the number of those actively at risk for alcohol abuse (as revealed by the PHQ) decreases with the number of training hours. This suggests that those who have a history of substance abuse, whether or not inadvertently, may be engaging in an "addiction exchange" and using training as their new drug of choice. There are countless articles, personal anecdotes, and even several websites dedicated to discussing the use of ultramarathon training, in particular, for managing alcohol addiction. irunanonymous.com is a website created specifically for ultra runners who are also members of Alcoholics Anonymous. Well known ultramarathoner Charlie Engle chronicles his journey to sobriety and relationship to ultrarunning in his book, *Running Man* (Engle, 2016). Ultra endurance triathlete, Rich Roll, has a Top 100 podcast and has also written a book called *Finding Ultra* about his experience with alcoholism and training (Roll, 2012). A 2019 study attempted to unravel the complex relationship between addiction and ultrarunning (McGannon, L'Estrange & McMahon, 2019). They used personal stories from many elite and recreational ultrarunners to construct a

framework of chaos narrative versus quest narrative to better describe the journey from addiction to recovery (McGannon, L'Estrange & McMahon, 2019).

Though it is beyond the scope of this discussion to speculate on the viability of this therapeutic approach, it is concerning to consider the myriad of ways that this very tenuous link may be broken. A person struggling with addiction will likely not approach training for UES with moderation and it is easy to imagine that they might be at increased risk for musculoskeletal or overtraining injury as their tolerance and appetite for symptom relief builds. If management of their substance addictions hinges on their ability to engage in training, they may find themselves in a dangerous situation if injury impedes physical activity. Again, this is more evidence that additional support and resources are desperately needed in the community of UEAs.

It is therefore logical to consider whether a formal recognition of exercise addiction as a viable diagnosis in the Diagnostic and Statistical Manual might aid in overall awareness of the perils of excessive amounts of training. The DSM IV-TR at least acknowledged and defined exercise addiction as any exercise that "significantly interferes with important activities, occurs at inappropriate times or in inappropriate settings, or when the individual continues to exercise despite injury or other medical complications" (American Psychiatric Association, 2000). However, the DSM-V failed to include exercise addiction due to disagreements about diagnostic criteria, validity and usefulness of diagnostic tools, a fear of over-pathologizing, and even some discussion of whether exercise addiction should be categorized as a subset of another anxiety or obsessive disorder along with internet, sex, love, work, technology, and shopping addictions (Pinna et al., 2015). It seems odd for the APA to have defined and subsequently dismissed this

concern, especially in light of the existence of several hypotheses for the neurobiological explanations for exercise addiction, setting it apart from other behavioral addictions (Pinna et al., 2015). Perhaps the excessive nature of training for UES, in particular, was overlooked in this assessment. Ultra endurance training is not normal exercise. It is hoped that the American Psychological Association would recognize the differences between normal exercise and the type of physical activity required to train for and participate in UES. It is unlikely that they will change their stance, but perhaps not unlikely that some diagnostic tools for mental health can be updated to accommodate for the fact that very high volumes of training may reveal high risk of mental health disorder. In a perfect world, healthcare practitioner intake forms would include a single question asking the patient how many hours per week they participate in physical activity. The number given would hopefully illicit a more pointed inquiry into mental health than a universal acceptance of physical activity as a positive habit.

The findings from this research shed more light on the potential existence of the U-shaped curve between exercise and health that was alluded to previously. Absolutely everything, in excess, can become unhealthy, dangerous, or even destructive. Despite our cultural affinity toward extreme feats of athleticism, high volume training may be less indicative of personal success and more indicative of the need for mental health support.

At the beginning of data analysis, a conscious choice was made to not separate the findings of this research by gender. There was a concern that a gender bias existed in sports psychology research that relegates certain mental health disorders to certain genders, preventing certain people from receiving care because of stereotypical associations. On further consideration of the survey results, the data was examined

separately by gender to better understand where recognizing differences in gender might better enable athletes to receive care. Analysis of the PHQ and EAT-26 results revealed that men, in particular, tended to have an increased risk of bulimia, binge eating disorder, eating disorder, and disordered eating behavior as their training volume increased. Since these disorders are normally associated with females, males who train at high volumes may not be properly screened in a healthcare practitioner visit. Although more women in the study indicated that they had a prior diagnosis of mental disorder, the potential risk as identified by the PHQ and EAT-26 was equal for males and females. Therefore, it is possible that more males are going undiagnosed and untreated for all types of mental disorder. It is, of course, unknown if they are reporting fewer symptoms, recognizing symptoms less often, or not being assessed properly in healthcare settings. Finally, the importance of the findings that more men in the study were at potential risk for suicidal thoughts cannot be overstated since the rate of suicide deaths in men (21%) is more than three times larger than women (6%) in the US(Death rates for suicide by sex, race, Hispanic origin, and age: United States, selected years 1950-2016, 2020)

