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The Relationship between Ultrarunning Status, Subjective Well-being, and Life Satisfaction

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This is to certify that the doctoral dissertation by

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Walden University
2024

Abstract

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by

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MPH, Benedictine University, 2012

BHA, Southwest Texas State University, 2002

Proposal Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

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Abstract

The COVID-19 pandemic resulted in a rise in mental health challenges across the United States. Consequently, two important well-being measures for Healthy People 2030—subjective well-being and life satisfaction—were negatively impacted. A plethora of evidence exists about the benefits of running for physical and mental health. Yet, there is no available evidence that shows the benefits of ultrarunning, subjective well-being, and life satisfaction. This quantitative cross-sectional study examined the relationship between ultrarunning status, subjective well-being, and life satisfaction among adult runners in the United States. The advanced triangle of epidemiology served as the conceptual framework. A convenience sample included 369 adult runners, who were recruited via the Survey Monkey online platform and through running and ultramarathon groups. Subjective well-being was measured using the Warwick Edinburgh Mental Well-being Scale, and life satisfaction was measured using the Satisfaction with Life Scale. Two hierarchical multiple linear regressions were conducted. The results showed that there was a statistically significant association between the agent (subjective well-being), the host (ultrarunners), and the environment (ultrarunning), adjusting for demographic characteristics, $F(1,364) = 3.79$, $p = .050$, $R^2 = .01$. However, there was no statistically significant association between the agent (life satisfaction), the host (ultrarunners), and the environment (ultrarunning), adjusting for demographic characteristics, $F(1,364) = 1.74$, $p = .188$, $R^2 = .00$. Implications for positive social change include helping public health officials create initiatives that improve well-being through community programs, leisure engagements, research, and policy.

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Dedication

First, I humbly dedicate this dissertation to Almighty God, the most powerful influencer of my life. Dear Lord, I extend my heartfelt appreciation for shaping my life story and for helping me share my true passion and life calling with others. I would not alter a single life chapter for anything. For my beautiful mom in heaven, and my #1 supporter in life and in this doctoral journey that she did not get to see to fruition. To my dedicated dad in heaven, who exemplified a work ethic that remains etched in my heart. Mom and Dad, you were always there to support me during the peaks and valleys of my life, standing proud, and believing in me when others didn't, which echoes deeply. You both did not get to experience an education past middle school because of the economics in the past—this doctoral degree is for you! I extend dedication to my dear husband, Mike, who was amazed at me when I started this journey—unknowingly becoming an integral part of it over the course of 5 years. Thank you, honey, for your enduring patience, support, and love throughout this challenging process. You are my rock! To my dear children, Mariah, Mikey, and Bella—my greatest accomplishments and cherished treasures. Remember the value of education, a gift that no one can ever take away. This dissertation stands as a testament to the importance of learning, a legacy I hope you carry forward. A special dedication to my sisters, Janie and Roxanne, who are my lifelines here on earth and in heaven. Your love and support throughout the years are an invaluable pillar. Lastly, I honor my ancestors—the bedrock of my existence. To my extended family, friends, and all those who embraced me with open arms, love, and support throughout this journey and life's path, I express my deepest gratitude.

Acknowledgments

"I have fought the good fight. I have finished the race. I have kept the faith" (2 Timothy 4:7). I extend my deepest gratitude to our Father, the Creator of Heaven and Earth, our Redeemer, Counselor, and the Almighty God, whose endless guidance and blessings have been constant throughout this journey. None of this would be possible without Him. Thank you, Father, for the honor of serving you and for the great achievement of attaining a doctoral degree.

I express an appreciation to every member of the Walden University faculty and staff, who have played integral roles in my educational journey. Your teaching and encouragement have formed a robust educational foundation. Each of you has shown me new possibilities, revitalized my passion for learning, and reignited my growth mindset within Walden's environment of social change. Also, a heartfelt thank you to my Walden Family, the peers who shared the dissertation journey, befriended me, and maintained close contact throughout—I was never alone.

A special acknowledgment goes to my dissertation chair, Dr. Shawn Munford, for taking me under your wing, providing consistent guidance, and sharing invaluable wisdom on the path to becoming Dr. Raquel Hernandez. Your kindness and support are deeply appreciated. I also extend my gratitude to Dr. Manoj Sharma, who stepped in during the final year, generously sharing expertise and timely feedback with kindness that propelled me across the finish line. In remembrance and dedication, I send special gratitude to my first second-committee member, the late Dr. Robert Marino, who was instrumental in helping me develop the conceptual framework of my study, the Advance

Triangle of Epidemiology. He leaves an indelible mark with his kindness, mentorship, and teachings that will forever accompany me. I dedicate this area of my study to Dr. Marino.

To the mentors and educational/life coaches who have played pivotal roles throughout my life, I express sincere appreciation. Thank you for believing in me when others doubted me, for steering me away from the wrong path, for urging me to reach beyond my perceived limits, and for instilling the belief that educational pursuits were possible. Your impact has been immeasurable, and I am sincerely thankful for your guidance and wisdom.

To my running and ultrarunning community, I extend my heartfelt gratitude for the support and encouraging words throughout this five-year journey. The phrase, "It's a marathon, not a sprint," aptly captures the essence of this dissertation trek. Yet, having embraced ultrarunning amid this endeavor, I can surely say, "It's an ultramarathon, not a sprint." This journey serves as an important reminder to navigate the path one step at a time and to respect the process, an enduring lesson of consistency. Running has been a defining element of my identity for over 25 years. It is ultrarunning that has guided me through and out of the pain cave and has given me invaluable lessons in perseverance, resilience, and the fortitude to persist even in the face of adversity (Keep Going).

Finally, I extend gratitude to the loves of my life—Mike, Mariah, Mikey, and Bella. Your patience, support, and love have been the pillars that sustained me through this challenging journey. I love you all with every beat of my heart.

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Chapter 1: Introduction

Sport organizing professionals and researchers have the chance to contribute to a larger discussion on how to promote public health as mass participation sports events have become more and more popular. Running continues to be an accessible and popular workout. Similarly, ultrarunning participation has risen over the past few decades (Hoffman & Krishnan, 2014; Ronto, 2021b). Even with, the overall benefits of running include a 23%-30% reduction in cardiovascular disease, cancer, and all-cause mortality (Pedisic et al., 2020), and enhanced physical and mental health (Martinez & Scott, 2016; Oswald et al., 2020; Silva et al., 2018). However, the mental health benefits of ultrarunning are not well understood in the current literature. Healthy People 2030 uses self-rated indicators of well-being as domains of mental health, such as subjective well-being and life satisfaction (Office of Disease Prevention and Health Promotion [ODPHP], n.d.-a; ODPHP, n.d.-c). Yet, existing literature centers on the physical and physiological components of ultrarunning. In addition, literature is limited regarding the relationship of ultrarunning, subjective well-being, and life satisfaction.

This chapter will provide the background, problem statement, purpose of the study, research questions, conceptual framework, and nature of the study. In addition, key definitions, assumptions and limitations, scope and delimitations, limitations, and significance are provided. A summary of the main points transitions into Chapter 2.

Background

In the United States, it was reported that 21% (1 in 5 or 52.9 million people) experience mental health issues each year that significantly impact personal well-being

(National Alliance on Mental Illness [NAMI], 2021). These statistics have risen due to the COVID-19 pandemic, with more than three in 10 adults in the United States reporting symptoms of anxiety and/or depression since May 2020 (Kaiser Family Foundation [KFF], 2021). The COVID-19 pandemic has stimulated high rates of depression among individuals who have not previously been diagnosed with a mental health diagnosis (Veldhuis et al., 2021). At least 28.2% of adults reporting anxiety and/or depressive disorder symptoms had an unmet need for treatment (KFF, 2021). The stress of the pandemic, coupled with mandatory lockdowns, separation from family and friends, losing loved ones to the virus, grief, elevated levels of uncertainty, and balancing work and caregiving has created the perfect storm for psychological distress (Veldhuis et al., 2021). The COVID-19 pandemic will widen in the long-term, already massive mental health disparities, including financial, care, and stigma obstacles to mental health (Veldhuis et al., 2021).

Current treatment guidelines for mental conditions such as depression, anxiety, and stress have not changed, and increased morbidity rates continue (Keating et al., 2018; Rehm & Shiel, 2019). Established guidelines include antidepressants, mood stabilizers, and psychotherapy as first-line agents for treatment (Keating et al., 2018). However, medication adherence is low, ranging from 30% to 70% for antidepressants and 18% to 52% for mood stabilizers (Keating et al., 2018). In addition, many individuals go untreated due to the lack of health insurance and medication access, which is worsened by the pandemic (NAMI, 2021; Veldhuis et al., 2021). Healthy People 2030 reports poorer health outcomes for individuals without insurance and the inability to receive

health care (ODPHP, n.d.). A goal of improving mental health, the quality of life, and overall health is an objective of Healthy People 2030 (ODPHP, n.d.). Untreated mental health conditions can interfere with daily activities and significantly impact work, school, socializing, and living everyday life (NAMI, 2021). As such, there is a need to examine alternative or supplementary coping strategies to traditional treatment for mental health issues.

In addition, a physically inactive lifestyle among American adults is a national public health concern (Centers for Disease Control and Prevention, [CDC], 2022). Over a fourth (25.3%) of American adults are physically inactive, defined as not participating in any regular leisure-time activities such as running, walking, or exercise (CDC, 2022). A lack of physical activity increases risks for obesity and a myriad of chronic illnesses ranging from hypertension to Type 2 diabetes and certain cancers (John Hopkins Medicine, 2022; Tiller et al., 2020). Moreover, a lack of physical activity has been significantly associated with depression, which affects an estimated 17 million Americans (Thompson et al., 2020). Yet, physical activity is associated with higher levels of subjective well-being and life satisfaction (Iwon et al., 2021). Sports is a foundation of a healthy life, and studies have shown that physical activity is necessary for physical and mental health (Iwon et al., 2021; Warburton & Bredin, 2017).

Exercise is medicine, and incorporating physical activity, including running, is a key strategy to improve overall health (Tiller et al., 2020; Thompson et al., 2020). Ultrarunning, defined as any running event where the distance exceeds 26.2 miles, may provide a means to improve one’s mental health (Cook, 2018; Mulvad et al., 2018;

Oswald et al., 2020). There is a lack of research in general on mental health issues among athlete populations beyond personal stories (Pereira Vargas et al., 2021), and the existing mental health research specific to ultrarunning is especially limited (Burgum & Smith, 2021; Grunseit et al., 2018; McGannon et al., 2020). Studies have, however, shown that mental health issues may be less prevalent among ultrarunners compared to the general population (Hoffman & Krishnan, 2014), and that ultrarunning may enhance one's sense of identity and self-esteem, act as an effective coping mechanism, and serve as a catalyst to improve life satisfaction, which is tied positively to subjective well-being (Gorichanaz, 2018; Grunseit et al., 2018; McGannon et al., 2020). Despite the acknowledged physical and emotional benefits of physical activity, exercise, and sports (Pereira Vargas et al., 2021), there is little or no literature that has explored if ultrarunning status is significantly associated with subjective well-being and life satisfaction.

Running positively impacts mental health, notably improved psychological wellness and decreased depression, anxiety, and stress disorders (Cook, 2018; Mulvad et al., 2018; Oswald et al., 2020). Data from 289 runners in Serbia illustrated a significant relationship between endurance running and emotional well-being with improved mental health states (Popov et al., 2019). Popov et al. (2019) found that coping with negative emotional states was the most important reason for practicing endurance running. Participation in community-based running events has benefited personal well-being through improved mental health and community connectedness (Grunseit et al., 2018; Hindley, 2020). The mental health aspects of running, including overall wellness, are

relevant and applicable to individuals with mental illness who could use running as a strategy for improvement in the mental well-being domain.

Healthy People 2030 organizes overall health and well-being measures into three tiers: well-being, healthy life expectancy, and mortality and health measures (Office of Disease Prevention and Health Promotion [ODPHP], n.d.-c). Overall well-being is presented as life satisfaction and is reflected in cumulative contributions of health and non-health factors (ODPHP, n.d.-c). As an indicator of well-being, life satisfaction takes a multidimensional facet that encompasses domains relating to self-rated mental health, overall well-being, and participation in society (ODPHP, n.d.-a; ODPHP, n.d.-c). Health-related quality of life, as a multifaceted approach, goes beyond direct measures of population health, life expectancy, and causes of death, centering on the positive aspects of emotions and life satisfaction that impact well-being (ODPHP, n.d.-a). Well-being manifests when one maximizes his or her physical, mental, and social functioning state in the context of supportive environments to live a satisfying life (ODPHP, n.d.-a).

Subjective well-being is how individuals broadly evaluate their life; it holds a cognitive element about satisfaction and an affective component assessing happiness with life (Grunseit et al., 2018). Subjective well-being is known as self-reported well-being, and it is often a measure of mental health. It can be a good predictor of individual health, wellness, longevity, and quality of life (Cherry, 2022; Grunseit et al., 2018). In a study on long-distance running and life satisfaction, Sato et al. (2015) found a positive association between a person’s life satisfaction and well-being. Participating in long-distance runs can provide positive experiences through event participation and benefit psychological

well-being and social connection (Sato et al., 2015). Evidence has shown that high levels of subjective well-being and life satisfaction include feeling accepted by others, being socially engaged, belongingness, and community support (De Neve et al., 2013; Kuykendall et al., 2015).

There is a gap in public health research on the mental health benefits of ultrarunning. In their study with ultrarunners, Burgum and Smith (2021) found that ultrarunning event performance was associated with reduced negative mood fluctuations. Moreover, Grunseit et al.'s (2018) study on Parkrun (i.e., weekly 5k runs) events with Australian runners and Sato et al.'s (2015) study with long-distance runners in the United States have shown that participation in endurance running events can serve as a catalyst to improve life satisfaction, which is tied positively to subjective well-being. Although researchers have investigated this issue, there is little or no literature about the relationships between ultrarunning status (i.e., recreational and/or competitive runners who do or who run in at least one ultramarathon [50k or 31 miles or more] annually) and subjective well-being and life satisfaction among adult runners in the United States.

Problem Statement

There is a lack of empirical examination of the relationships between ultrarunning status (i.e., recreational and/or competitive runners who do or who run in at least one ultramarathon [50k or 31 miles or more] annually) and subjective well-being and life satisfaction among adult runners in the United States. The independent variable was ultrarunning status (i.e., 1 = ultrarunner or 0 = runner), the covariables were the target population's demographic characteristics, and the two dependent variables were

subjective well-being, measured using the Warwick Edinburgh Mental Well-being Scale (WEMWBS), and life satisfaction, measured using the Satisfaction With Life Scale (SWLS).

Purpose of the Study

The purpose of this quantitative cross-sectional study was to examine the relationship between ultrarunning status, subjective well-being, and life satisfaction among adult runners in the United States. The independent variable was ultrarunning status (i.e., 1 = ultrarunner or 0 = runner), the covariables are the target population's demographic characteristics, and the dependent variables are subjective well-being and life satisfaction.

Research Questions and Hypotheses

The following research questions and hypotheses were produced from reviewing existing literature within areas of ultrarunning status, subjective well-being, and life satisfaction. A more detailed discussion of research methods is presented in Chapter 3.

Research Question 1 and Hypotheses

Research Question 1: Is there an association between ultrarunning status and subjective well-being among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level)?

H_0: There is no statistically significant association between ultrarunning status and subjective well-being among participants**,** adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level).

H_1: There is a statistically significant association between ultrarunning status and subjective well-being among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level).

Research Question 2 and Hypotheses

Research Question 2: Is there an association between ultrarunning status and life satisfaction among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level)?

H_0: There is no statistically significant relationship between ultrarunning status and life satisfaction among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level).

H_1: There is a statistically significant relationship between ultrarunning status and life satisfaction among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level).

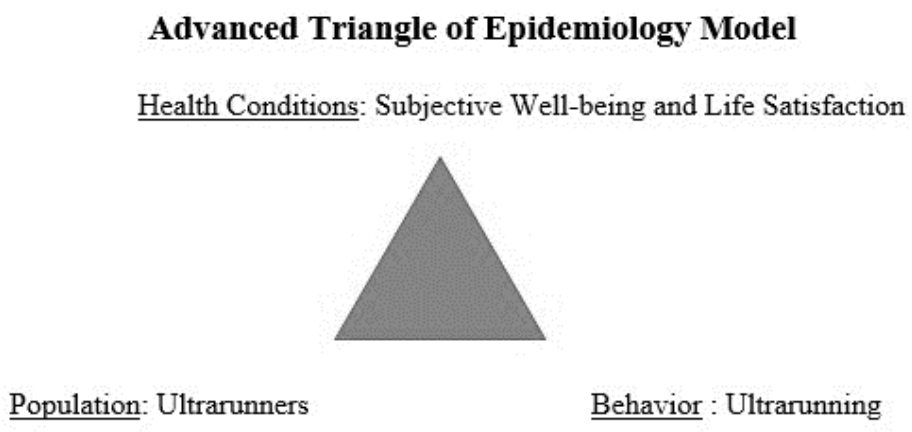
Conceptual Framework

The conceptual framework that grounds this study is the advanced epidemiology triangle, which has been used in studies of chronic diseases and behavioral health disorders (Johnson, n.d.; Miller, 2002; Oleckno, 2002). According to this model, disease (physiological or psychological) results when the agent, host, and environment are no longer balanced (Johnson, n.d.; Miller, 2002; Oleckno, 2002). Host factors include intrinsic characteristics that impact exposure susceptibility and response (Johnson, n.d.; Miller, 2002; Oleckno, 2002). “Agents” consist of causative factors (or conditions), and the environment impacts the opportunity for exposure (i.e., behavior, culture, and

physiological or psychological factors) (Johnson, n.d.; Miller, 2002; Oleckno, 2002). In using the advanced triangle of epidemiology model for this study, the host (population) is ultrarunners, the agent (health conditions) is subjective well-being and life satisfaction, and the environment (behavior) is ultrarunning (see Figure 1).

Figure 1

Advanced Triangle of Epidemiology



Nature of the Study

A quantitative, cross-sectional methodology was employed to examine the relationship between ultrarunning status, subjective well-being, and life satisfaction. Other variables such as participant sex, age, race/ethnicity, education level, and income level among adult runners in the United States were adjusted.

Definitions

For this study, the following definitions apply:

COVID-19 pandemic: A global outbreak of coronavirus, which is brought on by the SARS-CoV-2 virus, an infectious disease that started on March 11, 2020, and at the time of this study, is currently ongoing (World Health Organization, 2023).

Endurance running: Persons who run for distance, generally at a slower and steady pace to go longer distances while generally facing adversity, discomfort, fatigue, and pain (American Sports & Fitness Association, 2022; Salazar & Scheerder, 2022)).

Global life satisfaction: A person's cognitive component of subjective well-being and the overall quality of life (Diener, 1984).

Leisure engagement: Any personal activity that is enjoyable, takes place during a period of free time that is away from commitments and responsibilities, and benefits a person's well-being (Chen et al., 2022; Pressman et al., 2009; Newman et al., 2014).

Mental health: A person's emotional, psychological, and social well-being (Substance Abuse and Mental Health Services Administration, 2023).

Recreational runner: Non-competitive runner or running participation in 5 km and 10 km run events or less and train less frequently (Janssen et al., 2020).

Subjective well-being: How a person evaluates their own life (Diener et al., 2003).

Ultramarathon: A foot race that is longer than the 26.2-mile standard marathon (UltraRunning Magazine, 2013).

Ultrarunner: A person who participates in ultrarunning or ultramarathons.

Ultrarunning: Running distances that are longer than the 26.2-mile standard marathon (UltraRunning Magazine, 2013).

Well-being: A person's state that integrates mental health (mind) and physical health (body; Centers for Disease Control and Prevention, 2018).

Assumptions and Limitations

I assumed the study participants would understand the questionnaire. Likewise, I assumed that the Advanced Triangle of Epidemiology is an appropriate conceptual framework for examining the relationship between ultrarunning status, subjective well-being, and life satisfaction among adult runners in the United States. I also assumed that participants would provide honest responses to reflect an adequate representation of running for this study. However, a possible limitation of this study was that because a non-random convenience sample was proposed, participants who met inclusion criteria were a representative sample of the target population. Thus, external validity is limited as possible results from the sample may not apply to all runners or ultrarunners. Another limitation was related to the sample population, which includes only runners and ultrarunners, and does not include a sedentary sample. Thus, the effect size (*f2*) may be compromised due to measuring two categories.

Scope and Delimitations

The potential sample for this study was limited to adult runners in the United States. Participants were at least 18 years of age, met the inclusion criteria, and were willing to participate in the study. Participants must have identified as a runner and spend at least 30 minutes per week running for 21 or more weeks out of the year. Thus, the study was delimitated to investigating individuals who met the inclusion criteria. I assumed participants would answer the survey questions honestly and complete all

necessary responses. Regarding delimitations, the study does not include all the social determinants of health variables for the analysis, such as religion, marital status, or U.S. geographic location.

Limitations

Limitations are issues that are out of the researcher's control. According to Greener (2018), limitations should be included in a research study. A possible limitation may be social desirability bias, where participants can provide responses that they feel are socially desirable rather than accurately reporting genuine feelings (Greener, 2018). Other potential limitations include recall bias, response bias, and selection bias when using survey instrumentation. Respondents who are more willing to complete the survey/questionnaire may see a higher benefit of participation in running events or hold a higher mental well-being index. A possible solution is dose-response effect measurement, such as adding a measure of the frequency of attendance. Another potential limitation is missing information or data needed from online surveys. There are methods to deal with missing data, such as listwise or pairwise deletion or an imputation technique (i.e., mean substitution) within SPSS to complete the dataset. However, each method can introduce bias and discard pertinent information with listwise or pairwise deletion. Reporting missing values is necessary, and strategies taken to account or correct for missing data were reported.

In addition, I did not include all covariables pertaining to socio-demographic characteristics (e.g., marital status, family and dependents, employment, religion, or area of the U.S. the participant resides), which is a limitation. However, adding too many

socio-demographic questions can extend the survey time, which can increase the dropout rate of survey respondents (Chudoba, 2023). Another limitation was the use of a 14-item Likert (WEMWBS) scale and a 7-item Likert scale (SWLS), which could have confused participants. According to Johnson and Morgan (2016), using alternating scale points may cause respondent problems in discriminating between the scale points. To help avoid this issue, I added a sentence before each survey that includes the number of question and response categories (see Appendix E and F).

A potential barrier concerned the recruiting of participants. There may have been difficulty obtaining access to runners, both ultrarunners and those who engage in less strenuous running. My recruitment plan was to contact running clubs through local and national organizations to obtain permission to post study information on their website or to access their membership list and contact members via email. Because the study was not State-specific and involved runners from across America, this increased the number of various running clubs and organizations across the United States that I could contact. I used the Survey Monkey recruitment panel services to obtain the intended sample size of 212 participants. My recruitment methods, which included a backup plan, were effective in obtaining the necessary sample, which included a final total of 369 participants.

Significance

This study is significant because it added to the empirical literature on ultrarunning and could extend future public health research, programs, and policies. While research has shown that ultrarunners may experience fewer mental health issues in comparison to the general population (Hoffman & Krishnan, 2014), and that ultrarunning

may improve one's self-esteem and moods (Gorichanaz, 2018; Grunseit et al., 2018; McGannon et al., 2020), ultrarunning status has not been examined in relation to improving subjective well-being and life satisfaction. This was the first study to determine if ultrarunning status is significantly associated with personal well-being and life satisfaction, adding to the minimal body of work concerning mental health issues among runners and ultrarunners.