Limitations

COVID-19 has doubtless had an impact on this research as it has had an impact on virtually every aspect of life, as this research was planned prior to the global COVID-19 outbreak \. The outbreak of COVID-19 was likely responsible for an alteration in the training plans of many athletes, because thousands of race events were cancelled or postponed starting in March 2020 (Futterman, 2020). At no time during the pandemic were all Americans required to universally refrain from outdoor activity like running or cycling. However, it is possible that athletes' training volume was affected by the

necessity to train alone, changes in work/life habits, and concerns about virus spread. It is impossible to know if athletes would be training more than they would be prior to the pandemic, or less than normal.

The study data was gathered in October 2020, eight months after the initial outbreak and four months after the end of quarantine in much of the US. It is likely that the public experience with the pandemic caused an additional mental health burden at this time (Huremović, 2019). It is possible that the stresses of isolation and fear, as well as unknown physical, psychological, social, and economic effects of COVID-19 could have contributed to the overall amount of mental health disorder uncovered in participants without prior diagnosis (Huremović, 2019). Asking subjects about their prior mental health diagnosis was intended to assess the amount of known mental disorder in the study population separate from whatever current risk for mental disorder they may have. It was hoped that this information would guard against inaccuracies due to a possible pandemic-induced increase in mental disorder. The findings from that question suggest that this population has a higher prevalence of mental health disorder higher than the US average, irrespective of recent happenings.

This study was planned well before the pandemic and the actual study design of using an online survey did not need to be altered to accommodate the logistical challenges that the situation has presented. However, many individual's daily routines have been altered to such a degree that the amount and type of ultra endurance athletes available to both spend enough time on the internet to notice an advertisement for a study and have the time to finish the survey, may be different than it would have been prior to

the pandemic. Additionally, working from home, home schooling, and a shift in responsibilities may have altered the demographics of the study population.

The PHQ that was used as an assessment tool in this research, though ubiquitous, contains a question that asks about thoughts of suicide and self-harm. Participants were reminded both on the consent form and in the questionnaire instructions that they would be answering potentially sensitive questions and could withdraw consent and exit the study at any time. Additionally, those who responded in a way that was consistent with even minimal risk were given an additional alert with resources should they need additional guidance. While it was deemed necessary to provide a safe environment for participants, it is hypothesized that efforts to alert study participants at the beginning of the survey to the potentially sensitive nature of the questionnaire may have contributed to a relatively high incompletion rate, as 19.14% of respondents did not finish the survey. There is, of course, no way to be sure what contributed to this situation, but it nonetheless begs the question of whether or not increased alerts made respondents overly sensitive to their survey experience.

As is the case with all self-report questionnaires, some form of bias can be assumed. Self-reports can be subject to recall issues, the participant reflecting social desirability, confirmation bias, or of the potential for random errors as they selected answers (Althubaiti, 2016). Additionally, online research presents a number of concerns. In sourcing participants from websites, Facebook communities, and newsletters, it is impossible to know if the sample is truly representative of the population, whether the participants live in the targeted geographical area, or whether they are the type of person to respond to an online survey (Wright, 2006). To account for these discrepancies, efforts

were made to vary the marketing of the study, utilizing an array of invitations via newsletter, promotional listings in a daily news brief, posts in a Facebook group by group leader, purchased advertisements to participate on a popular website, Tweets from popular ultramarathon website, mentions on social media and shares by second parties, and promotional mentions on a popular ultrarunning podcast.

Additionally, the results of this study may be limited to the population of athletes who were not only interested enough in mental health to open the survey, but also comfortable to disclose potentially sensitive information about their own thoughts and behaviors around mental health concerns. It is also possible that some survey takers became uncomfortable with the material while answering the questions and ultimately did not finish. Therefore, the study results are limited to those athletes who did not have cultural or personal aversion to mental health topics and were able to complete the entire survey.