Mental health substantially impacts how individuals' function in society, make decisions, and manage stress (CDC, 2022). Living a full-filling life depends on mental health and is a fundamental concern for public health professionals (CDC, 2022). The prevalence of mental health issues has increased since the COVID-19 pandemic, which affects individual physical and social well-being (Veldhuis et al., 2021). This study, with its focus on physical activity and its provision of information concerning links between ultrarunning and mental health outcomes, provides an important data snapshot of mental health (i.e., subjective well-being and life satisfaction) among American runners. Furthermore, this study helps address Healthy People 2030 overall health and well-being measures (OHMs) to improve Americans' overall health and mental health (ODPHP, n.d.-b). More specifically, overall health and well-being measures (OHMs) that are addressed are Healthy People 2030 OHM-1 (overall well-being), OHM-6 (free of activity limitation), and OHM-8 (Respondent-assessed health status—in good or better health) (ODPHP, n.d.-b).

Physical inactivity is a significant public health concern because the lack of awareness and intervention will continue the risks for heart disease, diabetes, obesity,

certain cancers, and mental illness (Thompson et al., 2020). The American College of Sports Medicine (ACSM) created a global health initiative in 2007 ("Exercise is Medicine") to promote physical activity in clinical care and connect it to evidence-based physical activity resources to foster optimal health and prevent a variety of chronic diseases linked to physical inactivity (Thompson et al., 2020). The scientific and medical literature illustrate how sedentary life is a significant public health concern with many harmful health effects (Thompson et al., 2020). Exercise is medicine, and a solution that enables health professionals to support communities in disease prevention efforts (Thompson et al., 2020). It is posited that the most critical factor contributing to health outcomes is individual lifestyle and behavior (Thompson et al., 2020). Any efforts to influence behaviors, specifically physical inactivity, will likely have the greatest impact on population health (Thompson et al., 2020).

It has been well-established that engaging in physical activity and sports improves one's physical and emotional well-being (Pereira Vargas et al., 2021). While some sports are expensive, requiring special training or athletic equipment, ultrarunning is low-cost and requires little technical skills to participate (Pereira et al., 2021). As such, ultrarunning may provide an affordable alternative or supplementary coping strategy to more traditional mental health treatment approaches. Supporting ACSM's Exercise is Medicine initiative and Healthy People's 2030 health and well-being measures, ultrarunning status and how it is associated with subjective well-being and life satisfaction added new evidence for public health practice.

Summary

Running as a form of exercise improves physical and mental health. However, evidence in mental health research specific to ultrarunning (a running endurance event over 26.2 miles) is limited. Running as a recreational activity or for competitive pursuits at distances under the ultramarathon has shown positive associations between life satisfaction and well-being (Grunseit et al., 2018; Sato et al., 2015). Additionally, participation in running events has benefited subjective well-being and social connection (Sato et al., 2015). Evidence has shown that high levels of subjective well-being and life satisfaction include feeling accepted by others, being socially engaged, belongingness, and community support (De Neve et al., 2013; Kuykendall et al., 2015). Similarly, ultramarathon events routinely take place in natural outdoor environments, which provide a salutogenic context that is fundamental for physical and mental health and subjective well-being (Coon et al., 2011; Martinez & Scott, 2016; Silva et al., 2018). The power of nature facilitates novel insights into human perseverance in getting the vast distances of ultramarathons done (Cherrington et al., 2020). The social connectedness of the ultramarathon environment fosters a sense of connection, belonging, and camaraderie that fosters higher levels of well-being and happiness (Batmyagmar et al., 2019; Cook, 2018; Cleland et al., 2019; Grunseit et al., Hindley, 2020; Keating et al., 2018; Morris & Scott, 2019; Stevinson & Hickson, 2014).

A plethora of evidence exists about the benefits of running for physical and mental health. Nevertheless, there is no available evidence that shows the benefits of ultrarunning, subjective well-being, and life satisfaction. Healthy People 2030 uses well-

being measures that include overall well-being and life satisfaction as health indicators and how society is doing from a wellness perspective (ODPHP, n.d.-c). This study aimed to examine the relationship between ultrarunning status, subjective well-being, and life satisfaction among adult runners in the United States. The conceptual framework for this study is the advanced epidemiology triangle, previously used for chronic diseases and behavioral health disorders (Johnson, n.d.; Miller, 2002; Oleckno, 2002). This study used the model to examine the host (population) as ultrarunners, the agent (health conditions) as subjective well-being and life satisfaction, and the environment (behavior) as ultrarunning.

Furthermore, no available research uses this model to examine the relationship between ultrarunning status, subjective well-being, and life satisfaction. This work is significant because it could advance current and future public health research, initiatives, policies, and the empirical literature on ultrarunning. While studies have shown that ultrarunners may experience fewer mental health problems than the general population (Hoffman & Krishnan, 2014) and that ultrarunning may enhance moods and self-esteem (Gorichanaz, 2018; Grunseit et al., 2018; McGannon et al., 2020), the relationship between ultrarunning status and increasing subjective well-being and life satisfaction has not been studied.

Chapter 2: Literature Review

The mental health benefits of ultrarunning are not well-understood in the current literature. Existing literature focuses on the physical and physiological components of ultrarunning, and few studies exploring the mental health benefits of ultrarunning have relied predominantly on qualitative inquiry. Subjective well-being and life satisfaction are routine indicators of mental health; however, literature is limited in awareness of ultrarunning, subjective well-being, and life satisfaction as it relates to mental health. The purpose of this study was to examine the relationship between ultrarunning status, subjective well-being, and life satisfaction among adult runners in the United States.

A quantitative, cross-sectional study was conducted using primary data. There are four sections in this chapter. The first section summarizes the strategy used to conduct the literature review. The second section describes the advanced triangle of epidemiology, the conceptual framework for this study, and the rationale for using this model. The following section examines previous and current peer-reviewed articles on factors surrounding ultrarunning status, subjective well-being, and life satisfaction. Lastly, a summary of major themes in the literature, including identified gaps, and a transition to the next chapter concludes.

Literature Search Strategy

The literature review was initiated through the Thoreau multi-databases beginning in June 2021. Databases within the Walden University library provided only full-text, peer-reviewed scholarly journals, and a timeframe search between 2015 and current. Other available journals and databases included PubMed, ProQuest, Health Sciences

Databases A-Z, Medline, SAGE journals, APA PsycArticles, and dissertations and theses relevant to the topic. Various keywords were used alone and concurrently to retrieve appropriate literature, including mental health, running, run, ultrarunning, ultra-running, ultrarunners, Parkrun, green exercise, exercise, races, physical activity, organized sports, 5k, 10k, marathons, ultramarathons, ultra-marathons, subjective well-being, life satisfaction, psychological wellness, and psychological well-being. Although the date restriction to locate the most current literature included a publication date ranging from 2015 to the current, date restrictions were modified and lifted to account for retrieving literature regarding theoretical foundations and historical contexts published prior to 2015.

Conceptual Framework

Origins and Brief Background of the Epidemiological Triad

The conceptual framework for this study is the advanced triangle of epidemiology. The origins of this framework are uncertain; however, the epidemiological triad is attributed to Clark (1954, as cited in Cohen & Shang, 2015; Elliott, 2019) in his discussion of the natural history of syphilis and levels of prevention. However, the first visual of the triad with the same underlying concept of an agent, host, and environment was by Frost (1976). Since then, the epidemiologic triad has become popular in modern epidemiology giving rise to the equilibrium that changes one level of prevalence to another (Morabia, 2013). Frost (1976) depicted the triad as a microorganism capable of producing an infection or disease, a host population (e.g., man) containing susceptible

individuals in enough numbers to maintain the infection, and conducive environmental conditions necessary for bringing the specific microorganism into contact with the hosts.

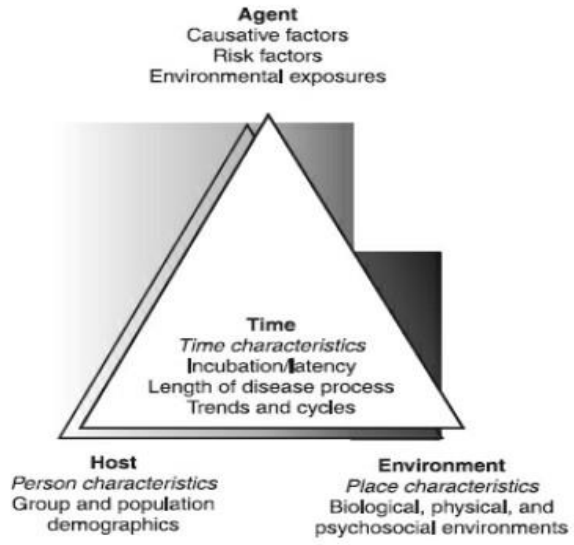
In the literature, the epidemiologic triad is also referred to as the epidemiologic triad of agent/host/environment (Bernardo et al., 2002), host-agent-environment complex (Smith, 1986), agent-host-environment model (Zastrow, 2011), epidemiological triangle (Huerta & Leventhal, 2002), and the traditional public health triangle (Wilde, 1997). This framework was originally developed as a model for infection prevention (Cohen & Shang, 2015; Frost, 1976; Morabia, 2013). Over time, the framework has been used in noninfectious disease studies (Cohen & Shang, 2015). Rather than a balance between the agent, host, and environment, humans can be both a reservoir of the disease and the behaviors and habits that influence the interactions between the triad (Clark, 1954; Cohen & Shang, 2015). Keyes et al. (2021) used the agent-host-environment triad with a noncommunicable disease (suicide risk) to leverage surveillance sources to inform prevention. Similar to the classic epidemiologic triad, agent (media reporting, close contact with suicide decedent, firearm ownership), host (psychiatric disorder history, previous attempts, family history, stressful life events, substance abuse, and demographics), and environment (season, temperature, country, altitude, country, and local macro-economics, and historical oppression) were used as communicable disease properties to complement clinical risk management (Keyes et al., 2021).

The epidemiologic triangle has historically been used to focus on communicable diseases; however, infectious diseases are no longer the primary cause of death in industrialized countries (Merrill, 2017). Epidemiologists not only measure the

interactions between the agent, host, and environment but also examine the population's health status in the environment (Gulis & Fujino, 2015). Therefore, a more advanced model has been developed, the advanced triangle of epidemiology. Miller (2002) modified epidemiologic triad models depicting the agent (causative factors, risk factors, environmental exposures), host (person characteristics, group and population demographics), and environment (place characteristics, biological, physical, and psychological environments). The element of time (time characteristics, incubation/latency, length of disease process, and trends and cycles) sits in the middle of the triangle (Miller, 2002; see Figure 2).

Figure 2

The Epidemiological Triad Model

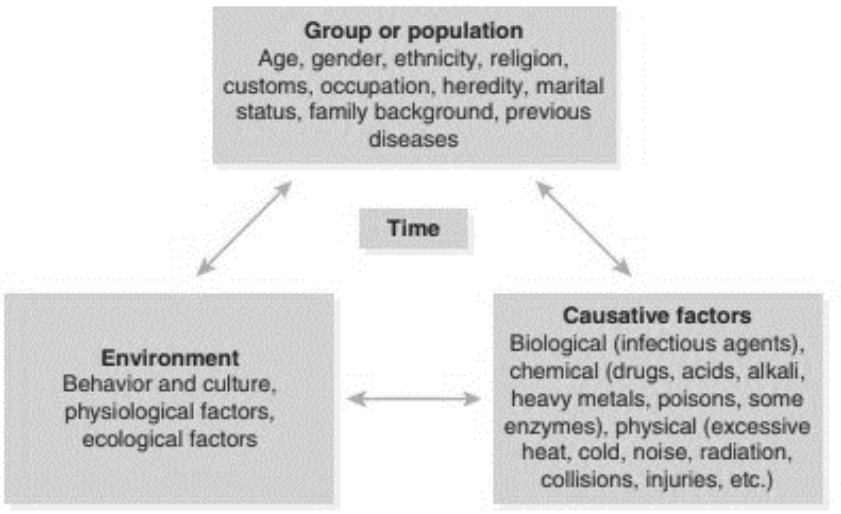


Note. This model was modified by Miller (2002) to depict the agent, host, and environment in an advanced format to show a complex model that includes a wider range of chronic disease factors and many elements that contribute to disease in the population. Copyright (2002) From *Epidemiology for Health Promotion and Disease Prevention Professionals* by R.E. Miller. Reproduced by permission of Taylor and Francis Group,

Merrill (2017) also modified the original epidemiology triad with the advanced epidemiology triangle for chronic diseases and behavioral disorders (see Figure 3). In this model, the host is group or population characteristics (age, gender, ethnicity, religion, customs, occupation, heredity, marital status, family background, and previous diseases), and the agent is causative factors influencing the health status of people (biological, chemical, physical, or social factors) and environment (behavior and culture, physiological, or ecological factors).

Figure 3

The Advanced Epidemiology Triangle for Chronic Diseases and Behavioral Disorders



Note. This figure illustrates the advanced epidemiology triangle for chronic diseases, including behavioral disorders by Merrill (2017). In this model, Merrill (2017) updated agents with causative factors that influence the health status of individuals. Reprinted from *Introduction to Epidemiology* (7th ed., p. 11), by R.M. Merrill, 2017, Jones and

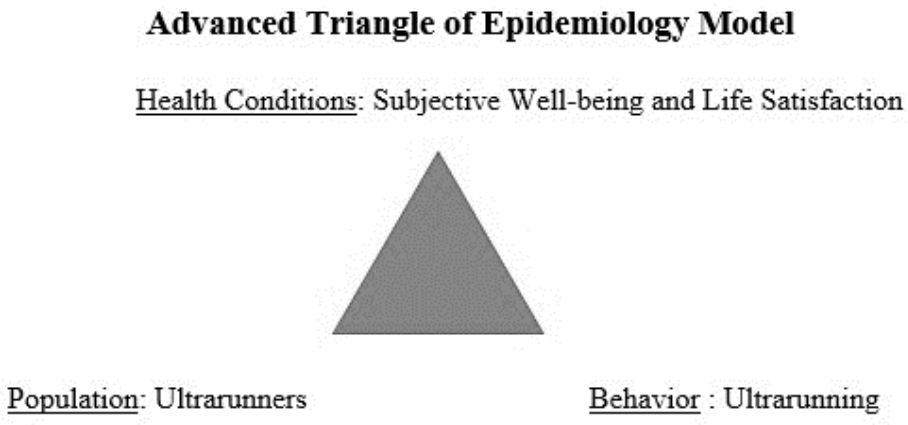
The new model includes all elements of the original epidemiological triad. To be more closely aligned with current health-related events, behaviors, lifestyle factors, environmental causes, ecologic elements, physical factors, non-communicable diseases, and conditions were included to further develop the advanced triangle of epidemiology (Merrill, 2017). The advanced model is neither comprehensive nor complete but acknowledges that disease states and conditions affect populations in a complex manner, with many factors influencing modern-day health (Merrill, 2017).

Advanced Triangle of Epidemiology

This study proposes using the framework in which disease (physiological or psychological) results when the agent, host, and environment are no longer in balance (Johnson, n.d.; Merrill, 2017; Miller, 2002; Oleckno, 2002). Host factors include intrinsic characteristics that impact exposure susceptibility and response (Johnson, n.d.; Merrill, 2017; Miller, 2002; Oleckno, 2002). In this model, the agents consist of causative factors or conditions. The environment impacts the opportunity for exposure (i.e., behavior, culture, and physiological or psychological factors) (Johnson, n.d.; Merrill, 2017; Miller, 2002; Oleckno, 2002). This study used the factors of the advanced triad model, such as the host (population) being ultrarunners, the agent (health conditions) being subjective well-being and life satisfaction, and the environment (behavior) as ultrarunning (see Figure 4).

Figure 4

The Advanced Triangle of Epidemiology Model



For this proposed study, the advanced triangle of epidemiology framework was applied to examine the relationship between ultrarunning status, subjective well-being, and life satisfaction among adult runners in the United States. The field of epidemiology is descriptive and can examine the relationship between factors that result in certain diseases or conditions that impact personal well-being (Center for Substance Abuse Treatment, 2007). Epidemiology cannot determine a causal pathway, but it can provide trends that inform the public of a relationship between factors over time (Center for Substance Abuse Treatment, 2007).

Literature Review Related to Key Variables and Concepts

Ultrarunning Status

Running longer than a marathon is an endurance sport known as ultrarunning, which is gaining popularity worldwide and attracting more people every year. An ultramarathon is any running event longer than the traditional race length of the

marathon, with the shortest starting at 31 miles or 50 kilometers (Knechtle & Nikolaidis, 2018). These events are either distance-limited runs categorized in kilometers (km) and miles, or time-limited events held in hours or days (Knechtle & Nikolaidis, 2018). The most popular ultrarunning distances are distance-limited races, including 50 km, 100 km, 50 miles, and 100 miles (Knechtle & Nikolaidis, 2018). Some ultras go beyond the 100-mile distance (e.g., Badwater 135, Moab 240, or 200 miles or more) but are not typical distances (Cook, 2018; UltraRunning Magazine, 2023). Distances are usually navigated alone, but relay, pacers, or a crew are not uncommon, all of which support the participant during the race (Malcolm, 2021; Renfree et al., 2016).

Following the running boom of the 1970s, an increased interest in trail running and testing oneself to the limit offers the perfect milieu for ultrarunning to grow in status. To support that notion, one study reported that the number of ultrarunning finishers worldwide has more than doubled since 2011, with 276,535 finishers in 2016 (Hoffman & Krouse, 2017; Waskiewicz et al., 2019). The United States has been the second leading country since 2018, with the most ultramarathon participants (12.1%) after France (12.4%; Ronto, 2021b). A similar study based on data from the Ultrarunners Longitudinal TRAcking survey demonstrated that 94.7% of 1,212 participants had completed an ultramarathon within the prior 12 months (Hoffman & Krishnan, 2014). Data from 85% of ultramarathons worldwide between 1996 to 2018 revealed a 1,676% rise in participation, from an estimated 34,401 ultrarunners in 1996 to 611,098 ultrarunners in 2018 (Ronto, 2021b). As ultramarathons become more prevalent, 41% of participants run more than one event annually, up from only 14% in 1996 (Ronto, 2021b). In addition,

most ultrarunners prefer distances below 50 miles (72%) compared to those who prefer more challenging distances (28%) above 50 miles (Ronto, 2021b). Not only have participation trends in the type of runs changed, but also the characteristics of the runner.

A number of studies show there are little differences in the characteristics of the ultrarunner (Hoffman & Fogard, 2012; Hoffman & Krishnan, 2014; Knechtle, 2012; Roebuck et al., 2018; Ronto, 2021b; Thompson & Nequin, 1983). Based on data between 1996 to 2018 from results of 5,010,730 million ultrarunner finishers worldwide, the average age of ultrarunners has remained about the same from 43.3 to 42.3 years, decreasing slightly (Ronto, 2021b). A similar study of 1,212 ultrarunner participants (88.0% from the U.S.) illustrated a median age of 42.3 years (Hoffman & Krishnan, 2014), illustrating that the average age has not changed much. Demographic studies indicated that ultrarunners are predominantly male and older, with a mean age of 45 (Hoffman & Fogard, 2012; Roebuck et al., 2018). The gender distribution has been consistent in different studies showing men participate in ultramarathons more than women (Hoffman & Fogard, 2012; Hoffman & Krishnan, 2014; Roebuck et al., 2018). The Ultrarunners Longitudinal TRAcking study included 68.0% of male ultrarunners (Hoffman & Krishnan, 2014), and in other related studies, most participants were men (Harris, 2012; Hoffman et al., 2010; Knechtle, 2012; Ronto, 2021b). Nevertheless, more females are starting to compete. At least 23% women participated in an ultramarathon in 2018, compared to 14% women in 1996 (Ronto, 2021b). Nevertheless, there are still significant gender disparities in this sport. Not changing much since data captured in 1982 about ultrarunners being clustered heavily in the professional and business areas,

with 53% of 185 survey participants holding a college degree (Thompson & Nequin, 1983), ultrarunners typically have higher levels of education and work in white-collar professions (Hoffman & Fogard, 2012; Hoffman & Krishnan, 2014; Roebuck et al., 2018). Ultrarunning has become an organized sport since the 1970s, with considerable participation trends from individuals who are less prepared ultrarunners (Roebuck et al., 2018; Ronto, 2021b). In 2017, about 20% of ultramarathon finishers were first timers (Koop, n.d.). In addition, the majority of ultrarunners start their running feats on the roads, covering shorter distances before switching to trail running and ultramarathons (Watkins, 2017).

Connection to Natural Environments

Ultramarathon events routinely take place in natural outdoor environments (e.g., trails, mountains, streams, hills, valleys, beaches, and parks), which provide a salutogenic context that is fundamental for physical and mental health and subjective well-being (Coon et al., 2011; Martinez & Scott, 2016; Silva et al., 2018). Ultramarathon participants appreciate the power of nature that facilitates novel insights into the human nature complex including sport, people, and place (Cherrington et al., 2020). Atkinson (2010) described these outdoor excursions as when "a run is stripped of urban contexts, and as the person is immersed in mud, wind, rain, grass, rock, sweat and occasionally blood, an almost Zen-like state may follow" (p. 1262). The practice of running in natural environments has been portrayed as somewhat of an Ashtanga yoga meditative practice (Atkinson, 2010). In one ethnographic study, a participant shared his experience of

running a treadmill, lifting weights, and taking aerobic classes in a gym as a sterile, depressing, and meaningless environment (Atkinson, 2010).

Evidence showed that spending time in natural outdoor environments is linked with therapeutic value and salutogenic health, which is associated with subjective well-being (Dadvand & Nieuwenhuijsen, 2019; Thomsen et al., 2018; Van Den Berg et al., 2013; White et al., 2019). The more humans spend time in nature, the fewer mental health issues they experience (Cook, 2018). Distance running is a spiritual activity that benefits the mind, body, and soul (Shipway & Holloway, 2010; Simpson et al., 2014). Runners can balance physical challenges, landscapes, and the ability to manage their emotions (Cherrington et al., 2020; Hoffman & Krouse, 2018; Roebuck et al., 2018).

Atkinson (2010) described fell running (running on hills or mountains) in natural environments or scapelands as heterotopic experiences that are generally private rather than public and involve a person's physical imminence with the expansiveness of nature. Ultramarathons are a form of scapeland that can engage a person in a natural environment in the vast outdoors with a sense of one's raw physical connection to time and place with a presence of emptiness, fear, and uncertainty (Atkinson, 2010; Cherrington et al., 2020; Lyotard, 1989). A similar study indicated a prominent role and experience in the event environment, with participants describing vivid memories of the landscapes, scenery, and natural beauty of the outdoors (Simpson et al., 2014). In that study, a participant described her connection to the outdoors as one with mother nature, including the animals, smells, and sounds experienced in the event environment.

Empirical research consistently indicates that natural environments lead to higher levels of positive affect and life satisfaction. Ultrarunning environments are held in natural environments. Individuals who partake in ultrarunning events are exposed to natural environments. Exposure to natural environments benefits physical and mental well-being, improves subjective well-being and life satisfaction (McMahan, 2018; Pryor, 2022; Rogerson et al., 2015; White et al., 2019). Silva et al. (2018) described natural environments as critical for physical health, psychological functioning, social functioning, and subjective well-being, which decreases adverse health effects relating to chronic disease morbidity and mortality. Silva et al. also portrayed natural settings as outdoor areas in nature with beneficial features, such as green and blue spaces, which enhance overall health by reducing urban stresses (e.g., urban noise, pollution, and sedentary life) and encouraging green exercise and connectedness to nature. These studies on natural environments support the idea of the conceptual framework for the current study that the environment impacts the opportunity for exposure. Ultrarunning occurs in natural environments, influencing the host and the agent.

Social Connectedness

Social interaction is essential for overall well-being, according to historical perspectives. Maslow (1943) noted that having a sense of connection or belonging is central to human well-being. According to a similar viewpoint put forth by Baumeister and Leary (1995), the need for belonging, a sense of connection, and the lack thereof could cause various ill effects related to physical and mental well-being. Social connection is a pillar of lifestyle medicine, and the lack of it affects health, increasing

chances for higher morbidity and early mortality (Holt-Lunstad, 2022; Holt-Lunstad et al., 2017; Martino, 2017; Shor & Roelfs, 2015; Yelpaze et al., 2021). Further convincing evidence suggested that lack of connectedness contributes to poor cardiovascular outcomes (American Heart Association, 2022; Holt-Lunstad, 2022; Martino et al., 2017; Paul et al., 2021), a weakened immune system, anxiety, depression, and cognitive decline (Holt-Lunstad et al., 2015). The evidence showed that social interaction is important for well-being, and the lack of connectedness with others leads to worse health.

The COVID-19 pandemic decreased social connectedness with mandatory stay-at-home orders and social distancing to reduce the spread of the virus. The pandemic significantly impacted social connectedness, resulting in decreased life satisfaction and mental well-being (Dailey et al., 2022). However, more people ran outside during this time than before the pandemic started, based on data from 10 countries (Nielsen Sports, 2021). During the COVID-19 outbreak, more people ran outdoors at least once a week, with at least 4 in 10 people identifying as runners (Nielsen Sports, 2021). A similar study found an increase in weekly outdoor running by 55% to 117% among 12,913 respondents (Ronto, 2021a). As the COVID-19 pandemic posed shelter-at-home orders, many individuals experienced the benefits of running outdoors regarding improved physical and mental health (Rizzo, 2021b).

A sense of community and connectedness is evident based on available literature that includes running. A common theme in these studies is a relationship between running, community connectedness, and higher levels of psychological well-being and happiness (Batmyagmar et al., 2019; Cook, 2018; Cleland et al., 2019; Grunseit et al.,

Hindley, 2020; Keating et al., 2018; Morris & Scott, 2019; Stevinson & Hickson, 2014). There is a sense of comradery between runners participating in ultramarathons compared to those in other race environments (Cook, 2018; Johnson et al., 2016; Krouse et al., 2011; Quicke, 2017). In addition, social interactions and interpersonal relationships are common in ultrarunning events. During an event, an ultrarunner will encounter different social interactions with fellow racers, volunteers, medics, friends, family, and the general public, influencing social connectedness (Harman et al., 2019). These social interactions occur organically, without deliberately forming bonds with others, and increase esteem support, motivation, and communal coping during the ultramarathon event (Harman et al., 2019). A similar study found that the shared experience in an ultramarathon among participants is a motivator and feeling of inclusion within the community (Quicke, 2017).

Ultramarathon environments foster social interactions, and the natural outdoor setting also matters. One study illustrated that running on trails increased social activity and perceived wellness more than nontrail running (Smiley et al., 2020). Ultramarathons are routinely run on trails (Martinez & Scott, 2016), and the longer the trails, the higher the runners' self-rated wellness and health index (Smiley et al., 2020). The literature showed that ultramarathon environments foster social connection, which is linked to overall well-being and improved mental health.

Running Benefits

The physical benefits of running are numerous. A recent meta-analysis showed a 23%–30% reduction in cardiovascular, cancer, and all-cause mortality regardless of dose (Pedisic et al., 2020). Other studies have shown the physical benefits of running, such as

cardiovascular health and a lower risk of all-cause and cardiovascular disease mortality (Damrongthai et al., 2021; Hespanhol Junior et al., 2015; Lee et al., 2014; Pedisic et al., 2020; Pereira et al., 2021). Public health guidelines recommend 150 minutes of moderate-intensity physical activity or 75 minutes of vigorous activity for adults (Plateau et al., 2022). Running is an example of vigorous physical activity within those standards (Plateau et al., 2022). Available evidence showed that increasing participation rates in running could have a significant positive impact on the population's health and quality of life.

Running has become popular worldwide, with countries such as Australia and the United States experiencing the highest participation rates (Pedisic et al., 2020). In the United States, an estimated 3.7 million (8.5%) adults participate in running as a sport or recreational event (Pedisic et al., 2020). Running has been ranked among the top 10 preferred physical activities among 25-44 inactive US adults who participated in the 2017 Physical Activity Council survey (Pedisic et al., 2020). One study of 4,538 active adults who reported being active at the start of the 2020 COVID-19 pandemic demonstrated that 59.1% chose running outdoors to stay healthy, and 39.4% of gym-only members switched to running (Rizzo, 2021a). However, the mental health aspects of ultrarunning are also essential.

Mental Health Benefits

Psychological well-being, improved mood, and mental health are benefits of running, based on a comprehensive literature review on the relationship between running and mental health (Oswald et al., 2020). That same review indicated that different bouts

of running lengths and intensities and running interventions could enhance mental health. In 16 of 47 studies, runners had lower depression, anxiety, and stress levels and higher psychological well-being than sedentary (nonrunning) controls (Oswald et al., 2020). Nineteen of the studies found a positive association with higher self-identity, low levels of depression, and increased self-efficacy (Oswald et al., 2020). Additionally, there was cross-sectional evidence of a positive association between mental health outcomes and habitual or long-term recreational running compared to nonrunners (Oswald et al., 2020). A study with similar findings measured the effects of different types of running distances on overall health and well-being, including 89 half-marathons, 65 marathons/ultramarathons, and 91 10-kilometer runners (Wirnitzer et al., 2022). Results indicated that distance running was associated with increased levels of well-being (Wirnitzer et al., 2022). Comparable research indicated that running promotes a person's mental health and has been demonstrated to reduce the symptoms of anxiety and depression significantly (Coleman & Sebire, 2017; Dai et al., 2020; Grunseit et al., 2018; Keating et al., 2018; Morris & Scott, 2019; Mulvad et al., 2018; Oborny, 2016; Oswald et al., 2020).

Psychological well-being is a broad term to describe well-being, and the concept includes subjective well-being (Diener et al., 2017). Individuals with higher subjective well-being are prone to a more positive response, closer social ties, and less loneliness, increasing physical and mental health benefits (VanderWeele et al., 2012). A person's cognitive reflections on life represent a reflective evaluation and include feelings of various types, such as emotions and moods, which tie with mental health (Diener et al.,

2017). Moreover, running has shown mental health benefits through its connection to natural environments and social connectedness (Atkinson, 2010; Batmyagmar et al., 2019; Cherrington et al., 2020; Cook, 2018; Grunseit et al., 2018; Martinez & Scott, 2016; Silva et al., 2018).

Subjective Well-Being

Since the mid-1980s, the study of subjective well-being among adults has grown (Eid & Larson, 2008). Subjective well-being refers to the degree to which a person thinks or feels that their life is going well and is an evidence-based proxy for a broader measure of well-being (Diener et al., 2018; Nima et al., 2019). Diener originally used the term, subjective well-being, to refer to a component of happiness that can be empirically measured. Diener (1984, 2000) took a holistic approach to subjective well-being by dividing the construct into two components. The affective component is revealed in the frequency of positive and negative emotions (Diener, 1984, 2000). The cognitive component is exhibited in subjective evaluation of life overall (i.e., global life satisfaction) or personal satisfaction in one's own life (Diener, 1984, 2000). Subjective well-being can be measured in key life domains, including leisure, work, family, health, finances, self, and one's group (Diener et al., 1999; Kuykendall et al., 2015). Measures of subjective well-being were created to examine positive mental health regarding subjective positive feelings toward one's life (Diener & Emmons, 1984).

Leisure activities have shown the promotion of subjective well-being, decreased psychological stress, and improved overall health (Kuykendall et al., 2015; Newman et al., 2014; Ryan & Deci, 2000;). Kuykendall et al. (2015) posited that leisure activities

promote psychological well-being; as a result, higher levels of leisure engagement are associated with higher levels of subjective well-being. Participation in extreme sports, recreational running events, and ultramarathons is rising among amateur athletes and is identified as a leisure activity (Kazimierczak et al., 2020). Ultrarunning participants see these events as an emotional experience with authentic sensations that are mixed with a unique atmosphere of camaraderie and support (Cook, 2018; Kazimierczak et al., 2020). Regular uptake of leisure activities such as ultrarunning positively affects physical and mental health (Cook, 2018; Grunseit et al., 2018; Kazimierczak et al., 2020). Positive physical and mental health levels are linked to higher levels of subjective well-being (Iwon et al., 2021).

There is a positive impact between leisure engagement and subjective well-being. Researchers have examined the relationship between leisure or recreational physical engagements (i.e., running, physical activity, or sports) and subjective well-being with similar findings that routine uptake or participating in such activities leads to higher levels of subjective well-being (Cypryanska & Nezlek, 2019, Grunseit et al., 2018, Iwon et al., 2021; Kuykendall et al., 2017). In a related study, Iwon et al. (2021) studied 217 people who frequented gyms and fitness clubs in Warsaw, Poland and discovered a significant link between regular physical exercise and subjective well-being. One meta-analysis with comparable results showed a positive association between leisure engagement and subjective well-being (Kuykendall et al., 2015). Another study by Sato et al. (2014) reported that among 827 participants in running events, there was a strong correlation between physically active leisure and a common subjective well-being

indicator (i.e., overall life satisfaction). The evidence shows that running as a leisure engagement and is related to higher levels of subjective well-being.

Leisure activities such as running can play an integral role in promoting quality of life. Lee et al. (2014) found that running a minimum of 10 minutes per day and at a slow speed (< 6 mph) was associated with markedly reduced risks of death from all causes and cardiovascular disease. A Copenhagen City Heart Study found similar mortality benefits among 1,878 joggers, demonstrating that jogging was associated with significantly lower mortality than nonjogging (Schnohr et al., 2013). Subjective well-being is a protective factor for mortality and has been associated with a decreased risk (Lee & Singh, 2019; Martin-Maria et al., 2017).

The COVID-19 pandemic disproportionately affected mental health and decreased subjective well-being and life satisfaction among the U.S. population. Although subjective well-being is not equivalent to mental health, it is statistically related (Li et al., 2022). Marconcin et al. (2022) found that psychological distress increased among sedentary populations with decreased physical activity. Other evidence showed that nonsedentary populations with at least weekly physical activity levels were associated with increased psychological well-being (Marconcin et al., 2022). In a similar study, data based on 13,696 respondents in 18 countries illustrated that those who exercised almost daily during the pandemic had higher levels of subjective well-being (Brand et al., 2020). The evidence has shown that running as a form of exercise improved overall health, increasing subjective well-being (Grunseit et al., 2018; Kuykendall et al., 2015; Sato et al., 2015).

Life Satisfaction

Life satisfaction has become a measurable global evaluation since the mid-1980s. Diener et al. (1985) developed and validated the Satisfaction With Life Scale to measure global life satisfaction, a component of subjective well-being. This scale has been shown to correlate with mental health assessments, predict future behaviors, and examine the subjective quality of life of individuals based on specific life domains (Pavot & Diener, 2008). The global evaluation of one's quality of life is influenced by specific broad life domains such as family, friendship, work, leisure, and health (Nakamura et al., 2021; Pavot & Diener, 1993; Pavot & Diener, 2008; Sato & Funk, 2015). Another scholar, Veenhoven (1996), noted contributing factors to life satisfaction into four sequential categories or domains: life chances, course of events, flow of experience, and evaluation of life. Life satisfaction is a subjective evaluation of one's life expectations being met as a whole, without reference to any specific period of time or domain (Diener, 1984; Diener et al., 1985; Iwon et al., 2021). Early research has described life satisfaction as a cognitive aspect and key indicator that focuses on a person's judgments instead of a criterion evaluated by another (Diener, 1984; Diener et al., 1985; Iwon et al., 2021; Lombardo et al., 2018). Other scholars have recounted life satisfaction as a hallmark of subjective well-being (Grunseit et al., 2018; Iwon et al., 2021; Pavot & Diener, 2008; Sato et al., 2015). The next paragraph will provide two philosophies of life satisfaction.

Scholars have distinguished two different theories to life satisfaction. The top-down approach is a dispositional theory that holds that people are predisposed to be diversely content with their lives based on variations in personality and other stable

characteristics (Diener, 1996; Diener et al., 2003; Diener et al., 1999; Heller et al., 2004). The bottom-up approach, in contrast, is concerned with how settings, events, and situations influence life satisfaction over time, which is generated from a summation of positive and negative experiences (Diener et al., 1999; Heller et al., 2004). The bottom-up concept has been used in exploring life satisfaction with physically active leisure (Sato et al., 2014; Sato et al., 2016). Distance running may promote people's life satisfaction if participation provides an opportunity for enjoyment and can serve as a form of self-expression (Sato et al., 2016). A sample of 827 running participants showed that satisfaction with event participation and psychological involvement in running were significant predictors of participants' life satisfaction among 10 life domains (i.e., community, family, financial, intellectual, leisure, overall health, personal achievement, social life, spiritual life, and work life) (Sato et al., 2016). A similar study used the bottom-up theory of life satisfaction to examine the quality of life. Park et al. (2019) examined 1,676 long and short-distance runners. They found that event satisfaction was statistically significant with physical well-being, which had a significant relationship with the overall quality of life. However, the bottom-up theory of life satisfaction was partially supported, and the nature of the event may have influenced the results (Park et al.). Yet, evidence in the preceding paragraphs illustrates the relationship between life satisfaction and running events. The next section will discuss well-being initiatives, including life satisfaction as a measure of the quality of life among policymakers.

Life satisfaction has been used in current well-being initiatives. Policymakers have proposed the importance of evaluating potential health and well-being effects on life

satisfaction, including organizations such as the World Health Organization, the Organisation for Economic Co-operation and Development, and Healthy People 2030. The World Health Organization (2012; 2023) used life satisfaction as a subjective indicator of the quality of life, with a multidimensional concept that included a person's perception of health status, psycho-social status, and other facets of life for broader measures of well-being. The Organisation for Economic Co-operation and Development (2020) used a well-being framework that included key dimensions, including subjective well-being and life satisfaction, which measured how well people were, including quality of life. Healthy People 2030 measured the cumulative contributions of health and non-health factors to overall well-being, with life satisfaction as an indicator of wellness (ODPHP, n.d.-c). While life satisfaction and well-being are not synonymous, evidence shows that life satisfaction plays a critical role in overall health.

Evidence shows a relationship between life satisfaction, morbidity, and mortality measures. Lee & Singh (2020) examined the association between life satisfaction, US life expectancy, and all-cause mortality using 2001 to 2014 National Health Interview Survey data and found that adults with higher life satisfaction levels had significantly higher life expectancy and lower all-cause mortality risks than individuals with lower satisfaction levels. Steptoe (2019) reported that happiness, which relates to life satisfaction, at low levels is a potential contributor to disease risk. Steptoe posited that happiness encompasses several constructs, such as affective well-being, eudaimonic well-being, and evaluative well-being (life satisfaction) (Steptoe, 2019). However, a prospective study of 719,671 women with a median age of 59 in the UK found that poor health leads to

unhappiness (Liu et al., 2016). After adjusting for potential confounders, happiness and life satisfaction did not affect mortality directly (Liu et al.). Nevertheless, other evidence demonstrates that life satisfaction is reportedly associated with reduced mortality, mainly from heart disease (Baumann et al., 2015; Diener & Chan, 2011; Lee & Singh, 2020; Natt och Dag et al., 2022). Another study by Rosella et al. (2018) found that mortality and incident chronic disease (diabetes, cancer, congestive heart failure, and chronic obstructive pulmonary disease were associated with poor life satisfaction. Yet, as evidence shows the connection between life satisfaction and morbidity and mortality trends, there is also a link between mental health and life satisfaction.

Further evidence has posited that poor mental health is associated with poor life satisfaction. One study illustrated that improving mental health led to higher life satisfaction among individuals, ultimately improving societal well-being (Lombardo et al., 2018). Another study found that life satisfaction was an effective target for health policies that sought to improve indicators of psychosocial well-being and overall health outcomes (Kim et al., 2021). Supporting that finding, Sato (2014) completed a study to investigate how physically active leisure, in the form of a 10-mile distance run, can promote global life satisfaction and found that event participation contributed to global life satisfaction while promoting psychological involvement. Because of the potential benefits of running as a leisure activity and how it relates to life satisfaction, more scholars are studying mass participation in running events and its relation to subjective well-being and life satisfaction.

Among runners, higher subjective well-being measures as an indicator of overall life satisfaction have been empirically proven (Cypryanska & Nezlek, 2018; Glasgow Caledonian University, 2018; Grunseit et al., 2018; Oswald et al., 2020; Sato, 2014; Shipway, 2010). Inclusive running organizations such as "Couch to 5k," "Girls on the Run," "Parkrun," and "Bigger than the Trail" support running activities while promoting well-being, life satisfaction, and physical health through community connectedness, facilitating socialization, and reducing loneliness (Bigger than the Trail, 2022; Girls on the Run, 2022; Masters, 2014; National Health Service, n.d.; Royal College of General Practitioners, n.d.; Sifers & Shea, 2013). Consistent with the prior evidence, Park et al. (2019) found that running improved overall health by reducing stress and health problems and enhanced psychological benefits. That same study found that the overall quality of life, in which life satisfaction is a subjective indicator (Lopez-Ruiz et al., 2021), enhanced life satisfaction and the domains of physical health, psychological, social relationships, environment, and life.

The Gap in the Literature

The literature review shows that no known studies conducted in the United States to date, examine the relationship between ultrarunning status, subjective well-being, and life satisfaction. Grunseit et al. (2018) conducted a study among Parkrun runners participating in a 5-kilometer weekly run community-based event in Australia to examine adult runners' overall and domain-specific subjective well-being. They found that the personal well-being index was positively associated with perceived community

connection for men and mental health benefits for women. Overall, satisfaction with life was positively associated with perceived mental health benefits.

A similar study by Kuykendall et al. (2015) demonstrated that increasing leisure activity had a significant positive impact on subjective well-being. Further evidence specific to running was Sato et al.'s (2015) longitudinal study examining whether the distance running event could promote a person's life satisfaction and if the runner's attitude was impacted through event participation and subsequent activity over five months. Even among experienced runners with previously higher-than-average satisfaction, they discovered that taking part in a distance running event was linked to a short-term (one day after the event) rise in life satisfaction, with a subsequent decline lasting up to four months after the event. Similarly, a study conducted in the United Kingdom among 7,000 parkrunners found that most Parkrun participants described themselves as non-runners before signing up for a Parkrun event and reported benefits of perceived well-being and a sense of community (Stevinson & Hickson, 2014). Relating to the latter, a common theme in the literature review is a relationship between running, community connectedness, and higher levels of psychological well-being (Batmyagmar et al., 2019; Cook, 2018; Cleland et al., 2019; Grunseit et al., Hindley, 2020; Keating et al., 2018; Morris & Scott, 2019; Stevinson & Hickson, 2014). Another common theme was the connection to natural environments, where ultrarunning events routinely take place. The literature review illustrated a salutogenic context that was fundamental for physical and mental health and subjective well-being (Coon et al., 2011; Dadvand &

Nieuwenhuijsen, 2019; Martinez & Scott, 2016; Silva et al., 2018; Thomsen et al., 2018; Van Den Berg et al., 2013; White et al., 2019).

Although multiple studies have been conducted, including a scoping review, research has not been conducted on the relationship between ultrarunning status, subjective well-being, and life satisfaction among adult runners in the United States. There is also no available research that uses the advanced triangle of epidemiology framework with ultrarunning status, subjective well-being, and life satisfaction. This study seeks to fill this gap by providing current evidence on ultrarunning as it relates to subjective well-being and life satisfaction. This study will therefore add to the literature and thereby filling the knowledge gap on the relationship between ultrarunning status, subjective well-being, and life satisfaction among adult runners in the United States.

Summary and Conclusions

The mental health benefits of ultrarunning are not well-understood in the current literature. A dearth of studies examined the impact of ultrarunning on mental health, and available literature is focused mainly on the physical and physiological aspects of ultrarunning but has relied predominantly on qualitative inquiry. Two common indicators of mental health are subjective well-being and life satisfaction. Nevertheless, this literature review illustrates that no current studies conducted in the United States examine the relationship between ultrarunning status, subjective well-being, and life satisfaction. This study used the advanced triangle of epidemiology framework to examine the relationship between the independent and dependent variables. This current study adopted a descriptive cross-sectional study design where data is collected from

participants using a structured questionnaire at a point in time. Findings from this study added to the literature and bridge the knowledge gap. The information revealed within this study has implications for social change by helping public health officials create initiatives that improve mental health through community programs, leisure engagements, research, and policy. In conclusion, Chapter 2 provided an overview of the advanced triangle of epidemiology as the conceptual framework for this study. Also, peer-reviewed literature was used to get an understanding of the topic and identify the gap in the literature. Chapter 3 will include the research design and rationale, methodology, data analysis plan, threats to validity, and summary.

Chapter 3: Research Method

The purpose of this quantitative cross-sectional study was to examine the relationship between ultrarunning status, subjective well-being, and life satisfaction among adult runners in the United States. Chapter 3 presents an overview of the study methodology. The definition of the cross-sectional research design and the rationale for its use is presented, followed by information on the study sample, inclusive of the sampling plan and sample size calculations, and the recruitment and data collection processes. After a review of the instrumentation and operationalization of study variables, the data analysis plan and threats to validity are summarized. A summary concludes Chapter 3.

Research Design and Rationale

A quantitative cross-sectional design is the best approach to address the study purpose, which is whether there are significant relationships among ultrarunning status, subjective well-being, and life satisfaction, controlling for pertinent participant demographics (i.e., age, sex, income level, educational level). In cross-sectional studies, all data are collected at the same time; the design offers a data snapshot of relevant epidemiological information “in a single moment” (Zangirolami-Raimundo et al., 2018, p. 356). The cross-sectional design is used in epidemiological studies for either descriptive purposes – to provide estimates of prevalence of health behaviors and diseases – or for analytical reasons, to determine if significant relationships exist between two or more health variables (Setia, 2016; Zangirolami-Raimundo et al., 2018). In this study, a cross-sectional design was employed for analytical purposes. While cross-

sectional studies can be used for analytical purposes, they can only provide information specific to a single period of observation and causality cannot be determined in cross-sectional studies. The cross-sectional design is one of the most commonly utilized methodological approaches in epidemiology due to its many advantages: data are collected and analyzed in a short period of time without the need for follow-up with participants "to produce faster results…at a lower cost" (Zangirolami-Raimundo et al., 2018, p.357).

The data collection was guided by research questions. The independent variable is ultrarunning status, while the dependent variables of the study are subjective well-being and life satisfaction. The covariables of the study are demographic characteristics of the target population, including sex, age, race/ethnicity, education level, and income level. The following research questions are addressed in this study:

RQ1: Is there an association between ultrarunning status and subjective well-being among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level)?

$H_0$1: There is no statistically significant association between ultrarunning status and subjective well-being among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level).

H_A1: There is a statistically significant association between ultrarunning status and subjective well-being among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level).

RQ2: Is there an association between ultrarunning status and life satisfaction among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level)?

$H_0$2: There is no statistically significant association between ultrarunning status and life satisfaction among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level).

H_A2: There is a statistically significant association between ultrarunning status and life satisfaction among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity; education level, and income level).

To gather and analyze primary data related to the independent and dependent variables, a quantitative cross-sectional study design was the best option for addressing the research problem. Deductive quantitative research designs use questionnaires or surveys in non-experimental methods to collect numerical data from a subset of research participants (Creswell, 2009). A quantitative study design is chosen due to its potential to provide information on the relationship between ultrarunning status, subjective well-being, and life satisfaction. A questionnaire survey is proposed to collect data from a convenience sample of participants who self-identify as adult runners in the United States.