There are also obvious limitations with regard to ethnic and gender diversity in this study. Limitations began with the use of the US Census categories for self-identification of ethnic background. The categories may be overly monolithic, not accounting for the variations of racial origin that exist in all of the groups. Analysis of individual ethnic categories was not performed as, none of the ethnic categories were large enough to create a representative sample. There is a lack of diversity of genders within the racial groups as well, making it impossible to accurately represent segments of the population such as Black or African American males, trans people, and those who are gender nonconforming. While the media outlets chosen to promote this study had the largest audiences of UEA, they did not necessarily attract the most diverse audience.

Future Research

The results of this research have provided a number of clear findings, but a compelling follow up study could be done that would center on understanding why it is that there is a higher prevalence of mental disorder in the ultra endurance athlete community. Clues to possible explanations may be found in the answer to the question of when the athlete experiences mental disorder –before being drawn to these kinds of sports or at some time during/after. One can imagine many different avenues for future research based on both options.

In thinking about those who have experienced mental disorder prior to participating in UES, perhaps it would be interesting to look into what correlating personality traits might be present, whether or not they had experienced previous trauma or addiction, and whether or not they use medication and/or talk therapy to manage their mental health. It would be interesting to ask athletes to elaborate about what draws them to UES training, what their beliefs are about what benefits they experience, and how participation affects their identity. Does the athlete suffering with depression find solace in spending many hours moving through nature? Does the athlete struggling with social anxiety find community in group trail runs, triathlon competitions, and training clubs? Does the person suffering from PTSD enjoy an alleviation of symptoms due to the opioid-like neurotransmitters released along a cross-state bike ride? Does the person who has a tendency toward binge eating find a way to hide his habits under the guise of “carb-loading” or “refueling”? Can a person suffering with exercise bulimia continue to exhibit disorder in plain sight because they are “training for Ironman”?

For those athletes who experience mental health disorder after participating in UES, it is important to understand if there is a link between the psychological and physiological side effects of training and mood. A deeper look into neuroscience would perhaps help to clarify the mechanisms at work in the development of a behavioral addiction. Is the influx of neurotransmitters, neuropeptides, and neuromodulators directly responsible for the development of an addiction-like mental state? Is declining physiological health stemming from overtraining a contributing factor to the development of mental health disorder? Is it that the athlete who eschews family, work, and social commitments in order to train will begin to experience depression or anxiety? Do athletes develop an obsession with nutrition, body composition, and body weight as their desire for improved performance increases?

Future study should also consider the role of HPA axis dysfunction in the development of mental disorder in the population of UEAs. In particular, the connection between HPA axis dysfunction and suicide risk in this population should be studied. As mentioned previously, athletes who train continuously at high volume are at risk for developing OTS, resulting in deterioration across multiple body systems and resulting endocrine dysfunction (Daly & Hackney, 2005). It is widely held that the condition arises due to HPA axis dysfunction as a result of chronic stress and an overwhelming cortisol response consistent with high volume training (Daly & Hackney, 2005). Perhaps then, the possibly higher risk of depression and suicide risk in UEA could be due to a similar chronic stress and subsequent HPA axis dysfunction, though possibly due to physical stress of training.

The hypothesis that HPA axis dysfunction and resulting depression and suicide risk could be influenced by elective, chronic physical stress has wide-ranging implications beyond the athlete population. It is possible that this theory could apply to any scenario where excessive physical stress becomes detrimental to normal functioning of the HPA axis. It would be important to know if and to what degree physical stress, aside from psychological stress, may have an impact on risk in this population so that strategy could be employed to ameliorate the effects of HPA axis dysregulation.

More efforts should be made to target different ethnicities and genders within the UES. While it is known that UES are not very diverse, additional efforts should be made to research and engage with media outlets that target diverse communities. Perhaps in reaching out to diverse communities, insight can be gained into why they are not well represented in ultra endurance sports, and steps can be taken to ensure inclusivity. Recently, the UES community has begun to acknowledge the lack of diversity in participation. Groups like USA Triathlon are working to consider minority groups and address barriers to entry. They have acknowledged that their membership should be as diverse as the American population and are committed to outreach across racial, gender, and ethnic groups ("Together We Thrive", 2020). It is hoped that adequate representation of minority groups will be achieved moving forward and that mental health messages can be tailored to meet the needs of all athletes.