Methodology

Population

The target population sought for this study is runners, both men and women, age 18 and older, who self-identify as an ultrarunner or runner in the United States. While age

and gender are known characteristics, classifying an ultrarunner or runner is a subjectively expressed response through the self-reported questionnaire in this study. Evidence surrounding this population defines running as purely recreational, for leisure, and with or without a competitive component (Pereira et al., 2021). Most recreational runners report putting in a lot of training time, running regularly for distances longer than 5 kilometers, and doing so all year round (Pereira et al., 2021). Yet, all runners differ based on the length and time of the run and how often it is completed (Scheerder et al., 2015).

In this study, individuals are designated as an ultrarunner, or runner based on a self-reported response. The criteria set for participation in this study are in accordance with operational definitions of "runners" or "ultrarunners" (Kakouris et al., 2021; Kemler et al., 2018; Kluitenberg et al., 2015). Study participants must indicate the following:

a) identify as "runners," for example, have been running for at least one year recreationally or non-competitively in any distance under the marathon; or
b) identify as "ultrarunners," for example, have completed one or more race longer than the marathon in the past year.

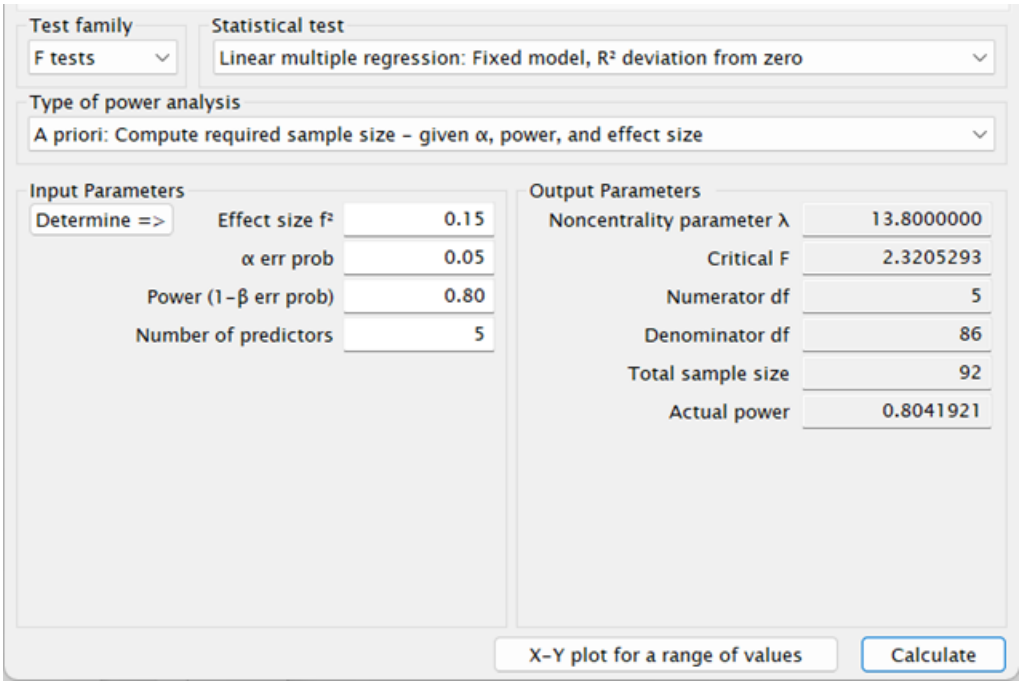
Participants can include trail or cross-country runners, middle- or long-distance runners, and marathon runners; however, approximately 50% of the sample must be ultrarunners, that is, they must have run an ultramarathon (i.e., 50 km or 31 miles or more) within the past year. Exclusion criteria include anyone under the age of 18 years or residing outside of the United States and not meeting the inclusion criteria. Appendix C contains the participant eligibility questions.

Sample Size Calculation

A priori power analysis using G*Power for hierarchical multiple linear regressions (HMLR) was conducted to determine the sample size needed to achieve adequate power. G*Power was used to determine the appropriate sample size for the study (Kang, 2021). The effect size was set to medium, $f2 = 0.15$, and the alpha (α) or probability of Type I error of 0.05 was set. Type II errors with specific power values of less than 80% are risky (Cohen, 1992). Therefore, the power was set to 80% to estimate the required sample size and avoid a type II error. The number of tested predictors was set to 1 (i.e., the independent variable of ultrarunning status), and the total number of predictors was set to 5 (i.e., the independent variable of ultrarunning status, and the five covariates of sex, age, race/ethnicity educational level, and income level). The total sample size needed for one hierarchical multiple linear regression to achieve adequate power of 80% was 92 (see Figure 5). As two hierarchical multiple linear regression analyses were conducted for hypothesis testing, the sample size doubled to 184. To minimize the risks that may occur with missing or incomplete data, which may occur with a smaller sample size, a 15% contingency factor of 28 participants was added. The sample size sought was 212 subjects (i.e., 184 original sample + 28 contingency sample).

Figure 5

*A Priori Sample Size Power Analysis for HMLR using G*Power*



Recruitment

Participants were recruited by contacting running and ultramarathon clubs (e.g., UltraSignUp, UltraRunning Groups, RunSignup, Road Runners Club of America, RunRepeat, iRunFar, and Ultrarunning Online Magazine) to ask permission to post the study information and online survey link on their website, or to obtain a member's list to email members directly. The plan to obtain a member's list to email members directly was not required, as the needed sample of 212 participants was exceedingly met via the Survey Monkey recruitment panel and participating ultrarunning groups. Thus, the initial plan for direct contact via email to individuals who met the criteria set for participation in accordance with the operational definitions of runners or ultrarunners was not necessary. In addition, the initial plan for any contact made with participants via email to be done

twice, with the second email sent within 72 hours (after three days) of the first email being sent to ensure the highest possible participation rate for the study (Zong, 2023) was not needed.

I used the Survey Monkey online recruitment panel services to obtain study participants and collect study data. In online survey-based research, a representative subset of participants completes online survey questions at their convenience when the respondent can focus on the questions being asked and within the comfort of their own home (Gaur et al., 2020; Miller et al., 2020). Survey Monkey is a safe and simple online panel service that recruited participants and collected high-quality data in accordance with ethical guidelines for research with human subjects and in a timely fashion (Edwards et al., 2019). Due to their low cost, convenience of use, and easier access to targeted populations, Survey Monkey was an excellent resource for this study to create, test, and distribute surveys online (Gaur et al., 2020; Miller et al., 2020).

These recruitment methods resulted in an adequate sample size of more than 212 participants, with a final sample of 369. The runners chose to participate in the study by clicking on the study link posted on the running club website. The online survey opened to the eligibility questions and the informed consent form, and runners must select “Yes,” they consent, to move on to the online survey questions; those who selected “No,” they do not consent, were directed out of the survey site. Also, participants who did not meet the eligibility questions were directed out of the survey. The online survey for the study was relatively short, taking participants less than 10 minutes to complete. The participant

recruitment invitation is available in Appendix A, and the participant eligibility questions in Appendix C. Appendix G contains a copy of the exit page.

The online survey included questions concerning the independent variable and covariates, and it contained the two instruments assessing the dependent variables. The participants were to provide a response to the independent variable question, "Have you run in an ultramarathon (50 km or 31 miles or more) in the past year?" The response choices were 1 = yes (ultrarunner) and 0 = no (regular runner). The participants then answered the covariate questions that pertained to their sex, age, race/ethnicity, education level, and income level. Next, the participants could answer the 14 items on the WEMWBS, used to assess the dependent variable of subjective well-being. They then could respond to the five items contained in the SWLS, a measure of life satisfaction, the second dependent variable. Lastly, any survey respondents from the study that failed to complete all necessary sections of the survey for analysis were excluded.

Instrumentation

To assess the dependent variable of subjective well-being, the Warwick Edinburgh Mental Well-Being Scale (WEMWBS) was employed. The dependent variable of life satisfaction was assessed with the Satisfaction with Life Survey (SWLS). These instruments were supplemented by additional questions to obtain general demographic data on participants' sex, age, race/ethnicity, education level, and income level. In this study, participants completed the runner status question and demographic questions first, proceeded by the WEMWBS and SWLS. The original survey instruments

are discussed further in the following sections, and versions of the original instruments are available in Appendix D, E, and F.

Warwick Edinburgh Mental Well-Being Scale

Participants subjective well-being was assessed using the WEMWBS survey. The WEMWBS survey was developed by Tennant et al. (2007) and included a scale of 14 statements, covering an extensive concept of subjective well-being and psychological functioning. The aim of developing this survey arose from the discipline of public health in the United Kingdom. The United Kingdom's public health field was upheld by the quantitative science of epidemiology and needed more precise measures of public mental health (Stewart-Brown, 2021). Subsequently, the WEMWBS was developed by Tennant et al. (2007) to measure public mental well-being quantitatively at the community level and has been extensively used since its development across 50 different countries worldwide (Stewart-Brown, 2021). Each month, around 350 licenses for using the WEMWBS are issued and used in 36 different languages (Stewart-Brown, 2021).

The WEMWBS is a 14-item self-reported measure of mental well-being. The WEMWBS items are all worded positively to cover functioning facets of mental well-being (e.g., feeling useful and confident) experienced in the past two weeks (Warwick Medical School, 2020). The 14 items that comprise the WEMWBS are Likert scored using ordinal scoring from 1 = *none of the time* to 5 = *all of the time.* The WEMWBS scale score is derived by summing the scores on the 14 items; the scores on the WEMWBS can range from 14 to 70, with higher scores indicating higher levels of mental well-being (Tennant et al., 2007; Warwick Medical School, 2020; Zurawik, 2020). The

WEMWBS is interval scored: it is a summed score of the 14 item responses, and the scoring (i.e., 14 to 70 points) no longer corresponds to the Likert scale of the items. As stated by Harper (2015), “by taking the sum or arithmetic mean of the responses to a set of items, the scales [become] interval” (p.839).

The WEMWBS is available in various languages, free of charge, and can be downloaded from the developer’s website after the researcher registers for copyright purposes on the website (Warwick Medical School, 2020). The WEMWBS is validated for use by those aged 16 and older (Stewart-Brown & Janmohamed, 2008). Two different versions of the WEMWBS exist—a short version (7 of the 14 statements that focus mainly on functioning than feelings) and a longer, more detailed version (Blodgett et al., 2022; Stewart-Brown, 2021; Warwick Medical School, 2020).

The WEMWBS was appropriate for my study because it has been used extensively among various public health groups, policymakers, and well-being and health promotion programs (Blodgett et al., 2022; Shah et al., 2018; Stewart-Brown, 2021; Stewart-Brown et al., 2015). Research from a rapid systematic review of 223 interventions evaluated with the WEMWBS survey showed strong evidence that a broad range of interventions, programs, and pilots to improve patient and population well-being that used this survey was effective (Blodgett et al., 2022). The survey is widely used in large publicly available government assessments and cohort studies and is validated in clinical and non-clinical populations (Bell et al., 2019; Stewart-Brown et al., 2011). Similar results show that the WEMWBS has been widely adopted across various societal sectors and has been especially useful in the context of public health (Stewart-Brown et

al., 2021). The WEMWBS has shown that internal consistency and stability over time are good (Cronbach's alpha = 0.913), suggesting the scale is a reliable instrument for measuring mental well-being (Zurawik, 2020). In addition, The WEMWBS showed high correlations with other mental health and well-being scales, and test-retest reliability was high (0.83) (Tennant et al., 2007). Social desirability bias was measured lower than on similar or comparable scales (Tennant et al., 2007). To use this survey, I registered for the free copyright non-commercial license on the link provided on Warwick Medical School's website. Appendix H contains the notification message to the WEMWBS authors acknowledging its usage. A non-commercial license was granted to use the WEMWBS (see Appendix L).

Satisfaction With Life Scale

The dependent variable of life satisfaction was assessed using the Satisfaction With Life Scale (SWLS), presented in Appendix F. The SWLS was developed by Diener et al. (1985) in response to the need for a measure that captured the affective (i.e., emotional) and judgmental (i.e., cognitive) components of life satisfaction. Diener et al., (1985) initially created the SWLS as a 48-item tool with three factors: life satisfaction, positive affect, and negative affect. Exploratory factor analysis revealed that 38 of the 48 items had factor loadings under .60, denoting little magnitude and association to the underlying construct of life satisfaction; these items were removed, resulting in 10 items (Diener et al., 1985). Five of the 10 items had "high semantic similarity" relating to life satisfaction and included wording redundancies with no effect on reliability; thus, the SWLS was reduced to is final five items (Diener et al., 1985).

The SWLS is a five-item scale that captures emotional and judgmental elements of life satisfaction. The SWLS items have response category Likert scoring (i.e., 1 = *strongly disagree* to 7 = *strongly agree*), and scores on the seven SWLS items are summed to derive the SWLS scale score. SWLS scores can range from 5 to 35, with higher scores denoting higher satisfaction levels with life. The SWLS scale scores do not correspond to the Likert scoring of the items; the scores can vary from 5 to 35 points. According to Boone and Boone (2012), when scale scores are computed by summing the scores on Likert items, the scale scores "should be analyzed at the interval measurement scale" (p. 4).

The SWLS was appropriate for my study to assess life satisfaction because it measured one component of subjective well-being, the global cognitive evaluation of life satisfaction (Diener et al., 1997; Pavot & Diener, 2008). The SWLS correlates with measures of mental health and can be predictive of future behaviors or emotional well-being (Pavot & Diener, 2008). The SWLS has favorable psychometric properties, high internal consistency, and high reliability (Diener et al., 1985). According to Field (2013), a value of 0.7 to 0.8 is an acceptable level for Cronbach's alphas. Some SWLS studies have shown high internal consistency, as indicated by Cronbach's alphas, ranging between 0.79 and 0.89 (Pavot & Diener, 1993). In one study examining SWLS and physical activity, internal consistency was greater than 0.70 (Rodrigues et al., 2023) and 0.81 in another study using the SWLS among runners (Martinez & Scott, 2016). The scale is found to have a good test-retest correlation measure (0.84 and 0.80 over a month interval; 0.54 over a 4-year span) (Pavot & Diener, 2008). SWLS scores correlate

moderately to high with other measures of subjective well-being (Diener et al., 1985). It is suited for different age groups. The SWLS is copyrighted but in the public domain and free to use without permission as long as the author of the measure is acknowledged (Smiley, 2009).

Operationalization

This study has one independent variable, which is ultrarunning status. There are two dependent variables, satisfaction with life and subjective well-being. Each variable is defined with its operational intent and role in the study.

Independent Variable: Ultrarunning Status. The independent variables of ultrarunning status, a nominal variable, was defined in accordance with the operational definitions of runners and ultrarunners presented in the literature (Kakouris et al., 2021; Kemler et al., 2018; Kluitenberg et al., 2015). The runner was defined as someone who has been running for at least one year recreationally or non-competitively or competitively in any distance under the marathon. In contrast, the ultrarunner was defined as someone who has competed in one or more races longer than the marathon in the past year. As such, ultrarunning status was operationalized based on whether the individual competed in at least one ultramarathon in the past year. Participants were asked the question, “Have you run in an ultramarathon (50k or 31 miles or more) in the past year?” The status groups were coded as 1 = yes, an ultrarunner or 0 = no, a regular runner.

Dependent Variable 1: Subjective Well-Being. The dependent variable of subjective well-being were assessed using the WEMWBS. Developed by Tennant et al. (2007), the WEMWBS is an assessment of perceived emotional and cognitive well-being,

psychological functioning, and overall life enjoyment. The WEMWBS is interval scored: the scores on the WEMWBS can range from 14 to 70, with higher scores indicating higher levels of subjective well-being (Tennant et al., 2007).

Dependent Variable 2: Satisfaction with Life. The dependent variable of satisfaction with life was assessed using the SWLS. The SWLS captures emotional and judgmental elements of life satisfaction. The scoring for the SWLS is interval: scores can range from 5 to 35, with higher scores denoting higher levels of satisfaction with life (Pavot & Diener, 2008).

In addition to the study's one independent variable and two dependent variables, there are five covariates that were examined in this study. The covariates are participants' sex, age, race/ethnicity, education level, and income level. The study variables, definitions, level of measurement, and associated instrument or questions are presented in Table 1.

Table 1

List of Variables

Variable	Variable Construct	Definition	Level of Measurement	Instrument
Independent Variable	Ultrarunning status	Running status (i.e., regular runner versus ultrarunner) as determined by competing in at least one race longer than the marathon in the past year	Nominal: 0=regular runner 1=ultrarunner	"Have you run in an ultramarathon (50k or 31 miles or more) in the past year?"
Dependent Variable	Subjective well-being	Perceived emotional and cognitive well-being, psychological functioning, and overall life enjoyment	Interval: WEMWBS scores can range from 14 to 70 points	WEMWBS (Warwick Medical School, 2020)
Dependent Variable	Satisfaction with Life	Perceived happiness with life, both emotionally and cognitively	Interval: SWLS scores can range from 5 to 35 points	SWLS (Diener et al., 1985)
Covariate	Sex	The biological sex of the participant	Nominal 1=male 2=female 3=prefer not to answer 4=other	"What is your sex?"
Covariate	Age	The age of the participant	Nominal 1=18 to 40 years 2=41 years or older	"What is your age?"
Covariate	Race/Ethnicity	The race/ethnicity of the participant	Nominal 1=Hispanic 2=Black 3=White 4=Other	"What is your race/ethnicity?
Covariate	Income level	The income level of the participant	Nominal 1=less than $50,000 2=more than $50,000	"What is your income level?"
Covariate	Highest level of education	The highest level of education of the participant	Ordinal 1=less than high school 2=high school diploma 3=undergraduate degree 4=graduate degree or higher	"What is you level of education?"

Data Analysis Plan

IBM © SPSS © Statistics Version 28 was used for the data analysis. The data was collected from the survey responses, exported, and downloaded from SurveyMonkey through the procurement of advanced services into a password-protected laptop, to which only SurveyMonkey and I had access. The data was screened and organized using the inclusion criteria. Using the SPSS software, appropriate variables were chosen and converted into identifiable codes. See Table 1 for a list of assigned coding to the variables.

The data analysis plan was used to set up the data to answer the research questions and the related alternative and null hypotheses. The research questions are as follows:

RQ1: Is there an association between ultrarunning status and subjective well-being among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level)?

RQ2: Is there an association between ultrarunning status and life satisfaction among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level)?

In this study, the independent variable, or predictor variable, was nominal (i.e., 1 = ultrarunner, 0 = runner). Whereas the dependent variables, or criterion variables, are subjective well-being and life satisfaction, measured using scales considered interval. Two HMLRs were conducted to answer the two research questions. An HMLR was conducted to examine the direction and strength of the relationships between variables

while controlling for the shared variance of other variables (Field, 2013). For an HMLR, the independent or predictor variable (and covariates) can be nominal or ordinal (in which case dummy coding is used) or interval or ratio, but the dependent or criterion variable must be interval or ratio (Field, 2013). There is often confusion between Likert-score questions that comprise a scale and the scale composite score because the question scores are summed to derive the composite scale score; they "are analyzed at the interval measurement level" (Boone & Boone, 2012, p. 1). As the Warwick Edinburgh Mental Well-Being Scale scores range from 14 to 70 and the possible range of scores for the Satisfaction With Life Scale is 5 to 35, the scores on these two instruments are considered intervals. As such, HMLR is an appropriate statistic to test study hypotheses. See the steps below that are planned for the data analysis.

Steps in the Data Analysis Plan

1. Downloaded, cleaned, and organized the data.
    a. Checked for and adjusted any entry errors.
    b. Checked for missing variables (e.g., Little's MCAR test) and removed cases or replaced missing variables using imputation.
    c. Computed Cronbach's alpha for WEMWBS and SWLS to determined inter-item reliability.
    d. Computed WEMWBS and SWLS composite variable scores (i.e., sum items and divided by the number of items in the scale).
2. Tested for HMLR assumptions

a. No significant outliers: Computed Mahalanobis distance values to identify multivariate cases (participants) and removed any outliers.
b. Variable normality: conducted normal Q-Q plots; identified and winsorized (i.e., replaced with the next lowest or highest value; Field, 2013) univariate outliers if the normality assumption was violated.
c. Linearity and homoscedasticity: computed P-P plots and scatterplots of predicted versus actual residuals; HMLR is generally robust against a violation of the linearity and homoscedasticity assumptions (Field, 2013), but if severe, the dependent variables were transformed using recommended techniques (Field, 2013).

3. Calculated descriptive statistics.
    a. The independent variable and covariates were nominal, dummy coded (e.g., Ultrarunner status: 1 = ultrarunner; 0 = runner; Age: 1 = 18 to 40 years; 2 = 41 years or older; Sex: 1 = male; 2 = female; 3 = prefer not to answer; 4 = other; Race/Ethnicity: 1 = Hispanic; 2 = Black; 3 = White; 4 = Other; Income level: 1 = less than $50,000 annual household income; 2 = more than $50,000 annual household income) and as such, frequencies and percentages were reported for these variables.
    b. The covariate of education level were ordinal, dummy coded (e.g., 1 = less than high school; 2 = high school diploma; 3 = undergraduate

degree; 4 = graduate degree or above), and frequencies and percentages were reported for this variable.

c. The dependent variables of subjective well-being, measured using the WEMWBS, and life satisfaction, assessed using the SWLS, are intervals. As such, the mean, median, standard deviation, and minimum and maximum scores were reported.

4. Conducted HMLRs for hypothesis testing.
    a. The dummy coded covariates were entered together on the first model (or step) of the HMLR, followed by the independent, or predictor, variable on the second model (or step).
    b. Reported model *F* and associated *p*-value for overall model significance and R^2 for model effect size
    c. Reported standardized beta weight (β) and associated *p* values for the relationship between the independent variable (and covariates) and dependent variables.

Threats to Validity

Validity describes how well a method measures what it is meant to measure (Creswell, 2009; Patino & Ferreira, 2018). There are two domains of validity for a research study: internal and external validity. Internal validity is the degree to which the observed results accurately reflect the population that is being studied (Creswell, 2009; Patino & Ferreira, 2018). External validity is the degree to which the results of the study

can be generalized to the population it should represent (Creswell, 2009; Patino & Ferreira, 2018).

For this study, instrumentation was selected that included sound content validity, a Cronbach's alpha score of 0.89 in a 354-student sample, and 0.91 in a 2,075-population sample (Tennant et al., 2007). When the WEMWBS was tested by Tennant et al. (2007), it showed high correlations with other scales measuring overall health, with a distribution near normal and not sowing ceiling effects in the population sample, guaranteeing criterion validity. Test-retest reliability was high (0.83) in one week, and social desirability bias was lower than other comparable scales (Tennant et al., 2077). The SWLS was chosen due to its good internal consistency with an alpha of 0.87 and solid test-retest reliability with a correlation of 0.82 across a two-month period (Magyar-Moe, 2009). The SWLS has shown good internal consistency and construct validity across different studies (Lopez-Ortega et al., 2016). Thus, a formidable attempt to minimize any instrumentation threat to internal validity was chosen based on the selection of scales for this study.

Even though study participants are sought based on specific inclusion criteria, it is possible that they may provide unreliable answers to the questions, which might affect the survey's statistics. It is anticipated that study participants are truthful in their responses. Generalization is only possible when the available population is sampled using a probability sampling technique (Creswell, 2009). Because convenience sampling was used in this study, its use threatens the study's external validity and constrains the generalizability of its findings to the target group.

Ethical Procedures

Institutional Review Board (IRB) approval was obtained prior to the commencement of any recruitment, data collection, and analysis (approval number 09-08-23-0757409; see Appendix K). Permission from running and ultramarathon clubs was completed before the introduction of the survey to ensure adequate sampling for this study. To guarantee participant understanding and awareness of the study before participating, informed consent was provided for any participant meeting the inclusion criteria with no harm predicted. In addition, any participant wishing to withdraw from the study could do so without any consequence. The data collected from this study was through Survey Monkey with exporting of the data to a password-protected laptop. Only the principal investigator and Walden University staff involved in the study had access to the data on a need-to-know basis. The data also did not include personally identifiable information about the survey participants but was still respectfully kept in a confidential manner. Lastly, my involvement in the research or attainment of its findings were not conflicted in any way, personally or professionally.

Summary

The purpose of this quantitative cross-sectional study was to examine the relationship between ultrarunning status, subjective well-being, and life satisfaction among adult runners in the United States. The cross-sectional design was used for the data collection and recruitment of participants via a convenience sampling design and analyzed with IBM © SPSS © Statistics Version 28. The WEMWBS was employed to measure the subjective well-being of participants, and the SWLS was used to measure

life satisfaction. Data collection included additional questions to obtain demographic characteristics of the participants and inclusion criteria questions. Survey Monkey was used to collect a minimum of 212 participants. Statistical techniques were employed to analyze the collected data. Lastly, threats to validity and ethical considerations were presented. The results and findings of this study are presented in Chapter 4.

Chapter 4: Results

Introduction

The purpose of this quantitative cross-sectional study was to examine the relationship between ultrarunning status, subjective well-being, and life satisfaction among adult runners in the United States. This study addressed the gap in the empirical literature regarding possible association between the variables. It advanced the understanding of the mental health aspects of running in terms of personal well-being. The following research questions and hypotheses guided this study:

Research Question 1: Is there an association between ultrarunning status and subjective well-being among participants, adjusted for demographic characteristics (i.e., sex, age, race, ethnicity, education level, and income level)?

H01: There is no statistically significant association between ultrarunning status and subjective well-being among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level).

HA1: There is a statistically significant association between ultrarunning status and subjective well-being among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level).

Research Question 2: Is there an association between ultrarunning status and life satisfaction among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level)?

H02: There is no statistically significant association between ultrarunning status and life satisfaction among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level).

HA2: There is a statistically significant association between ultrarunning status and life satisfaction among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level).

Along with answering the research questions, the specific aim of this research study was to examine the relationship between ultrarunning status, subjective well-being, and life satisfaction. The primary independent variable examined was ultrarunning status, a nominal variable, and was defined in accordance with the operational definitions of runners and ultrarunners presented in the literature (Kakouris et al., 2021; Kemler et al., 2018; Kluitenberg et al., 2015). A participant who has run any distance under the marathon for at least a year, whether recreationally, non-competitively, or competitively, was considered a runner. On the other hand, an ultrarunner is a participant who has participated in one or more races longer than a marathon during the previous year. As a result, ultrarunning status was operationalized based on whether the participant competed in at least one ultramarathon in the past year. Participants were asked, “Have you run in an ultramarathon (50k or 31 miles or more) in the past year?” The status groups were coded as 1 = yes, an ultrarunner, or 0 = no, a runner.

The primary dependent variables examined were subjective well-being and life satisfaction; both were interval-scored. Subjective well-being was measured using the Warwick Edinburgh Mental Well-being Scale (WEMWBS). The WEMWBS was

developed by Tennant et al. (2007) and assesses perceived emotional and cognitive well-being, psychological functioning, and overall life enjoyment of respondents. The instrument is interval scored with a range from 14 to 70, with higher scores indicating higher levels of subjective well-being (Tennant et al., 2007). Life satisfaction was measured using the Satisfaction with Life Scale (SWLS). The SWLS, developed by Diener et al. (1985), measures the global cognitive evaluation of life satisfaction, one component of subjective well-being (Diener et al., 1997; Pavot & Diener, 2008). The SWLS is interval scored with a range from 5 to 35, with higher scores denoting higher satisfaction levels with life.

Data Collection

The following sections include a description of the approval and consent to proceed, instrumentation, and the population and sample size attainment. The data collection and analysis plan were reviewed in Chapter 3. This research study was conducted in accordance with the intended plan.

Approval and Consent

Approval to conduct the study was granted before any data collection was initiated, and compliance with university procedures was maintained. IRB approval from Walden University was permitted and granted on September 8, 2023 (09-08-23-0757409; see Appendix K). The IRB consent permitted the use of an approved anonymous survey to collect primary data. A non-commercial license was granted to use the WEMWBS (see Appendix L). The SWLS is copyrighted but in the public domain and free to use without permission if the author is acknowledged. Furthermore, to protect the anonymity and

confidentiality of the respondents, participants' consent was obtained through implied consent processes. This option was made available via the SurveyMonkey survey link following eligibility verification.

Instrumentation

Primary data for this study were collected using Survey Monkey recruitment services. Within the Survey Monkey online portal, a web-based survey was developed following the instrumentation plans in Chapter 3. The survey was open for one month and posted via the Survey Monkey online panel services, which recruited participants and collected survey data. In addition, a web link was created for the same survey and shared with various running groups. A total of 12 questions addressed eligibility, consent, covariates (i.e., sex, age, race/ethnicity, education level, and income level), the independent variable of ultrarunning status, and the two instruments (i.e., WEMWBS, SWLS) that assessed the dependent variables of subjective well-being and life satisfaction. Question 11 included the 14 items on the WEMWBS that assessed the dependent variable of subjective well-being. Question 12 included the five items contained in the SWLS that measured life satisfaction. The use of the original WEMWBS survey was retained to ensure consistent reliability and validity (Tennant et al., 2007; Zurawik, 2020), as well as the SWLS (Diener et al., 1985; Pavot & Diener, 1993). The study instruments had sound inter-item reliability: Cronbach's alpha for the WEMWBS was $\alpha = .93$, and the SWLS had Cronbach's alpha of $\alpha = .89$.

The intended sample size of 212 was met and included a final total of 369 participants that provided usable data. The data met the assumptions for hierarchical

multiple linear regression (HMLR). HMLR was the analysis used for hypothesis testing. There were no changes needed to the planned collection and analysis of data.

Population and Sample Size

The study population consisted of adult runners (≥18 years) in the United States. The criteria set for participation in the study were in accordance with operational definitions of running status (Kakouris et al., 2021; Kemler et al., 2018; Kluitenberg et al., 2015). Participants were classified as either (a) "runners," that is, those who have been running for at least one year recreationally or non-competitively in any distance under the marathon, or (b) "ultrarunners," that is, those who have completed one or more race longer than the marathon in the past year (Kakouris et al., 2021; Kemler et al., 2018; Kluitenberg et al., 2015).

As described in Chapter 3, the minimum sample size necessary to achieve an adequate power of 80% for one HMLR was 92. As two HMLRs were required for hypothesis testing, the sample size was doubled to 184, and a 15% contingency sample of 28 was added (e.g., for possible attrition or missing data), resulting in a sought sample size of N = 212. The comparative element of the study required that at least half of the sample was comprised of ultrarunners (i.e., n = 106), and the other half as runners (i.e., n = 106).

The sampling technique used was convenience sampling, with participants recruited using the Survey Monkey recruitment panel services. Convenience sampling was preferred as it increased access to the sample of runners, and a higher number of runners had an increased opportunity to be part of the study. A copy of the participant

recruitment invitation is found in Appendix M. The participants provided informed consent in accordance with Survey Monkey procedures. The length of the Survey Monkey recruitment and data collection lasted six weeks during the fall of 2023. The online study remained open during that time to ensure an adequate sample size was collected to test statistical significance and effect size. There were no adverse incidents to report.

Data Transfer

IBM © SPSS © Statistics Version 28 was used to analyze the data collected from the study participants. Data was transferred from Survey Monkey for all individual responses into an Excel spreadsheet and exported into an SPSS 28 data file onto a password-protected laptop I owned. While the survey was created to require a reply for each question of the survey, including each item of the WEMWBS and SWLS instruments, the ineligible and incomplete responses remained. In SPSS, the data were studied to alleviate missing responses. Raw data was prepared, cleaned, and organized. With only complete responses remaining, the demographic characteristic questions were given identifiable labels. The independent and dependent variables were selected and transformed into identifiable codes. In this study, the independent variable, or predictor variable, was nominal (i.e., 1 = ultrarunner, 0 = runner). The dependent variables are subjective well-being and life satisfaction, measured using scales considered interval.

The SPSS 28.0 data file showed 523 cases. A review of the data showed that 95 (18.2% of 523) respondents did not provide informed consent and/or did not meet study eligibility and thus had unusable data, reducing the sample size to n = 428. A review of

the data set showed that 51 (11.9% of 428) of the participants, while providing consent and meeting study eligibility, did not answer the survey questions. The cases were removed, resulting in n = 377. A review of the participant data set revealed that one participant did not provide an answer to the ultrarunning status question, the independent variable, and thus, the case was removed from the data set, resulting in a sample of n = 376. A review of the demographic questions indicated that all 376 participants provided results to the demographic questions (i.e., sex, age, race/ethnicity, education level, and income level). Then, I reviewed the WEMWBS and SWLS item-level data from 376 respondents. There were eight respondents who completed the WEMWBS but not the SWLS. As such, the eight data points were replaced with the respective item mean score (i.e., item mean score imputation; Field, 2009). The scale scores for the WEMWBS and SWLS were computed to allow for the testing of outliers.

Using the dataset of 376 participants, I identified if any multivariate outliers were present in the dataset. According to Osborne and Overbay (2004) and Smiti (2020), multivariate outliers can have detrimental effects on study findings, as they can (a) increase error variance, (b) result in violations of normality assumptions, (c) add bias correlational and/or regression estimates, and (d) enhance the likelihood of committing a Type 1 error. A Mahalanobis distance value is computed by conducting a multiple linear regression (MLR) with the study predictor variables entered into the model as predictors and the criterion variable being a randomly selected interval/ratio variable (Field, 2009). Thus, I computed Mahalanobis distance values and their significance level to identify multivariate outliers. To do this, an MLR was conducted, collectively entering the two

predictors, SWLS and WEMWBS, and control variables as predictors of a random interval/ratio variable, which was the participant's level of education. The Mahalanobis distance value was calculated for each participant. One outlier was found using the $p < .001$ criterion. Due to this statistical reason, the multivariate outlier case was removed from the dataset, resulting in a sample size of n =375.

The dataset of 375 participants was then assessed for univariate outliers or cases with WEMWBS and/or SWLS scores that were +/- 3 standard deviations from the mean assessment scores. Univariate outliers can introduce statistical error and increase the likelihood that the normality assumption is violated; they can increase the possibility of committing a Type 1 error (Field, 2009; Smiti, 2020). In accordance with recommendations (Field, 2009; Smiti, 2020), normal Q-Q plots and boxplots were computed to identify any cases that were univariate outliers. Six cases were identified as outliers. All six participants had SWLS scores that were +3 standard deviations above the mean assessment score. Two of these six participants also had WEMWBS scores that were +3 standard deviations above the mean assessment score. The six cases were removed from the data set, resulting in a final sample size of 369 participants. Of the 369 participants, 255 (69.1%) were runners, and 114 (30.9%) were ultrarunners. Table 2 provides information on the initial sample size, the removal of cases, and the final sample size.

Table 2

Removal of Cases and Final Sample Size

Removal of Cases	Removed *n*	Sample *n Adjusted*
Did not provide informed consent and/or did not meet study eligibility	95	523
Had 100% missing data on survey questions	51	428
Did not answer ultrarunning status question	1	377
Multivariate outlier (Mahalanobis distance value at item level, $p < .001$)	1	376
Univariate outlier (item scores > =/-1.5 boxplots)	6	375
Final sample		369

Descriptive Statistics

For this study, a quantitative survey design was applied with the testing for statistical significance through two HMLRs to examine the relationship between ultrarunning status, subjective well-being, and life satisfaction. Descriptive statistics were performed from the study's sample population ($N = 369$). To generate the descriptive statistics for this study, IBM © SPSS © Statistics Version 28 was the software used to perform the analytical testing of the research questions. Descriptive demographic information on the study participants is presented, followed by descriptive statistics of the WEMWBS, and SWLS assessment scores.

Participants

Descriptive statistics were computed for the participant variables of running status, age, sex, race/ethnicity, level of education, and income level. Results showed that of the 369 participants, 255 (69.1%) were runners, and 114 (30.9%) were ultrarunners. The average (mean) age of participants was 44 years (Md = 44 years, SD = 0.50 years).

At least 44.4% of the participants were 18 to 40 years old (n = 164), and 55.6% were 40 and older (n = 205): a little more than half of this sample were older adults past 40 years of age. The sample was comprised of 50.7% (n = 187) females and 49.3% (n = 182) males. This sample included the race/ethnicity category as White/Caucasian 76.4% (n = 282), followed by Other 10.3% (n = 38), Hispanic 8.9% (n = 33), and Black 4.3% (n = 16). Descriptive statistics for the level of education indicated that 46.6% (n = 172) of participants held a graduate degree or higher, 40.1% (n = 148) an undergraduate degree, 13.3% (n = 48) high school degree, and 0.3% (n = 1) had less than high school degree. Concerning income level, 83.2% (n = 307) of participants earned more than $50,000 per year, and 16.8% (n = 62) earned less than $50,000 per year. Table 3 below provides the descriptive statistics (i.e., frequencies and percentages) for the running status, age, sex, race/ethnicity, level of education, and income level variables.

Table 3

Descriptive Statistics of the Participants (n = 369)

Variables		Frequency (n)	Percentage (%)
Running Status	Runner	255	69.1
	Ultrarunner	114	30.9
Sex	Male	182	49.3
	Female	187	50.7
Age	18-40 years	164	44.4
	40 and older	205	55.6
Race/Ethnicity	Black	282	76.4
	Other	38	10.3
	Hispanic	33	8.9
	Black	16	4.4
Income Level	More than $50,000 a year	307	83.2
	Less than $50,000 a year	62	16.8
Level of Education	Graduate degree or higher	172	46.6
	Undergraduate degree	148	40.1
	High School Diploma	48	13.0
	Less than High School	1	0.3

WEMWBS

Descriptive statistics for the WEMWBS, the instrument used to measure psychological well-being, showed that the overall mean score was 52.05 (SD = 8.75) with a 95% confidence interval of 51.15 - 52.95, indicative of average to high levels of subjective well-being. The WEMWBS scores can range from 14 to 70, with each question scored on a scale of 1-5 (Tennant et al., 2007). The scores in this study, however, ranged from 29 to 70, with no participants reporting very low subjective well-being. See Table 4 below for descriptive statistics of the WEMWBS.

Table 4

Descriptive Statistics for WEMWBS Measuring Participants' Subjective Well-Being (n = 369)

Variables	*M*	*SD*	*Skewness*	*Kurtosis*
WEMWBS (overall)	52.05	8.75	-.07	-.28
1. I've been feeling optimistic about the future	3.75	.85	-.42	.07
2. I've been feeling useful	3.88	.78	-.32	-.25
3. I've been feeling relaxed	3.41	.91	-.02	-.53
4. I've been feeling interested in other people	3.64	.89	-.33	.16
5. I've had energy to spare	3.36	.98	-.12	-.49
6. I've been dealing with problems well	3.65	.80	-.09	-.29
7. I've been thinking clearly	3.88	.77	-.38	.07
8. I've been feeling good about myself	3.76	.88	-.41	-.35
9. I've been feeling close to other people	3.55	.89	-.24	-.24
10. I've been feeling confident	3.70	.88	-.42	-.05
11. I've been able to make up my own mind about things	4.06	.79	-.54	-.17
12. I've been feeling loved	3.96	.91	-.53	-.36
13. I've been interested in new things	3.75	.92	-.32	-.40
14. I've been feeling cheerful	3.69	.91	-.48	.08

SWLS

Descriptive statistics for the SWLS, the assessment that measured life satisfaction, showed that the overall mean score was 25.95 (SD = 6.16), with a 95% confidence interval of 25.32 – 26.58, indicative of average to high levels of life satisfaction. The scores on the SWLS can range from 5 to 35, with each question scored on a 1-7 scale (Pavot & Diener, 2008). The range of scores in this study demonstrated a range of 8 to 35, consistent with Diener (1985) SWLS. See Table 5 below for descriptive statistics of the SWLS for this study.

Table 5

Descriptive Statistics for SWLS Measuring Participants' Life Satisfaction (n = 369)

Variables	*M*	*SD*	*Skewness*	*Kurtosis*
SWLS (overall)	25.95	6.16	-.95	.47
1. In most ways my life is close to my ideal	5.03	1.51	-1.03	.41
2. The conditions of my life are excellent	5.37	1.34	-1.14	1.01
3. I am satisfied with my life	5.47	1.38	-1.22	.99
4. So far, I have gotten the important things want in life	5.59	1.33	-1.33	1.46
5. If I could live my life over, I would change almost nothing	4.46	1.82	-.40	-1.01

Data Analysis Procedures

This section provides the findings of this study. Chapter 3 included a complete review of the data collection and analysis plan. This research study was conducted in accordance with the intended plan. The data were collected online using Survey Monkey, and the study achieved the intended sample size, as mentioned previously, with a total of 369 participants providing usable data. The study instruments had sound inter-item reliability, and the data met the assumptions for hierarchical multiple linear regression (HMLR), the analysis used for the hypothesis testing. The intended data collection and analysis plan remained the same.

This section has subsections on specific topics. The first subsection covers information on the testing of data assumptions, variable normality, linearity and homoscedasticity, and multicollinearity, followed by a subsection on the testing of the control variables. The last subsection provides the results from the two HMLRs conducted for the two research questions.

Testing of Assumptions

Statistical tests were conducted to determine if the data met the assumptions for HMLR. As per Field (2009), the key data assumptions tested were (a) variable normality, (b) linearity and homoscedasticity, and (c) lack of multicollinearity. Statistical tests and plots in accordance with the data analysis plan noted in Chapter 3 were conducted to ascertain if the data met the assumptions for HMLR.

Variable Normality

Variable normality was the first assumption tested for HMLR. For continuous data, normality is described as the equal distribution of scores around the mean score (Field, 2009) and was analyzed by computing normal Q-Q plots. Normality is seen when the points on the plot align with the diagonal (Field, 2009). The test of normality showed points aligned along the diagonal for the Q-Q plots, and some variables show slight deviations. The assumption of normality was met in this study. The normal Q-Q plots are presented in Appendix N.

Linearity and Homoscedasticity

Additional assumptions of the data must be met for linear regression models; these include linearity and homoscedasticity between the predictor/covariate and criterion variables (Field, 2009). To test for this assumption, P-P plots and scatterplots of standardized predicted versus actual residuals for the predictor/criterion and control variables were computed. The linearity assumption can be met if the residuals align along a diagonal plot line (Field, 2009). Homoscedasticity is indicated on the scatterplot if equal distribution residuals above and below a horizontal zero value are evident,

demonstrating that the data points are not shifting to either side (Field, 2009). The assumption of linearity and homoscedasticity were met. The P-P plots show that the residuals aligned along the diagonal (see Appendix O), and the scatterplots show that residuals were equally dispersed above and below the diagonal (see Appendix P).

Lack of Multicollinearity

The lack of multicollinearity between the subjective well-being and life satisfaction scores was the last assumption tested. Multicollinearity occurs when variables are so highly correlated that they assess conceptually similar, if not the same, constructs (Field, 2009). Subjective well-being and satisfaction with life are highly similar constructs, and as such, it was possible that the WEMWBS and SWLS scores were highly correlated and displayed multicollinearity. The assumption of lack of multicollinearity between the WEMWBS and SWLS scores was assessed by computing a variance inflation factor (VIF). A VIF is a statistical indicator of the degree to which the variance is inflated due to the introduction of both conceptually similar variables in the regression model (Field, 2009). A VIF is computed by running an MLR with the two variables entered as predictors of a randomly selected variable, and a VIF of 4.00 is indicative of multicollinearity (Field, 2009). In this study, one MLR was conducted, with the WEMWBS and SWLS entered as predictors of the income variable to compute the VIF. The VIF was 1.77, lower than the critical value of 4 (see Table 6 below). The WEMWBS and SWLS scores were not highly correlated and displayed a lack of multicollinearity, meeting this data assumption.

Table 6

Coefficients[a]:Variance Inflation Factor (VIF) Showing Lack of Multicollinearity

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.398	.115		12.207	<.001		
	WEMWBS	.002	.003	.038	.565	.572	.565	1.770
	SWLS	.013	.004	.221	3.286	.001	.565	1.770

Note: a. Dependent Variable: Income level

Testing of Control Variables

A series of point biserial correlations were conducted to determine if the demographic variables were significantly correlated with the WEMWBS and/or SWLS scores and needed to be included as control variables in the HMLRs for hypothesis testing. A point biserial correlation, indicated by rp, measures the degree and strength between a dichotomous variable and a continuous (i.e., interval, ratio) variable (Field, 2009). To compute the point biserial correlations, all the control variables, which pertained to participant demographics (i.e., sex, ethnicity/race, age group, income level, and education level), were dummy coded to allow for the computation of point biserial correlations. That is, a new dichotomous variable was created for each (a) sex group (i.e., 1 = male, 0 = female); (b) age group (i.e., 1 = 18 to 40, 0 = 41 or older); (c) ethnicity/race (i.e., Hispanic, 1 = yes, 0 = no; Black, 1 = yes, 0 = no; White, 1 = yes, 0 = no; and Other, 1 = yes, 0 = no); (d) income (i.e., 1 = less than $50,000, 0 = more than $50,000); and (e) education level (i.e., less than high school, 1 = yes, 0 = no; high school degree, 1 = yes, 0 = no; undergraduate degree, 1 = yes, 0 = no; and graduate degree, 1 = yes, 0 = no).

A series of point biserial correlations were conducted between the dummy coded demographic variables and the WEMWBS and SWLS scores (Table 6). There were no significant correlations between sex, age, and the WEMWBS and SWLS scores. There were significant ethnicity/race group correlations with the WEMWBS and SWLS scores. Results showed there was a significant negative correlation between Hispanic ethnicity/race and with lower levels of life satisfaction as measured by the SWLS ($rp = -.11$, $p < .05$). Black race showed a significant, strong, positive correlation with higher levels of subjective well-being, as assessed by the WEMWBS ($rp = .11$, $p < .05$). Being White or not of an Other ethnicity/race group were both significant with a strong positive correlation with life satisfaction, as measured by the SWLS ($rp = .16$, $p < .01$ and $rp = -.14$, $p < .01$, respectively).

Point biserial correlations further showed that an income status of less than $50,000 a year was a significant negative correlation with lower levels of subjective well-being, as evaluated by the WEMWBS ($rp = -.18$, $p < .01$) and reduced life satisfaction, assessed using the SWLS ($rp = -.25$, $p < .001$). Significant associations were found between education levels and WEMWBS and SWLS scores. Higher education levels were positively correlated with higher levels of subjective well-being, but negatively correlated with life satisfaction. Lower education levels were strongly correlated with lower levels of subjective well-being and life satisfaction. Having less than a high school degree was significantly related to reduced levels of life satisfaction, measured using the SWLS ($rp = -.15$, $p < .01$). Having a high school degree or an undergraduate degree were both significantly associated with lower levels of subjective well-being, assessed using

the WEMWBS ($r_p = -.22$, $p < .001$ and $r_p = -.12$, $p < .05$), and reduced life satisfaction, assessed using the SWLS ($r_p = -.20$, $p < .01$ and $r_p = -.11$, $p < .05$). Having a graduate degree showed higher levels of subjective well-being, as evaluated by the WEMWBS ($r_p = .27$, $p < .001$), and life satisfaction, assessed using the SWLS ($r_p = .26$, $p < .001$). Therefore, a positive correlation between a graduate degree or higher and the dependent variables (i.e., subjective well-being and life satisfaction) was statistically significant.