In all cases, it is important to know if training for UES is a helpful therapeutic intervention, or a maladaptive coping mechanism for disorder. Isolation of the point at which the therapeutic effect turns into disorder would potentially save many people from possible complications arising from a disordered relationship with exercise. Warning

signs, and both behavioral and physiological symptoms need to be studied and shared widely along with diagnosis and treatment protocols.

In conclusion, practitioners can be the conduit to better mental health care, provided that they are made aware of the myriad of mental and physical health concerns that can be uncovered by asking questions like, “How many hours of physical activity do you do per week?” The answers to this and other questions can potentially provide healthcare practitioners with valuable information that can greatly influence the overall wellness of many individuals. There is no doubt that training for ultra endurance sport is an important part of many people’s lives–and they would like to continue to train for as long as possible. The goal, then, is to ensure that they can healthfully continue to run toward total health, and not away from receiving support and attention for their mental health. Athletes do not have difficulty recognizing and receiving care for physiological concerns. They should have the same success in having mental health concerns be recognized and treated. If athletes and informed healthcare practitioners can work together to recognize the possible pitfalls to high volume training, perhaps there would be less tendency toward mental disorder in UEAs. If balance is to be achieved, both athletes and healthcare practitioners will need to monitor training volumes along with physical and mental health in order to ensure balance and a fuller, healthier life.

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Appendix 1. Glossary of Terms

Overtraining Syndrome (OTS): A constellation of symptoms affecting multiple body systems, OTS is the result of increasing training loads without adequate rest and recovery. Also known as “burnout,” it has been described as a kind of “chronic fatigue” for athletes and can be a devastating health condition. OTS is not easily remedied with rest and may require multiple weeks or months of recovery.

Overreaching: A condition that precedes OTS in which an increase in volume and intensity of training without adequate recovery is met with negative physiological and psychological symptoms. This condition is relieved with rest.

Ultra-endurance athlete (UEA): an athlete training for and participating in endurance sport training and/or races. This person typically engages in periodic increases in training volume, self-identifies as a member of the ultra endurance community, and participates in/races at least one ultra event per year.

Ultra marathon: A running event that can take place on trails, roads, or track at any distance over the marathon (26.2 miles). Common distances are 50K, 50Mile, 100K, and 100Mile. These events may also be designated by time, such as 6-hour, 12-hour, 24 hour. Multiple day events, covering between 200 and 3100 miles exist currently.

Ultra-endurance sports (UES): running, trail/mountain running, triathlon, swimming, cycling, open water kayaking, cross country ski, skimo, or any other sport requiring multiple hours of aerobic training/participation at steady-state, sub-maximal heart rate and over long distances.

Appendix 2. Patient Health Questionnaire

1. During the last 4 weeks, how much have you been bothered by any of the following problems?

(Not bothered, Bothered a little, Bothered a lot)

a. Stomach pain

b. Back pain

c. Pain in your arms, legs, or joints (knees, hips, etc.)

d. Menstrual cramps or other problems with your periods

e. Pain or problems during sexual intercourse

f. Headaches

g. Chest pain

h. Dizziness

i. Fainting spells

j. Feeling your heart pound or race

k. Shortness of breath

l. Constipation, loose bowels, or diarrhea

m. Nausea, gas, or indigestion

2. Over the last 2 weeks, how often have you been bothered by any of the following problems? (Not at all Several days More than half the days Nearly every day)

a. Little interest or pleasure in doing things

b. Feeling down, depressed, or hopeless

c. Trouble falling or staying asleep, or sleeping too much

d. Feeling tired or having little energy

e. Poor appetite or overeating

f. Feeling bad about yourself — or that you are a failure or have let yourself or your family down

g. Trouble concentrating on things, such as reading the newspaper or watching television

h. Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual

i. Thoughts that you would be better off dead or of hurting yourself in some way

3. Questions about anxiety.

a. In the last 4 weeks, have you had an anxiety attack — suddenly feeling fear or panic? (No, Yes)

If you checked “NO”, go to question #5.

b. Has this ever happened before?

c. Do some of these attacks come suddenly out of the blue — that is, in situations where you don’t expect to be nervous or uncomfortable?

d. Do these attacks bother you a lot or are you worried about having another attack?