The point biserial correlational results showed that Hispanic, Black, and Other ethnicity/race groups – in contrast to the White group - were significantly associated with one or both dependent variables (i.e., WEMWBS and SWLS). Higher levels of subjective well-being as measured by the WEMWBS were higher in the Black ethnicity/race group, indicating a strong, positive correlation. Higher levels of life satisfaction as measured by the SWLS were higher for the White and Other ethnicity/race groups, illustrating a strong positive correlation. However, there was no significant association between the White, Hispanic, and Other ethnicity/race groups and subjective well-being.

Income and all education levels were also significantly related to subjective well-being, as evaluated by the WEMWBS, and life satisfaction, assessed using the SWLS. Higher education and income levels were evident with higher levels of subjective well-being and life satisfaction and positively correlated. The initial proposed study was to include all demographic variables. However, the ethnic minority groups dummy coded variables of Hispanic, Black, and Other displayed significant multicollinearity, and income and education were also highly multicollinear. The introduction of sex and age, neither of which were significantly correlated with the dependent variables, increased the

error variance into the HMLR model. As such, for each HMLR, the ethnicity/race groups of Hispanic, Black, and Other, and the income level dummy coded variables were entered into the first step of the HMLR as control variables, with running status entered as the independent variable on the second step of the HMLR.

Table 7

Point Biserial Correlations: Demographic Variables and WEMWBS and SWLS Scores (n = 369)

	WEMWBS	*SWLS*
Sex	-.02	-.10
Age	-.08	-.08
Ethnicity/Race Group		
Hispanic	-.07	-.11*
Black	.11*	.04
White	.05	.16**
Other	-.08	-.14**
Income	-.18***	-.25***
Education Level		
Less than High School	-.08	-.15**
High School	-.22***	-.20***
Undergraduate Degree	-.12*	-.11*
Graduate Degree	.27***	.26***

Note. *$p < .05$; **$p < .01$; ***$p < .001$

HMLR for Hypothesis Testing

The concluding step in the data analysis plan was the conduction of HMLRs for the study's two research questions. The first question was to test if there was an association between ultrarunning status and subjective well-being among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level). The second question was to measure if there was an association between ultrarunning status and life satisfaction among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income

level). Key assumptions for conducting linear regression models were assessed, and no issues were detected.

HMLR: Research Question 1

The first research question was: “Is there an association between ultrarunning status and subjective well-being among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level)?” One HMLR was conducted to address the first research question (Table 7). At the first step, the control variables of Hispanic, Black, and Other ethnicity/race groups and income levels were entered as predictors of subjective well-being, assessed using the WEMWBS. The first model was significant, $F(4, 364) = 4.88$, $p < .001$, $R2 = .05$. A review of the beta coefficients revealed that an income level of $50,000 or higher was significantly predictive of higher levels of subjective well-being ($\beta = .17$, $p < .001$). There were no significant relationships between Hispanic, Black, or Other ethnicity/race groups and subjective well-being.

The independent variable, ultrarunning status, was entered on the second step of the HMLR as the single predictor of subjective well-being, as measured by the WEMWBS. The second model was significant, $Fchange(1, 364) = 3.79$, $p = .050$, $R2change = .01$. The beta coefficient indicated a significant association between ultrarunning status and higher levels of subjective well-being ($\beta = .10$, $p = .050$). Based on the statistical significance of the HMLR model and beta coefficient, the null hypothesis, “H01: There is no statistically significant association between ultrarunning status and subjective well-being among participants, adjusted for demographic

characteristics (i.e., sex, age, race/ethnicity, education level, and income level);" therefore, we reject the null. That is, the observed association between ultrarunning status and subjective well-being, while statistically significant, exhibited a small effect size, accounting for only 1% of the variance in subjective well-being. Despite its statistical significance, the practical significance of this relationship may be considered modest.

Table 8

HMLR: Running Status Predicting Subjective Well-Being, As Measured Using the WEMWBS, Controlling for Ethnicity/Age Groups and Income Level (n = 369)

	Model 1				Model 2			
	B	*SE B*	*β*	*p*	*B*	*SE B*	*β*	*p*
Hispanic	-1.48	1.59	-.05	.354	-1.30	1.59	-.04	.416
Black	4.12	2.20	.10	.062	4.13	2.20	.10	.061
Other	-1.98	1.48	-.07	.182	-2.04	1.48	-.07	.169
Income Level	4.03	1.21	.17	<.001	3.97	1.20	.17	<.001
Running Status					1.88	0.97	.10	.050

Note. Significant findings are bolded.

HMLR: Research Question 2

The second research question was: "Is there an association between ultrarunning status and life satisfaction among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level)?" One HMLR was conducted to address the second research question. The control variables of Hispanic, Black, and Other ethnicity/race groups and income levels entered as predictors of life satisfaction, measured using the SWLS, into the first model of the HMLR. The first model was significant, $F(4, 364) = 8.55$, $p < .001$, $R2 = .09$. A review of the beta coefficients showed that the other ethnicity/race group was predictive of lower levels of life satisfaction ($\beta = -.14$, $p = .008$), while an income level of $50,000 or higher was significantly predictive of higher levels of life satisfaction ($\beta = .23$, $p < .001$). There were

no significant relationships between the Hispanic or Black ethnicity/race groups and life satisfaction.

Running status was entered on the second step of the HMLR as the single predictor of life satisfaction, assessed using the SWLS. The second model was not significant, $F(1, 364) = 1.74$, $p = .188$, R2change = .00. The beta coefficient indicated no significant association between ultrarunning status and life satisfaction ($\beta = .07$, $p = .188$). Based on the non-significance of the HMLR model and beta coefficient, the null hypothesis, "H02: There is no statistically significant association between ultrarunning status and life satisfaction among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level)," we fail to reject the null.

Table 9

HMLR: Running Status Predicting Life Satisfaction, As Measured Using the SWLS, Controlling for Ethnicity/Age Groups and Income Level (n = 369)

	Model 1				Model 2			
	B	SE B	β	p	B	SE B	β	p
Hispanic	-2.05	1.10	-.10	.063	-1.97	1.10	-.09	.075
Black	0.50	1.52	.02	.741	0.51	1.52	.02	.739
Other	-2.74	1.03	-.14	.008	-2.76	1.02	-.14	.007
Income Level	3.75	0.83	.23	<.001	3.71	0.83	.23	<.001
Running Status					0.88	0.67	.07	.188

Note. Significant findings are bolded.

Summary

The purpose of this quantitative cross-sectional study was to examine the relationship between ultrarunning status, subjective well-being, and life satisfaction among adult runners in the United States. This study had two research questions, which concerned the associations between ultrarunning status (defined as having run in an

ultramarathon in the past year, coded as 1 = yes, an ultrarunner, or 0 = no, a runner) and subjective well-being, as assessed by the WEMWBS, and life satisfaction, measured using the SWLS, respectfully. This study addressed the gap in the empirical literature regarding links between ultrarunning status and psychological wellness outcome variables. It advanced the understanding of the mental health aspects of running in terms of personal well-being.

The study participants were recruited using the Survey Monkey recruitment panel services, and data were collected in accordance with research with human subjects. The final sample size for the study was 369 participants (30.9% ultrarunners, 69.1% runners), exceeding the required sample size 212. The average age of the participants was 44 years, and the sample was roughly sex-equivalent (49.3% male, 50.7% female). Most participants were White (76.4%) and earned more than $50,000 per year (83.2%). Almost half (46.6%) of the participants had a graduate degree or higher. The sample of runners in this study was predominantly White, in their 40s, of middle income, and well educated.

To address the two research questions regarding the relationship between ultrarunning status and subjective well-being and life satisfaction, HMLRs were conducted for hypothesis testing. The data met the assumptions for HMLR. Based on significant point biserial correlational results, the demographic variables of ethnic minority status (i.e., Hispanic, Black, or Other) and income level were included as control variables, and these variables were entered in the first step (or model) of the HMLR. The first HMLR, conducted to explore the association between ultrarunning status and subjective well-being while adjusting for demographic characteristics, yielded

statistically significant findings. Ultrarunning status was statistically significantly associated with higher levels of subjective well-being. As the results were statistically significant, we reject the null hypothesis (i.e., there is no statistically significant association between ultrarunning status and life satisfaction among participants, adjusted for demographic characteristics). Despite its statistical significance, the practical significance of this relationship may be considered modest with a small effect size that accounted for only 1% of the variance in subjective well-being.

The second HMLR, performed to examine the association between ultrarunning status and life satisfaction while controlling for demographic variables, did not yield statistically significant results. Ultrarunning status was not significantly related to life satisfaction levels in runners. Due to the nonsignificant findings, we fail to reject the null hypothesis (i.e., there is no significant association between ultrarunning status and life satisfaction among participants, adjusted for demographic characteristics).

The study findings are comprehensively reviewed in Chapter 5. Chapter 5 opens with an introductory section, followed by a presentation of the research questions and summary of findings. Interpretations of study findings are then posed, with results discussed in relation to findings in pertinent empirical work. After a review of the study limitations, recommendations for future research are presented, and implications for social change are then discussed. Chapter 5 closes with a conclusion.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

Evidence indicates that the COVID-19 pandemic disproportionately affected mental health and has resulted in decreased subjective well-being and life satisfaction among the U.S. population (KFF, 2021; Veldhuis et al., 2021), calling for a need for empirical study of ways to improve the mental health of Americans. Running as a form of exercise has shown improvements in mental health (Grunseit et al., 2018; Pereira et al., 2021; Pereira Vargas et al., 2021; Thompson et al., 2020), and there is evidence that participation in endurance running events specifically improves subjective well-being and life satisfaction (Grunseit et al., 2018; Sato et al., 2015). However, the research examining relationships between ultrarunning status (i.e., running a 50k or 31 miles or more) and mental health outcomes is especially limited (Oswald et al., 2020). Although subjective well-being and mental health are not the same, they are statistically related (Li et al., 2022). It was important to discern if ultrarunning status, a health behavior that could improve health and mental health outcomes, differentially influenced the two related yet distinct outcomes of subjective well-being and life satisfaction.

The purpose of this quantitative cross-sectional study was to examine the relationship between ultrarunning status, subjective well-being, and life satisfaction among adult runners in the United States. The conceptual framework that grounded this study was the advanced epidemiology triangle, which posits an interaction between the host (i.e., population), the environment (i.e., behavior), and the agent (i.e., health condition; Johnson, n.d.; Miller, 2002; Oleckno, 2002). In accordance with the advanced

epidemiology triangle, (a) the host (population) being ultrarunner status (i.e., “runners” who have been running for at least one year recreationally or non-competitively in any distance under the marathon, or “ultrarunners” who have completed one or more race longer than the marathon in the past year); (b) the environment was the condition of running, and (c) the agents (health conditions) were subjective well-being and life satisfaction. Based on available literature, this is the first study to use the advanced triangle of epidemiology as the conceptual framework to examine the relationship between ultrarunning status, subjective well-being, and life satisfaction.

This study utilized a quantitative correlational method, and data were collected through an approved anonymous self-reported questionnaire using the Survey Monkey study panel recruitment services. Primary data (n = 369) were collected utilizing an online survey comprised of 12 questions that addressed eligibility, consent, demographic variables (i.e., sex, age, race/ethnicity, education level, and income level), the independent variable of ultrarunning status, and the two instruments (i.e., WEMWBS, SWLS) used to assess the dependent variables of subjective well-being and life satisfaction, respectively. The objectives of this study were to answer the following research questions:

Research Question 1

Is there an association between ultrarunning status and subjective well-being among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level)?

Research Question 2

Is there an association between ultrarunning status and life satisfaction among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level)?

This chapter begins with a summary of findings, followed by a discussion and interpretation of the results regarding relevant empirical literature. The limitations of the study are then presented. After recommendations for future research are summarized, implications for theory, practice, and social change are posed. A conclusion ends the chapter.

Summary of Findings

This study aimed to examine the relationship between ultrarunning status, subjective well-being, and life satisfaction, controlling for pertinent demographic variables, in a sample of adult runners in the United States. The study was conducted with 369 adult runners who self-identified as ultrarunners (30.9%) or runners (69.1%) in the U.S. The sample was comprised of 49.3% males and 50.7% females. The higher percentage of females in this study differed from the sex percentages seen in previous research: studies have documented that the majority of ultrarunners are male (Harris, 2012; Hoffman et al., 2010; Hoffman & Krishnan, 2014; Knechtle, 2012; Ronto, 2021b). The average mean age of participants was 44 years, in correspondence to the average age (M = 45 years) of ultrarunners seen in the literature (Hoffman & Fogard, 2012; Roebuck et al., 2018). The participants were predominantly White/Caucasian (76.4%), 83.2% earned $50,000 a year or more, and 46.6% held a graduate degree or higher. The ethnicity

and higher socioeconomic status of participants in this study corresponded to data on runners in previous studies, which have shown that ultrarunners tend to be White/Caucasian, have higher levels of education, and tend to work in professional and business fields (Hoffman & Fogard, 2012; Hoffman & Krishnan, 2014; Roebuck et al., 2018).

Two HMLRs were employed for this study to answer two research questions. The first research question concerned the association between ultrarunning status and subjective well-being among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level). Findings from this HMLR were statistically significant: ultrarunning status was significantly associated with higher levels of subjective well-being. The observed association between ultrarunning status and subjective well-being, while statistically significant, revealed a small effect size, accounting for only 1% of the variance in subjective well-being. Despite its statistical significance, the practical significance of this relationship may be considered modest. Therefore, we reject the null hypothesis.

The second research question inquired whether there was an association between ultrarunning status and life satisfaction among participants, adjusted for demographic characteristics (i.e., sex, age, race/ethnicity, education level, and income level). Findings from the second HMLR were not statistically significant: ultrarunning status was not associated with life satisfaction. Therefore, we fail to reject the null hypothesis as no statistically significant association was found between variables.

Interpretation of Findings

The conceptual framework for this study was the advanced triangle of epidemiology. The epidemiologic triangle has historically been used to focus on communicable diseases; however, infectious diseases are no longer the primary cause of death in industrialized countries (Merrill, 2017). The epidemiologic triangle model, developed by Miller (2002) and advanced by Merrill (2017), posits that chronic disease and behavioral disorders occur as a result of the dynamic between (a) the host (i.e., person characteristics, group and population demographics); (b) the environment (i.e., place characteristics, biological, physical, and psychological environments); and (c) the agent (i.e., causative factors, risk factors, environmental exposures). This study is the first known study to apply the advanced triangle of epidemiology to the context of ultrarunning, with the argument that associations exist between (a) the host, or the runners in the study; (b) the environment, or the ultrarunning context, and (c) the agents, which are the outcomes of subjective well-being and life satisfaction. The advanced triangle of epidemiology model received some support in this study: notably, a significant relationship was found between ultrarunning status and subjective well-being. This finding suggested that ultrarunners who engage in ultramarathons may experience higher levels of well-being compared to their regular running companions. The non-significant results pertaining to the relationship between ultrarunning status and life satisfaction did not, however, provide empirical evidence for the advanced triangle of epidemiology.

The current study was the first known study to determine if ultrarunning status was significantly associated with subjective well-being and life satisfaction and added to

the minimal body of work concerning mental health among runners and ultrarunners. There is significant evidence that an active lifestyle positively impacts health and mental health outcomes (Park et al., 2020; Yang et al., 2022), so much so that ACSM ("Exercise is Medicine") advocates for research-informed and evidence-based physical activity initiatives to promote optimal mental health (Thompson et al., 2020). The significant association found between ultrarunning status and subjective well-being in this study confirms the benefits of exercise.

The findings in the study did, however, differ. While ultrarunning status was statistically significantly associated with subjective well-being, it was not correlated with life satisfaction. The statistical significant relationship between ultrarunning status and subjective well-being aligns with research documenting that running (e.g., at least 26.2 miles or less) contributes to higher levels of subjective well-being (Cypryanska & Nezlek, 2019; Grunseit et al., 2018; Iwon et al., 2021; Kuykendall et al., 2015; Kuykendall et al., 2017), as well as research showing that social connectedness of the ultramarathon environment leads to higher levels of subjective well-being (Batmyagmar et al., 2019; Cook, 2018; Cleland et al., 2019; Keating et al., 2018; Morris & Scott, 2019). Although the practical significance of this relationship may be considered modest with a small effect size accounting for only 1% of the variance in subjective well-being, it still added empirical knowledge. In addition, ultrarunning status was not significantly associated with life satisfaction, a finding that differed from studies that found a significant link between running and life satisfaction (Park et al., 2019; Sato et al., 2014, 2015, 2016). It may be that the ultrarunning environment provides a unique context in

which one's sense of purpose and well-being is emphasized and heightened; however, it may not provide a means in which to enhance life satisfaction, a more global evaluation of one's life (Badri et al., 2022; Diener et al., 1999).

Limitations of the Study

Certain limitations of this study should be considered. As previously stated, participant responses were self-reported, which means the data are subject to social desirability bias. The tendency to overreport more desirable qualities and underreport socially unfavorable behaviors and views is known as the social desirability bias (Latkin et al., 2017). Other potential limitations of this study include participants' recall bias (e.g., respondents can erroneously provide responses that rely on their ability to recall past events), response bias (e.g., self-reporting data that may be inaccurate or false either knowingly or inadvertently), and selection bias (e.g., when the selection of participants are not random) when using the survey instrument (Althubaiti, 2016). Recall, response, and selection bias may lead to inaccurate self-reports or study conclusions, reducing the study's internal validity (Latkin et al., 2017). In this study, respondents who were more inclined to complete the survey or questionnaire may have a stronger sense of subjective well-being and/or life satisfaction or a greater perception of the benefits of running. However, the survey was anonymous and did not include any personal or identifiable information, which helped reduce bias.

There was a limitation regarding the generalizability of the study findings. Convenience sampling, one type of non-random sampling, was used in this study to obtain a sample of participants from the population of interest: adult runners over the age

of 18 in the United States. The sample was not randomly selected. Participants were recruited from running groups; therefore, the study was only made known to runners who were part of a running group, participated in Survey Monkey online panel survey, and were made aware of the study via the group announcement during a specific timeframe. As such, the study findings cannot be generalized to runners outside of those in running groups, and/or who participate in online survey panels, or active adults who are athletes but not runners and runners outside of the United States.

Another limitation arises from the increased sample size, which bolstered statistical power and yielded statistically significant results regarding the relationship between ultrarunning status and subjective well-being. The final sample size of 369 participants exceeded the initially determined requirement of 212 subjects, as determined by G*Power analysis set at 80% power for two hierarchical multiple linear regression models. Additionally, a notable limitation pertains to the small effect size observed. Despite achieving statistical significance, the association between ultrarunning status and subjective well-being accounted for only 1% of the variance in subjective well-being. Consequently, while statistically significant, the practical significance of this relationship may be deemed modest.

Recommendations

The current study was the first to explore subjective well-being and life satisfaction within the context of ultrarunning. An association was identified between ultrarunning status and subjective well-being, but ultrarunning status was not significantly related to life satisfaction. The significant and non-significant findings of

this study help to guide future research. There is a need to replicate this study, particularly using probability sampling technique to obtain participants so that the results can be better generalized to the target population. There is also a need for correlational and/or causal-comparative studies that examine if the ultrarunning status has implications for not only subjective well-being and life satisfaction but also other mental health (i.e., resilience, hope) and health (i.e., increased cardiovascular fitness) outcomes.

In this study, the demographic factors of ethnicity/race group as Other and income were related to the mental health outcomes of subjective well-being and life satisfaction. These were intriguing and unexpected findings, and they suggest a need for future studies that examine ultrarunning status in relation to subjective well-being and life satisfaction specific to certain racial/ethnic and income groups. There is an additional need for research that explores interactions between ultrarunning status and demographic factors (i.e., race/ethnicity, income, sex) to influence mental health outcomes. It may be that ultrarunning is especially beneficial for individuals of certain ethnicity/race or income groups.

Previous research has suggested that distance running (i.e., not ultrarunning) may promote people's life satisfaction if running is increased weekly (Sato et al., 2016). This current study did not assess how often a person ran and how it contributes to life satisfaction, which is recommended for future research. However, public health professionals and community policymakers may find the current study useful and a helpful template. There is also a lack of research that examines ultrarunning experience

(Martinez & Scott, 2016). Future research that explores the motivation, personality, and routines of ultrarunners would be supportive.

As mental health issues continue to rise, especially after the COVID-19 pandemic (KFF, 2021; NAMI, 2021; Veldhuis et al., 2021), it is essential to explore alternative or supplementary coping strategies to improve well-being outlets for Americans. Any public health awareness of increasing physical activity, including running and ultrarunning, is essential in improving mental health outlets (Cook, 2018; Mulvad et al., 2018; Oswald et al., 2020). Ultrarunning is becoming popular, and though the field is growing, scientific research is limited (Uhan, 2022). Thus, any future studies or peer-reviewed and published studies are essential. In addition, public neighborhood parks, trails, and improving walkability in neighborhoods are essential ideas to promote physical activity, which is linked to improved well-being and mental health (Cohen & Leuschner, 2019; Merriam et al., 2017).

Implications

This is the first known study to examine the association between ultrarunning status, subjective well-being, and life satisfaction. This is significant because this study added to the empirical literature on ultrarunning and can extend future public health research, programs, and policies. Other studies have shown that ultrarunners may experience few mental health issues in comparison to the general population (Hoffman & Krishnan, 2014), and that ultrarunning may improve a person’s self-esteem and mood (Gorichanaz, 2018; Grunseit et al., 2018; McGannon et al., 2020), but there are no studies

to date that have examined the relation of ultrarunning status to subjective well-being and life satisfaction.

The findings from the current study can be extended into future studies or applied to community programs or public health policy that seek to improve physical activity and well-being and promote mental health awareness. The current study provides an essential data snapshot of well-being measures (i.e., subjective well-being and life satisfaction) that support Healthy People 2030 overall health and well-being measures (OHMs) to improve the overall health of Americans (ODPHP, n.d.-b). Well-being measures go beyond traditional health indicators such as disease prevalence and mortality rates (Lindert et al., 2015), encompassing a broader perspective of health that includes physical, mental, social, and emotional aspects (Lindert et al., 2015). This holistic approach provides a more comprehensive understanding of individuals' and communities' health, which is vital for public health.

Since the COVID-19 pandemic, mental health problems have become more prevalent, which has an impact on people's social and physical well-being. In addition, physical inactivity or sedentary life continues to be a significant public health concern. The rise in heart disease, diabetes, obesity, certain cancers, and mental illness continues (Thompson et al., 2020). Increasing public health awareness and practice is vital to decrease these dire statistics and help improve the lives of Americans. Individual lifestyle and behavior are the most critical factors contributing to health outcomes (Thompson et al., 2020). Thus, the most significant influence on public health will come from any efforts made to modify behaviors, particularly physical inactivity. Public health initiatives

can use the findings from this research and look into the practice of ultrarunning to help individuals engage in more moderate forms of exercise. Not only do ultrarunning events promote moderate forms of activity, but they also promote social interaction and community engagement (Cook, 2018; Martinez & Scott, 2016). While ultrarunning may not suit everyone, its principles of endurance, discipline, and commitment can be applied as a potential asset in promoting public health.

The role of mass participation sports events (MPSEs) is an essential part of an overall strategy to promote physical activity and well-being initiatives within communities. Participation in MPSEs has been shown to improve social connections, inclusivity, community, self-efficacy, mental health, and physical health (Piper et al., 2022; Sato et al., 2016). As the focus continues to increase on fostering more MPSEs within communities for wellness initiatives and disease prevention (Piper et al., 2022; Sato et al., 2016), this study provided current evidence on ultramarathons, a type of MPSE and the potential associations between the sport, subjective well-being, and life satisfaction. This study included a sample of 369 individuals who partake in running or ultrarunning and included associations with subjective well-being and life satisfaction. It provided an essential piece of new literature that involves endurance running and well-being measures.

Social Change Implications

This study provides positive social change implications by not only contributing new empirical evidence of scholarship but also providing awareness of the positive impact of ultrarunning on communities. Likewise, this new information forms the basis

for innovating and enhancing community programs, as well as developing policies aimed at improving society by focusing on social determinants of health. Specifically, the domains of neighborhood and built environment and social and community context can be focused areas to reduce sedentary life and improve physical activity measures (U.S. Department of Health and Human Services, n.d.). Walden stands for social change, which includes a commitment to building communities that elevate social change outcomes (Walden University, 2023). Findings from this study elicit social change by adding to the current literature and providing new linkages regarding determinants that affect physical activity and the importance of positive community environments.

The need for social change to integrate healthy habits within communities to improve mental health and chronic disease issues in the US requires a proactive response of preparedness. This study also provides a positive social impact that extends beyond individual well-being by influencing broader social change and creating more active, connected, and health-conscious communities. Also, subjective well-being and life satisfaction are essential measures as they provide a holistic understanding of an individual's happiness, mental health, and overall quality of life (Diener et al., 1984, 2000, 2018; Pavot & Diener, 1993, 2008). Positive social change is fostered as these measures are monitored and promoted and contribute to the development of future policies and interventions to enhance societal well-being. Walden is committed to positive social change and empowering change-makers, building communities, and elevating social change outcomes (Walden University, 2023). This study supports Walden's commitment to positive social change by applying new scholarship for public

health practice and a new understanding of the associations between ultrarunning status, subjective well-being, and life satisfaction, which can empower future change-makers in building healthier communities.

Conclusion

Sport organizing professionals and researchers now can contribute to a more considerable discussion on how to promote public health as mass participation in sports events becomes more and more popular. Positive social change is fostered at the local level as MPSEs bring people together in community spirit and cohesion while promoting active and healthy lifestyles. Public health professionals and community planners can improve urban planning and community development initiatives by investing in infrastructure such as parks, walking paths, recreational facilities, and trails to help promote MPSEs and increase active lifestyles (CDC, 2023). In addition, MPSEs attract participants from diverse backgrounds, ages, and fitness levels, which promotes inclusivity and a sense of belonging, helping to break down socio-economic barriers in diverse communities (Quirk et al., 2021).

Ultrarunning is a form of an MPSE that is connected to natural environments and fosters social connectedness, running benefits, and mental health benefits. This study has shown the relationship between ultrarunning status, subjective well-being, and life satisfaction. It is also the first study to examine these variables and provide new insight into the world of ultrarunning and empirical evidence on well-being measures (i.e., subjective well-being and life satisfaction) as they relate to ultrarunning. This study is the first of its kind based on available research. A similar study that examined running,

subjective well-being, and life satisfaction was conducted by Grunseit et al. (2018), examining 865 Australian adult parkrunners who participated in a weekly, community-based, accessible, and widespread running event. That study found that personal well-being was positively associated with perceived community connections for men and mental health benefits for women. What is imperative and insightful about the latter is that future research can build on Grunseit et al. (2018) and this current study to see how MPSEs, Parkrun events, or ultramarathons can be provided in communities to offer support during life-changing events when options for social interaction and physical activity may otherwise be lacking.

As the COVID-19 pandemic illustrated, social interaction and physical activity were hampered as mandatory lockdowns and shelter-in-place protocols were instituted (Veldhuis et al., 2021). Elevated levels of uncertainty and stress were evident and created the perfect storm for psychological distress (Veldhuis et al., 2021). Both mental health and physical health were hampered during the pandemic (Ai et al., 2021). Thus, there was and still is a need to explore and identify alternative and complementary activities that promote mental health, physical health, and overall well-being. If another pandemic was to occur, it would be a great investment and social change effort for public health to look into hosting outdoor MPSEs such as ultrarunning events to help individuals stay active. Ultrarunning events usually take place outside in natural environments, and social distancing is possible (Coon et al., 2011; Martinez & Scott, 2016; Silva et al., 2018).

A plethora of evidence exists about the benefits of running for physical and mental health. Nevertheless, there is no available evidence that shows the benefits of

ultrarunning, subjective well-being, and life satisfaction. This study is the first to add to the literature about the relationship between ultrarunning status, subjective well-being, and life satisfaction.

References

Ai, X., Yang, J., Lin, Z., & Wan, X. (2021). Mental health and the role of physical activity during the COVID-19 Pandemic. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.759987

Althubaiti, A. (2016). Information bias in health research: Definition, pitfalls, and adjustment methods. *Journal of Multidisciplinary Healthcare*, *9*, 211–217. https://doi.org/10.2147/JMDH.S104807

American Heart Association. (2022). *Social isolation and loneliness increase the risk of death from heart attack, stroke.* https://newsroom.heart.org/news/social-isolation-and-loneliness-increase-the-risk-of-death-from-heart-attack-stroke

American Sports & Fitness Association. (2022). *Endurance running vs. Sprinting.* https://www.americansportandfitness.com/blogs/fitness-blog/endurance-running-vs-sprinting

Atkinson, M. (2010). Entering scapeland: Yoga, fell and post-sport physical cultures. *Sport in Society*, *13*(7-8), 1249–1267. https://doi.org/10.1080/17430431003780260

Badri, M.A., Alkhaili, M., Aldhaheri, H., Yang, G., Albahar, M., & Alrashdi, A. (2022). Exploring the reciprocal relationships between happiness and life satisfaction of working adults—Evidence from Abu Dhabi. *International Journal of Environmental Research and Public Health, 19*(6), 3575. https://doi.org/10.3390/ijerph19063575

Batmyagmar, D., Kundi, M., Ponocny-Seliger, E., Lukas, I., Lehrner, J., Haslacher, H., &

Winker, R. (2019). High intensity endurance training is associated with better quality of life, but not with improved cognitive functions in elderly marathon runners. *Scientific Reports, 9*, 4629. https://doi.org/10.1038/s41598-019-41010-w

Baumann, M., Tchicaya, A., Vanderpool, K., Lorentz, N., & Bihan, E. L. (2014). Life satisfaction, cardiovascular risk factors, unhealthy behaviours and socioeconomic inequality, 5 years after coronary angiography. *BMC Public Health*, *15*, 668. https://doi.org/10.1186/s12889-015-2047-0

Baumeister, R.F., & Leary, M.R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117*93, 497–529. https://doi.org/10.1037/0033-2909.117.3.497

Bell, S. L., Audrey, S., Gunnell, D., Cooper, A., & Campbell, R. (2018). The relationship between physical activity, mental wellbeing and symptoms of mental health disorder in adolescents: A cohort study. *The International Journal of Behavioral Nutrition and Physical Activity*, *16*, 138. https://doi.org/10.1186/s12966-019-0901-7

Bernardo, L.M., Gardner, M.J., Rosenfield, R.I., Cohen, B., & Pitetti, R. (2002). A comparison of dog bite injuries in younger and older children treated in a pediatric emergency department. *Pediatric Emergency Care, 18*(3), 247–249.

Bigger than the Trail. (2022). *Creating a positive impact on mental health.* https://www.bttt.run/

Blodgett, J.M., Birch, J.M., Musella, M., Harkness, F., & Kaushal, A. (2022). What works to improve wellbeing? A rapid systematic review of 223 interventions

evaluated with the Warwick-Edinburgh Mental Well-being Scales. *International Journal of Environmental Research and Public Health, 19*(23), 15845. https://doi.org/10.3390/ijerph192315845

Boone, H. N., & Boone, D. A. (2012). Analyzing Likert data. *Journal of Extension, 50*(2), 1–5. https://eric.ed.gov/?id=EJ1042448

Brand, R., Timme, S., & Nosrat, S. (2020). When pandemic hits: Exercise frequency and subjective well-being during COVID-19 pandemic. *Frontiers in Psychology, 11*, 570567. https://doi.org/10.3389/fpsyg.2020.570567

Burgum, P., & Smith, D.T. (2021). Reduced mood variability is associated with enhanced performance during ultrarunning. *PLOS One, 16*(9), e0256888. https://doi.org/10.1371/journal.pone.0256888

Centers for Disease Control and Prevention. (2018). *Health-related quality of life: Well-being concepts.* https://www.cdc.gov/hrqol/wellbeing.htm

Centers for Disease Control and Prevention. (2022). *Physical activity: Data and statistics.* https://www.cdc.gov/physicalactivity/data/index.html

Centers for Disease Control and Prevention. (2023). Priority strategy: Increasing physical activity through community design. https://www.cdc.gov/physicalactivity/community-strategies/activity-friendly-routes-to-everyday-destinations.html

Center for Substance Abuse Treatment. (2007). *The epidemiology of co-occurring substance use and mental disorders. COCE overview paper 8*. DHHS Publication No. (SMA) 07–4308. U.S. Department of Health and Human Services. https://www.addictioncounselorce.com/articles/101550/OP8Epidemiology10-03-

07.pdf

Chen, S.T., Hyun, J., Graefe, A.R., Mowen, A.J., Almeida, D.M., & Sliwinski, M.J. (2022). The influence of leisure engagement on daily emotional well-being. *Leisure Sciences, 44*(7), 995–1012. https://doi.org/10.1080/01490400.2020.1757537

Cherrington, J., Black, J., & Tiller, N. (2020). Running away from the taskscape: Ultramarathon as 'dark ecology'. *Annals of Leisure Research, 23*(2), 243–263. https://doi.org/10.1080/11745398.2018.1491800

Cherry, K. (2022). What is subjective well-being? *Verywell Mind.* https://www.verywellmind.com/what-is-subjective-well-being-5221255

Chudoba, B. (2023). Does adding one more question impact survey completion rate? *Momentive.* https://www.surveymonkey.com/curiosity/survey_questions_and_completion_rates/

Clark, E.G. (1954). Natural history of syphilis and levels of prevention. *The British Journal of Venereal Diseases, 30*(4), 191–197. https://doi.org/10.1136/sti.30.4.191

Cleland, V., Nash, M., Sharman, M. & Claflin, S. (2019). Exploring the health-promotion potential of the "parkrun" phenomenon: What factors are associated with higher levels of participation. *American Journal of Health Promotion, 33*(1), 13–23. https://doi.org/10.1177/0890117118770106

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155–

159. https://doi.org/10.1037/0033-2909.112.1.155

Cohen, C.C., & Shang, J. (2015). Evaluation of conceptual frameworks applicable to the study of isolation precautions effectiveness. *Journal of Advanced Nursing, 71*(10), 2279–2292. https://doi.org/10.1111/jan.12718

Cohen, D.A., & Leuschner, K.J. (2019). How can neighborhood parks be used to increase physical activity? *Rand Health Quarterly, 8*(3), 4.

Coleman, S.J., & Sebire, S.J. (2017). Do people's goals for mass participation sporting events matter? A self-determination theory perspective. *Journal of Public Health, 39*(4), e202–e208. https://doi.org/10.1093/pubmed/fdw090

Cook, J.J. (2018). *The relationship between mental health and ultra-running: A case study* (Publication No. 2850) [Doctoral dissertation, University of Arkansas, Fayetteville]. https://scholarworks.uark.edu/etd/2850

Coon, J.T., Boddy, K., Stein, K., Whear, R., Barton, J., & Depledge, M.H. (2011). Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors? A systematic review. *Environmental Science & Technology, 25*(5), 1761–1772. https://doi.org/10.1021/es102947t

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Sage Publications, Inc.

Cypryanska, M., Nezlek, J.B. (2019). Everyone can be a winner: The benefits of competing in organized races for recreational runners. *The Journal of Positive Psychology, 14*(6), 749–755. https://doi.org/10.1080/17439760.2018.1557244

Dadvand, P., & Nieuwenhuijsen, M. (2019). Green space and health. In P. Dadvand & M. Nieuwenhuijsen (Eds.), *Integrating Human Health into Urban and Transport Planning* (pp.409–423). Springer, Cham. https://doi.org/10.1007/978-3-319-74983-9_20

Dai, C.L., Chen, C.C., Richardson, G.B., & Gordon, H.R. (2020). Managing substance use disorder through a walking/running training program. *Substance Abuse: Research and Treatment, 14*, 1–8. https://doi.org/10.1177/1178221820936681

Dailey, S.F., Parker, M.M., & Campbell, A. (2022). Social connectedness, mindfulness, and coping as protective factors during the COVID-19 pandemic. *Journal of Counseling & Development, 101*(1), 114–126. https://doi.org/10.1002/jcad.12450

Damrongthai, C., Kuwamizu, R., Suwabe, K., Ochi, G., Yamzaki, Y., Fukuie, T., Adachi, K., Yassa, M.A., Churdchomjan, W., & Soya, H. (2021). Benefit of human moderate running boosting mood and executive function coinciding with bilateral prefrontal activation. *Scientific Reports, 11*, 22657. https://doi.org/10.1038/s41598-021-01654-z

De Neve, J.E., Diener, E., Tay, L., & Xuereb, C. (2013). The objective benefits of subjective well-being. In Helliwell, J., Layard, R., & Sachs, J., eds. *World Happiness Report 2013.* New York: UN Sustainable Development Solutions Network., Available at SSRN: https://ssrn.com/abstract=2306651

Diener, E. (1984). Subjective well-being. *Psychological Bulletin, 95*(3), 542–575. https://doi.org/10.1037/0033-2909.95.3.542

Diener, E. (2000). Subjective well-being: The science of happiness and a proposal for a

national index. *American Psychologist, 55*(1), 34–43. https://doi.org/10.1037/0003-066X.55.1.34

Diener, E. (1996). Traits can be powerful, but are not enough: Lessons from subjective well-being. *Journal of Research in Personality*, *30*(3), 389–399. https://doi.org/10.1006/jrpe.1996.0027

Diener, E., & Chan, M.Y. (2011). Happy people live longer: Subjective well-being contributes to health and longevity. *Applied Psychology: Health and Well-Being, 3*(1), 1–43. https://doi.org/10.1111/j.1758-0854.2010.01045.x

Diener, E., & Emmons, R.A. (1984). The independence of positive and negative affect. *Journal of Personality and Social Psychology, 47*(5), 1105–1117. https://psycnet.apa.org/doi/10.1037/0022-3514.47.5.1105

Diener, E., Emmons, R.A., Larsen, R.J., & Griffin, S. (1985). The Satisfaction With Life Scale. *Journal of Personality Assessment, 49*(1), 71–75. https://doi.org/10.1207/s15327752jpa4901_13

Diener, E., Lucas, R. E., & Oishi, S. (2018). Advances and open questions in the science of subjective well-being. *Collabra: Psychology*, *4*(1), 15. https://doi.org/10.1525/collabra.115

Diener, E., Oishi, S., & Lucas, R. E. (2003). Personality, culture, and subjective well-being: Emotional and cognitive evaluations of life. *Annual Review of Psychology*, *54*(1), 403–425. https://doi.org/10.1146/annurev.psych.54.101601.145056

Diener, E., Pressman, S.D., Hunger, J., & Delgadillo-Chase, D. (2017). If, why, and when

subjective well-being influences health, and future needed research. *Applied Psychology: Health and Well-Being, 9*(2), 133–167. https://doi.org/10.1111/aphw.12090

Diener, E., Suh, E., M., Lucas, R.E., & Smith, H.L. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin, 125*(2), 276–302. https://doi.org/10.1037/0033-2909.125.2.276

Edwards, R., Campbell, A., & Porteous, D. (2018). Generation Scotland participant survey on data collection. *Wellcome Open Research*, *4*, 111. https://doi.org/10.12688/wellcomeopenres.15354.2

Eid, M., & Larsen, R.J. (2008). *The science of subjective well-being [electronic resource]*. Guilford Press.

Elliott, L.M. (2019). *Spatial scale and modeling disease transmission risk: The case of malaria in Sub-Saharan Africa and the Kenya highlands* [Bachelor's thesis, Pennsylvania State University]. https://honors.libraries.psu.edu/files/final_submissions/6057

Field, A. (2009). *Discovering statistics using IBM SPSS* (4th Ed.). Sage.

Field, A. (2013). *Statistics using SPSS*. Sage

Frost, W.H. (1976). Some conceptions of epidemics in general. *American Journal of Epidemiology, 103*(2), 141–151. https://doi.org/10.1093/oxfordjournals.aje.a112212

Gaur, P. S., Zimba, O., Agarwal, V., & Gupta, L. (2020). Reporting survey based studies – A primer for authors. *Journal of Korean Medical Science, 35*(45), e398.

https://doi.org/10.3346/jkms.2020.35.e398

Girls on the Run. (2022). *Our impact.* https://www.girlsontherun.org/what-we-do/our-impact/

Glasgow Caledonian University. (2018). *Regular running makes you a happier person.* https://www.gcu.ac.uk/aboutgcu/universitynews/2018-regular-running-makes-you-happier-person

Gorichanaz, T. (2018). Understanding and information constellations in ultrarunning. *Library Trends*, *66*(3), 329–350. https://core.ac.uk/download/pdf/294754865.pdf

Grunseit, A., Richards, J., & Merom, D. (2018). Running on a high: Parkrun and personal well-being. *BMC Public Health, 18*, 59. https://doi.org/10.1186/s12889-017-4620-1

Gulis, G., & Fujino, Y. (2015). Epidemiology, population health, and health impact assessment. *Journal of Epidemiology, 25*(3), 179–180. https://doi.org/10.2188/jea.je20140212

Harman, B., Kosirnik, C., & Antonini Philippe, R. (2019). From social interactions to interpersonal relationships: Influences on ultra-runners' race experience. *PLOS One*, *14*(12), e0225195. https://doi.org/10.1371/journal.pone.0225195

Harper, S. E. (2015). How to analyze Likert and other rating scale data. *Currents in Pharmacy Teaching and Learning*, *7*(6), 836–850. https://doi.org/10.1016/j.cptl.2015.08.001

Harris, A. (2012). Beyond limits: Exploring motivation and the lack of women in

ultramarathoning. *Journal of Undergraduate Research at Minnesota State University, Mankato, (12)*3. https://cornerstone.lib.mnsu.edu/jur/vol12/iss1/3

Heller, D., Watson, D., & Ilies, R. (2004). The role of person versus situation in life Satisfaction: A critical examination. *Psychological Bulletin, 130*(4), 574–600. https://psycnet.apa.org/doi/10.1037/0033-2909.130.4.574

Hespanhol Junior, L.C., Pillay, J.D., van Mechelen, W., & Verhagen, E. (2015). Meta-Analyses of the effects of habitual running on indices of health in physically inactive adults. *Sports Medicine, 45*(10), 1455–1468. https://doi.org/10.1007/s40279-015-0359-y

Hindley, D. (2020). "More than just a run in the park": An exploration of Parkrun as a shared leisure space. *Leisure Sciences, 42*(1), 85–105. https://doi.org/10.1080/01490400.2017.1410741

Hoffman, M.D., & Fogard, D. (2012). Demographic characteristics of 161-km ultramarathon runners. *Research in Sports Medicine, 20*(1), 59–69. https://doi.org/10.1080/15438627.2012.634707

Hoffman, M.D., & Krishnan, E. (2014). Health and Exercise-related medical issues among 1,212 ultramarathon runners: Baseline findings from the ultrarunners longitudinal TRAcking (ULTRA) study. *PLOS One, 9*(1), e83867. https://doi.org/10.1371/journal.pone.0083867

Hoffman, M.D., & Krouse, R. (2017). Ultra-obligatory running among ultramarathon runners. *Research in Sports Medicine, 26*(2), 211–221. https://doi.org/10.1080/15438627.2018.1431533

Hoffman, M.D., Ong, J.C., & Wang, G. (2010). Historical analysis of participation in 161 km ultramarathons in North America. *The International Journal of the History of Sport*, *27*(11), 1877–1891. https://doi.org/10.1080/09523367.2010.494385

Holt-Lunstad, J. (2022). Social connection as a public health issue: The evidence and a systemic framework for prioritizing the "social" in social determinants of health. *Annual Reviews*, *43*, 193–213. https://doi.org/10.1146/annurev-publhealth-052020-110732

Holt-Lunstad, J., Robles, T., & Sbarra, D.A. (2017). Advancing social connection as a public health priority in the United States. *American Psychologist*, *72*(6), 517–530. https://doi.org/10.1037/amp0000103

Holt-Lunstad, J., Smith, T.B., Baker, M., Harris, T., & Stephenson, D. (2015). Loneliness and social isolation as risk factors for mortality: A meta-analytic review. *Perspectives on Psychological Science*, *10*(2), 227–237. https://doi.org/10.1177/1745691614568352

Huerta, M., & Leventhal, A. (2002). The epidemiologic pyramid of bioterrorism. *Israel Medical Association Journal*, *4*(7), 498–502.

Iwon, K., Skibinska, J., Jasielska, D., & Kalwarczyk, S. (2021). Elevating subjective well-being through physical exercises: An intervention study. *Frontiers of Psychology*, *12*, 702678. https://doi.org/10.3389/fpsyg.2021.702678

Janssen, M., Walravens, R., Thibaut, E., Scheerder, J., Brombacher, A., & Vos, S. (2020). Understanding different types of recreational runners and how they use running-related technology. *International Journal of Environmental Research and*

Public Health, *17*(7), 2276. https://doi.org/10.3390/ijerph17072276

John Hopkins Medicine. (2022). *Risks of physical inactivity.* https://www.hopkinsmedicine.org/health/conditions-and-diseases/risks-of-physical-inactivity

Johnson, P. (n.d.). Epidemiology and surveillance in chronic disease prevention and control. *Kennesaw State University.* https://dph.georgia.gov/document/document/epidemiology-and-surveillance/download

Johnson, U., Kentta, G., Ivarsson, A., Alvmyren, I., & Karlsson, M. (2016). An ultra-runner's experience of physical and emotional challenges during a 10-week continental run. *International Journal of Sport and Exercise Psychology, 14*(1), 72–84. https://doi.org/10.1080/1612197X.2015.1035736

Johnson, R. L., Morgan, G.B. (2016). *Survey scales: A guide to development, analysis and reporting.* New York: Guilford Press.