4. Think about your last bad anxiety attack. (No, yes)

a. Were you short of breath?

b. Did your heart race, pound, or skip?

c. Did you have chest pain or pressure?

d. Did you sweat?

e. Did you feel as if you were choking?

f. Did you have hot flashes or chills?

g. Did you have nausea or an upset stomach, or the feeling that you were going to have diarrhea?

h. Did you feel dizzy, unsteady, or faint?

i. Did you have tingling or numbness in parts of your body?

j. Did you tremble or shake?

k. Were you afraid you were dying?

5. Over the last 4 weeks, how often have you been bothered by any of the following problems? (Not at all, Several days, More than half the days)

a. Feeling nervous, anxious, on edge, or worrying a lot about different things. If you checked “Not at all”, go to question #6.

b. Feeling restless so that it is hard to sit still.

c. Getting tired very easily.

d. Muscle tension, aches, or soreness.

e. Trouble falling asleep or staying asleep.

f. Trouble concentrating on things, such as reading a book or watching TV.

g. Becoming easily annoyed or irritable.

6. Questions about eating. (No, Yes)

a. Do you often feel that you can't control what or how much you eat?

b. Do you often eat, within any 2-hour period, what most people would regard as an unusually large amount of food? If you checked "NO" to either #a or #b, go to question #9.

c. Has this been as often, on average, as twice a week for the last 3 months?

7. In the last 3 months have you often done any of the following in order to avoid gaining weight? (No,Yes)

a. Made yourself vomit?

b. Took more than twice the recommended dose of laxatives?

c. Fasted — not eaten anything at all for at least 24 hours?

d. Exercised for more than an hour specifically to avoid gaining weight after binge eating?

8. If you checked "YES" to any of these ways of avoiding gaining weight, were any as often, on average, as twice a week? (No, Yes)

9. Do you ever drink alcohol (including beer or wine)? If you checked "NO" go to question #11. (No, Yes)

10. Have any of the following happened to you more than once in the last 6 months? (No, Yes)

a. You drank alcohol even though a doctor suggested that you stop drinking because of a problem with your health.

b. You drank alcohol, were high from alcohol, or hung over while you were working, going to school, or taking care of children or other responsibilities.

c. You missed or were late for work, school, or other activities because you were drinking or hung over.

d. You had a problem getting along with other people while you were drinking.

e. You drove a car after having several drinks or after drinking too much.

11. If you checked off any problems on this questionnaire, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people? (Not difficult at all, Somewhat difficult, Very difficult, Extremely difficult)

Appendix 3. Eating Attitudes Test-26

Please mark ONE answer per question.

(always, usually, often, sometimes, rarely, never)

1. I am terrified about being overweight.
2. I avoid eating when I am hungry.
3. I find myself preoccupied with food.
4. I have gone on eating binges where I feel that I may not be able to stop.
5. I cut my food into small pieces.
6. I am aware of the calorie content of foods that I eat.
7. I particularly avoid food with a high carbohydrate content (i.e. bread, rice, potatoes, etc.)
8. I feel that others would prefer if I ate more.
9. I vomit after I have eaten.
10. I feel extremely guilty after eating.
11. I am preoccupied with a desire to be thinner.
12. I think about burning up calories when I exercise.
13. Other people think that I am too thin.
14. I am preoccupied with the thought of having fat on my body.

15. I take longer than others to eat my meals.
16. I avoid foods with sugar in them.
17. I eat diet foods.
18. I feel that food controls my life.
19. I display self-control around food.
20. I feel that others pressure me to eat.
21. I give too much time and thought to food.
22. I feel uncomfortable after eating sweets.
23. I engage in dieting behavior.
24. I like my stomach to be empty.
25. I have the impulse to vomit after meals.
26. I enjoy trying new rich foods.

1. A. Have you ever gone on eating binges where you feel that you may not be able to stop? (Defined as eating much more than most people would under the same circumstances and feeling that eating is out of control.) (Never, Once a month or less, 2-3 times per month, Once a week, 2-6 times a week, Once a day or more)

1. Ever made yourself sick (vomited) to control your weight or shape?
2. Ever used laxatives, diet pills or diuretics (water pills) to control your weight or shape?
3. Exercised more than 60 minutes a day to lose or to control your weight?

4. Lost 20 pounds or more in the past 6 months?

5. Have you ever been treated for an eating disorder?