Kaiser Family Foundation. (2021). *Mental health in Texas.* https://www.kff.org/statedata/mental-health-and-substance-use-state-fact-sheets/texas/

Kakouris, N., Yener, N., & Fong, D. T. (2021). A systematic review of running-related musculoskeletal injuries in runners. *Journal of Sport and Health Science*, *10*(5), 513–522. https://www.sciencedirect.com/science/article/pii/S2095254621000454

Kang, H. (2021). Sample size determination and power analysis using the G*Power software. *Journal of Educational Evaluation for Health Professions, 18*, 17.

https://doi.org/10.3352/jeehp.2021.18.17

Kazimierczak, M., Dabrowska, A., Adamczewska, K., & Malchrowicz-Mosko, E. (2020). The impact of modern ultramarathons on shaping the social identity of runners. The case study of Karkonosze winter ultramarathon. *International Journal of Environmental Research and Public Health, 17*(1), 116. https://doi.org/10.3390/ijerph17010116

Keating, L.E., Becker, S., McCabe, K., Whattam, J., Garrick, L., Sassi, R.B., Frey, B.N., & McKinnon, M.C. (2018). Effects of a 12-week running programme in youth and adults with complex mood disorders. *BMJ Open Sport & Exercise Medicine, 4*, e000314. https://doi.org/10.1136/bmjsem-2017-000314

Kemler, E., Blokland, D., Backx, F., & Huisstede, B. (2018). Differences in injury risk and characteristics of injuries between novice and experienced runners over a 4-year period. *The Physician and Sports Medicine, 46*(4), 485–491. https://doi.org/10.1080/00913847.2018.1507410

Keyes, K.M., Kandula, S., Olfson, M., Gould, M.S., Martinez-Ales, G., Rutherford, C., & Shaman, J. (2021). Suicide and the agent-host-environment triad: Leveraging surveillance sources to inform prevention. *Psychological Medicine, 51*(4), 529–537. https://doi.org/10.1017/s003329172000536x

Kim, E.S., Delaney, S.W., Tay, L., Chen, Y., Diener, E., & Vanderweele, T.J. (2021). Life satisfaction and subsequent physical, behavioral, and psychosocial health in older adults. *The Milbank Quarterly, 99*(1), 209–239. https://doi.org/10.1111/1468-0009.12497

Kluitenberg, B., van Middelkoop, M., Diercks, R., & van der Worp, H. (2015). What are the differences in injury proportions between different populations of runners? A systematic review and meta-analysis. *Sports Medicine, 45*, 1143–1161. https://doi.org/10.1007/s40279-015-0331-x

Knechtle, B. (2012). Ultramarathon runners: Nature or nurture? *International Journal of Sports Physiology and Performance, 7*(4), 310–320. http://dx.doi.org/10.5167/uzh-67287

Knechtle, B., & Nikolaidis, P.T. (2018). Physiology and pathophysiology in ultra-marathon running. *Frontiers in Psychology, 9*, 634. https://doi.org/10.3389/fphys.2018.00634

Koop, J. (n.d.). State of the sport: Ultrarunning by the numbers. *CTS.* https://trainright.com/state-sport-ultrarunning-numbers/

Krouse, R.Z., Ransdell, L.B., Lucas, S.M., & Pritchard, M.E. (2011). Motivation, goal orientation, coaching, and training habits of women ultrarunners. *Journal of Strength and Conditioning Research*, 25(10), 2835–2842. https://doi.org/10.1519/JSC.0b013e318204caa0

Kuykendall, L., Lei, X., Tay, L., Cheung, H.K., Kolze, M., Lindsey, A., Silvers, M., & Engelsted, L. (2017). Subjective quality of leisure & worker well-being : Validating measures & testing theory. *Journal of Vocational Behavior, 103*, 14–40. https://doi.org/10.1016/j.jvb.2017.07.007

Kuykendall, L., Tay, L., & Ng, V. (2015). Leisure engagement and subjective well-being: A meta-analysis. *Psychological Bulletin, 141*(2), 364–403.

https://doi.org/10.1037/a0038508

Latkin, C. A., Edwards, C., Davey-Rothwell, M. A., & Tobin, K. E. (2017). The relationship between social desirability bias and self-reports of health, substance use, and social network factors among urban substance users in Baltimore, Maryland. *Addictive Behaviors, 73,* 133. https://doi.org/10.1016/j.addbeh.2017.05.005

Lee, D.C., Pate, R.R., Lavie, C.J., Sui, X., Church, T.S., & Blair, S.N. (2014). Leisure-time running reduces all-cause and cardiovascular mortality risk. *Journal of the American College of Cardiology, 64*(5), 472–481. https://doi.org/10.1016/j.jacc.2014.04.058

Lee, H., & Singh, G. K. (2019). Inequalities in life expectancy and all-cause mortality in the United States by levels of happiness and life satisfaction: A longitudinal study. *International Journal of Maternal and Child Health and AIDS, 9*(3), 305–315. https://doi.org/10.21106/ijma.392

Lee, H., & Singh, G.K. (2020). Marked disparities in cardiovascular disease mortality by levels of happiness and life satisfaction in the United States. *International Journal of Translational Medical Research and Public Health, 4*(2), 170–177. https://doi.org/10.21106/ijtmrph.207

Li, C., Xia, Y., & Zhang, Y. (2022). Relationship between subjective well-being and depressive disorder: Novel findings of cohort variations and demographic heterogeneities. *Frontiers in Psychology, 13,* 1022643. https://doi.org/10.3389/fpsyg.2022.1022643

Lindert, J., Bain, P. A., Kubzansky, L. D., & Stein, C. (2015). Well-being measurement and the WHO health policy Health 2010: Systematic review of measurement scales. *European Journal of Public Health*, *25*(4), 731–740. https://doi.org/10.1093/eurpub/cku193

Liu, B., Floud, S., Pirie, K., Green, J., Peto, R., & Beral, V. (2016). Does happiness itself directly affect mortality? The prospective UK Million Women Study. *Lancet (London, England)*, *387*(10021), 874–881. https://doi.org/10.1016/S0140-6736(15)01087-9

Lombardo, P., Jones, W., Wang, L., Shen, X., & Goldner, E.M. (2018). The fundamental association between mental health and life satisfaction: Results from successive waves of a Canadian national survey. *BMC Public Health*, *18*(342). https://doi.org/10.1186/s12889-018-5235-x

Lopez-Ortega, M., Torres-Castro, S. & Rosas-Carrasco, O. (2016). Psychometric properties of the Satisfaction With Life Scale (SWLS): Secondary analysis of the Mexican Health and Aging Study. *Health Quality Life Outcomes*, *14*, 170. https://doi.org/10.1186/s12955-016-0573-9

Lopez-Ruiz, R., Huete-Alcocer, N., Alfaro-Navarro, L., & Nevado-Peña, D. (2020). The relationship between happiness and quality of life: A model for Spanish society. *PLOS ONE*, *16*(11). https://doi.org/10.1371/journal.pone.0259528

Lyotard, J.F. (1989). Scapeland. In A. Benjamin (Ed.). *The Lyotard Reader* (pp. 212–219). Basil Blackwell.

Magyar-Moe, J. L. (2009). Positive psychological tests and measures. In Jeana L.

Magyar-Moe (Eds.), *Therapist's Guide to Positive Psychological Interventions*, 43–72. Academic Press. https://doi.org/10.1016/B978-0-12-374517-0.00003-6

Malcolm, C. (2021). Pacers: The science behind the ultra luxury. *I Run Far.* https://www.irunfar.com/pacers-the-science-behind-the-ultra-luxury

Marconcin, P., Werneck, A.O., Peralta, M., Ihle, A., Gouveia, E.R., Ferrari, G., Sarmento, H., & Marques, A. (2022). The association between physical activity and mental health during the first year of the COVID-19 pandemic: A systematic review. *BMC Public Health*, *22*, 209. https://doi.org/10.1186/s12889-022-12590-6

Martin-Maria., N., Miret, M., Caballero, F.F., Rico-Uribe, L.A., Steptoe, A., Chatterji, S., & Ayuso-Mateos, J.L. (2017). The impact of subjective well-being on mortality: A meta-analysis of longitudinal studies in the general population. *Psychosomatic Medicine*, *79*(5), 565–575. https://doi.org/10.1097/psy.0000000000000444

Martinez, C.T., & Scott, C. (2016). Trail and ultrarunning: The impact of distance, nature, and personality on flow and well-being. *Psi Chi Journal of Psychological Research*, *21*(1), 6–15.

Martino, J., Pegg, J., & Frates, E.P. (2017). The connection prescription: Using the power of social interactions and the deep desire for connectedness to empower health and wellness. *American Journal of Lifestyle Medicine, 11*(6), 466–475. https://doi.org/10.1177/1559827615608788

Maslow, A.H. (1943). A theory of human motivation. *Psychological Review, 50*(4), 370–396.

Masters, N. (2014). Parkrun eases the loneliness of the long-distance runner. *British*

Journal of General Practice, 64(625), 408. https://doi.org/10.3399/bjgp14X681025

McGannon, K. R., L'Estrange, M., & McMahon, J. (2020). The role of ultrarunning in drug and alcohol addiction recovery: An autobiographic study of athlete journeys. *Psychology of Sport and Exercise, 46,* 101585. https://www.sciencedirect.com/science/article/abs/pii/S1469029219304649

McMahan, E.A. (2018). Happiness comes naturally: Engagement with nature as a route to positive subjective well-being.

Merriam, D., Bality, A., Stein, J., & Boehmer, T. (2017). Improving public health through public parks and trails: Eight common measures. Summary Report. *US Department of Health and Human Services, Centers for Disease Control and Prevention and US Department of the Interior, National Park Service.* https://npgallery.nps.gov/RTCA/GetAsset/f09e69fc-2696-45e8-b4d5-90e4cea5e689

Merrill, R.M. (2017). *Introduction to Epidemiology* (7th ed.). Jones and Bartlett Learning.

Miller, C. A., D. Guidry, J. P., Dahman, B., & Thomson, M. D. (2020). A tale of two diverse Qualtrics samples: Information for online survey researchers. *Cancer Epidemiology, Biomarkers & Prevention: A publication of the American Association for Cancer Research, cosponsored by the American Society of Preventive Oncology*, *29*(4), 731–735. https://doi.org/10.1158/1055-9965.EPI-19-0846

Miller, R.E. (2002*). Epidemiology for health promotion and disease prevention*

professionals. The Haworth Press.

Morabia, A. (2013). Snippets from the past: The evolution of Wade Hampton Frost's epidemiology as viewed from the American Journal of Hygiene/Epidemiology. *American Journal of Epidemiology, 178*(7), 1013–1019. https://doi.org/10.1093/aje/kwt199

Morris, P., & Scott, H. (2019). Not just a run in the park: A qualitative exploration of parkrun and mental health. *Advances in Mental Health, 17*(2), 110–123. https://doi.org/10.1080/18387357.2018.1509011

Mulvad, B., Nielsen, R.O., Lind, M., & Ramskov, D. (2018). Diagnoses and time to recovery among injured recreational runners in the Run Clever trial. *PLOS One, 13*(10), e0204742. https://doi.org/10.1371/journal.pone.0204742

Nakamura, J.S., Delaney, S.W., Diener, E., VanderWeele, T.J., & Kim, E.S. (2021). Are all domains of life satisfaction equal? Differential associations with health and well-being in older adults. *Quality of Life Research, 31*, 1043–1056. https://doi.org/10.1007/s11136-021-02977-0

National Alliance on Mental Illness. (2021). *Mental health by the numbers.* https://www.nami.org/mhstats#:~:text=22.8%25%20of%20U.S.%20adults%20experienced,represents%201%20in%2020%20adults.

National Health Service. (n.d.). *Get running with couch to 5k.* https://www.nhs.uk/live-well/exercise/running-and-aerobic-exercises/get-running-with-couch-to-5k/

Natt och Dag, Y., Engström, G., & Rosvall, M. (2022). Life satisfaction and coronary atherosclerosis: The SCAPIS study. *Journal of Psychosomatic Research, 152*,

110663. https://doi.org/10.1016/j.jpsychores.2021.110663

Newman, D.B., Tay, L., & Diener, E. (2014). Leisure and subjective well-being: A model of psychological mechanisms as mediating factors. *Journal of Happiness Studies: An Interdisciplinary Forum on Subjective Well-Being, 15*(3), 555–578. https://doi.org/10.1007/s10902-013-9435-x

Nielsen Sports. (2021). *Recreational running consumer research study.* https://assets.aws.worldathletics.org/document/60b741d388549ceda6759894.pdf

Nima, A. A., Cloninger, K. M., Persson, B. N., Sikström, S., & Garcia, D. (2020). Validation of subjective well-being measures using item response theory. *Frontiers in Psychology, 10*. https://doi.org/10.3389/fpsyg.2019.03036

Oborny, J. (2016). Opinions of veteran runners on the influence between long-distance running and holistically interpreted health. *Acta Facultatis Educationis Physicae Universitatis Comenianae*, 56(2), 93–106. https://doi.org/10.1515/afepuc-2016-0008

Office of Disease Prevention and Health Promotion. (n.d.). Health insurance. *Healthy People 2030.* U.S. Department of Health and Human Services. https://health.gov/healthypeople/objectives-and-data/browse-objectives/health-insurance#:~:text=Healthy%20People%202030%20focuses%20on,to%20have%20poor%20health%20outcomes.

Office of Disease Prevention and Health Promotion. (n.d. -a). Health-related quality of life & well-being. *Healthy People 2020.* U.S. Department of Health and Human Services. https://www.healthypeople.gov/2020/topics-objectives/topic/health-

related-quality-of-life-well-being

Office of Disease Prevention and Health Promotion. (n.d. -b). Mental health and mental disorders. *Healthy People 2030.* U.S. Department of Health and Human Services. https://health.gov/healthypeople/objectives-and-data/browse-objectives/mental-health-and-mental-disorders

Office of Disease Prevention and Health Promotion. (n.d. -c). Overall health and well-being measures. *Healthy People 2030.* U.S. Department of Health and Human Services. https://health.gov/healthypeople/objectives-and-data/overall-health-and-well-being-measures#cit1

Oleckno, W.A. (2002). *Essential epidemiology: Principles and applications.* Waveland Press, Inc.

Organisation for Economic Co-operation and Development. (2020). *How's life? 2020: Measuring well-being.* OECD Publishing. https://www.oecd.org/wise/how-s-life-23089679.htm

Osborne, J.W., & Overbay, A. (2004). The power of outliers (and why researchers should always check for them). *Practical Assessment, Research & Evaluation, 9*. http://PAREonline.net/getvn.asp?v=9&n=6

Oswald, F., Campbell, J., Williamson, C., Richards, J., & Kelly, P. (2020). A scoping review of the relationship between running and mental health. *International Journal of Environmental Research and Public Health, 17*(21), 8059. https://doi.org/10.3390/ijerph17218059

Quicke, J.M. (2017). *The phenomenon of community: A qualitative study of the*

ultrarunning community (Publication No. 10276702) [Doctoral dissertation, Prescott College]. https://www.proquest.com/dissertations-theses/phenomenon-community-qualitative-study/docview/1904927429/se-2

Park, J. H., Moon, J. H., Kim, H. J., Kong, M. H., & Oh, Y. H. (2020). Sedentary lifestyle: Overview of updated evidence of potential health risks. *Korean Journal of Family Medicine*, *41*(6), 365–373. https://doi.org/10.4082/kjfm.20.0165

Park, K., Kim, H., and Chung, I.Y. (2019). Bottom-up theory of life satisfaction by running event participants. *E-Review of Tourism Research*, *16*(6). https://ertr-ojs-tamu.tdl.org/ertr/article/view/435

Patino, C. M., & Ferreira, J. C. (2018). Internal and external validity: Can you apply research study results to your patients? *Jornal Brasileiro de Pneumologia*, *44*(3), 183. https://doi.org/10.1590/S1806-37562018000000164

Paul, E., Bu, F., & Fancourt, D. (2021). Loneliness and risk for cardiovascular disease: Mechanisms and future directions. *Current Cardiology Reports, 23*(6), 68. https://doi.org/10.1007/s11886-021-01495-2

Pavot, W., & Diener, E. (1993). Review of the Satisfaction With Life Scale. *Psychological Assessment, 5*, 164–172.

Pavot, W., & Diener, E. (2008). The Satisfaction With Life Scale and the emerging construct of life satisfaction. *The Journal of Positive Psychology, 3*(2), 137–152. http://dx.doi.org/10.1080/17439760701756946

Pedisic, Z., Shrestha, N., Kovalchik, S., Stamatakis, E., Liangruenrom, N., Grgic, J., Titze, S., Biddle, S.J., Bauman, A.E., & Oja, P. (2020). Is running associated with

a lower risk of all-cause, cardiovascular and cancer mortality, and is the more the better? A systematic review and meta-analysis. *British Journal of Sports Medicine, 54*(15), 898–905. https://doi.org/10.1136/bjsports-2018-100493

Pereira, H.V., Palmeira, A.L., Encantado, J., Marques, M.M., Santo, I., Carraca, E.V., & Teixeira, P.J. (2021). Systematic review of psychological and behavioral correlates of recreational running. *Frontiers in Psychology, 12,* 624783. https://doi.org/10.3389/fpsyg.2021.624783

Pereira Vargas, M. L. F., Papathomas, A., Williams, T. L., Kinnafick, F. E., & Rhodes, P. (2021). Diverse paradigms and stories: mapping 'mental illness' in athletes through meta-study. *International Review of Sport and Exercise Psychology*, 1–27. http://doi/org/10.1080/1750984X.2021.2001840

Piper, K., Wainwright, N., Emanuel, L., & Williams, A. (2022). Well-being resources and mass participation sprots events in Pembrokeshire. *Event Management, 26,* 59–72. https://doi.org/10.3727/152599521X16192004803610

Plateau, C.R., Anthony, J., Clemes, S.A., & Stevinson, C.D. (2022). Prospective study of beginner running groups: Psychological predictors and outcomes of participation. *Behavioral Medicine.* https://doi.org/10.1080/08964289.2022.2100865

Popov, S., Sokić, J., & Stupar, D. (2019). Relations between motivation for long-distance running and emotional well-being. *Psihologija, 52*(2), 139–154. https://doi.org/10.2298/PSI180605032P

Pressman, S.D., Matthews, K., Cohen, S., Martire, L.M., Scheier, M., Baum, A., & Schulz, R. (2009). Association of enjoyable leisure activities with psychological

and physical well-being. *Psychosomatic Medicine, 71*(7), 725–732. https://doi.org/10.1097/psy.0b013e3181ad7978

Pryor, B. (2022). Unlocking the "why": The science behind what motivates ultrarunners. *Trailrunner.* https://www.trailrunnermag.com/people/culture-people/unlocking-why-science-behind-ultrarunner-motivation/

Quirk, H., Bullas, A., Haake, S., Goyder, E., Graney, M., Wellington, C., Copeland, R., Reece, L., & Stevinson, C. (2021). Exploring the benefits of participation in community-based running and walking events: A cross-sectional survey of parkrun participants. *BMC Public Health, 21*, 1978. https://doi.org/10.1186/s12889-021-11986-0

Rehm, J., & Shield, K.D. (2019). Global burden of disease and the impact of mental and addictive disorders. *Current Psychiatry Reports, 21*(2), 1–7. https://doi.org/10.1007/s11920-019-0997-0

Renfree, A., Crivoi do Carmo, E., & Martin, L. (2016). The influence of performance level, age and gender on pacing strategy during a 100-km ultramarathon. *European Journal of Sport Science, 16*(4), 409–415. https://doi.org/10.1080/17461391.2015.1041061

Rizzo, N. (2021a). Fitness trends 2021: New trends in fitness [Global Report]. *RunRepeat.* https://runrepeat.com/fitness-trends

Rizzo, N. (2021b). Scientific benefits of exercise [research review]. *Run Repeat.* https://runrepeat.com/benefits-of-exercise

Roebuck G.S., Fitzgerald, P.B., Urquhart, D.M., Ng, S.K., Cicuttini, F.M., & Fitzgibbon,

B.M. (2018). The psychology of ultra-marathon runners: A systematic review. *Psychology of Sport and Exercise, 37,* 43–58. https://doi.org/10.1016/j.psychsport.2018.04.004

Rogerson, M., Brown, D.K., Sandercock, G., Wooller, J.J., & Barton, J. (2015). A comparison of four typical green exercise environments and prediction of psychological health outcomes. *Perspectives in Public Health, 136*(3), 171–180. https://doi.org/10.1177/1757913915589845

Ronto, P. (2021a). Exercise is up 88% during COVID-19 [12,913 person study]. *RunRepeat.* https://runrepeat.com/exercise-covid-19-study

Ronto, P. (2021b). The state of ultra running 2020. *RunRepeat.* https://runrepeat.com/state-of-ultra-running

Rosella, L. C., Fu, L., Buajitti, E., & Goel, V. (2019). Death and chronic disease risk associated with poor life satisfaction: A population-based cohort study. *American Journal of Epidemiology*, *188*(2), 323–331. https://doi.org/10.1093/aje/kwy245

Royal College of General Practitioners. (n.d.). *Parkrun practice*. https://r1.dotdigital-pages.com/p/49LX-52M/parkrunpractice

Ryan, R.M., & Deci, E.L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Salazar, N., & Scheerder, J. (Eds.). (2022). *Contemporary meanings of endurance: An interdisciplinary approach* (1st ed.). Routledge. https://doi.org/10.4324/9781003321842

Sato, M., Jordan, J.S., & Funk, D.C. (2016). A distance-running event and life satisfaction: The mediating roles of involvement. *Sport Management Review, 19*(5), 536–549. https://doi.org/10.1016/j.smr.2016.04.001

Sato, M., Jordan, J.S., & Funk, D.C. (2015). Distance running events and life satisfaction: A longitudinal study. *Journal of Sport Management, 29,* 347–361. http://dx.doi.org/10.1123/jsm.2013-0164

Sato, M., Jordan, J.S., & Funk, D.C. (2014). The role of physically active leisure for enhancing quality of life. *Leisure Sciences: An Interdisciplinary Journal, 36*(3), 293–313. https://doi.org/10.1080/01490400.2014.886912

Scheerder, J., Breedveld, K., and Borgers, J. (2015). *Running across Europe. The rise and size of one of the largest sport markets.* Palgrave Macmillan. https://doi.org/10.1057/9781137446374

Schnohr, P., Marott, J.L., Lange, P., & Jensen, G.B. (2013). Longevity in male and female joggers: The Copenhagen City Heart Study. *American Journal of Epidemiology, 177*(7), 683–689. https://doi.org/10.1093/aje/kws301

Setia, M.S. (2016). Methodology series module 3: Cross-sectional studies. *Indian Journal of Dermatology, 61*(3), 261–264. https://doi.org/10.4103/0019-5154.182410

Shah, N., Cader, M., Andrews, W.P., Wijesekera, D., & Stewart-Brown, S.L. (2018). Responsiveness of the Short Warwick Edinburgh Mental Well-Being Scale (SWEMWBS): Evaluation a clinical sample. *Health and Quality of Life Outcomes, 16*(239). https://doi.org/10.1186/s12955-018-1060-2

Shipway, R., & Holloway, I. (2010). Running free: embracing a healthy lifestyle through

distance running. *Perspectives in Public Health*, *130*(6), 270–276. https://doi.org/10.1177/1757913910379191

Shor, E., & Roelfs, D.J. (2015). Social contact frequency and all-cause mortality: A meta-analysis and meta-regression. *Social Science & Medicine*, *128*, 76–86. https://doi.org/10.1016/j.socscimed.2015.01.010

Sifers, S.K., & Shea, D.N. (2013). Evaluations of Girls on the Run/Girls on Track to enhance self-esteem and well-being. *Journal of Clinical Sport Psychology*, *7*(1), 77–85. https://doi.org/10.1123/jcsp.7.1.77

Silva, R.A., Rogers, K., & Buckley, T.J. (2018). Advancing environmental epidemiology to assess the beneficial influence of the natural environment on human health and well-being. *Environmental Science & Technology*, *52*(17), 9545–9555. https://doi.org/10.1021/acs.est.8b01781

Simpson, D., Post, P.G., Young, G., & Jensen, P.R. (2014). "It's not about taking the easy road": The experiences of ultramarathon runners. *Sport Psychologist*, *28*, 176–185. http://dx.doi.org/10.1123/tsp.2013-0064

Smiley, J.R. (2009). Satisfaction With life scale (SWLS). *University of Illinois at Urbana-Champaign.* http://labs.psychology.illinois.edu/~ediener/contacts.html

Smiley, A., Ramos, W.D., Elliott, L.M., & Wolter, S.A. (2020). Association between trail use and self-rated wellness and health. *BMC Public Health*, *20*, 128. https://doi.org/10.1186/s12889-020-8273-0

Smith, M.N. (1986). The best possible condition for nature to act upon host-agent environment relationships. *AAOHN Journal*, *34*(3), 120–121.

https://doi.org/10.1177/216507998603400304

Smiti, A. (2020). A critical overview of outlier detection methods. *Computer Science Review*, *38*, 100306. https://doi.org/10.1016/j.cosrev.2020.100306

Steptoe, A. (2019). Happiness and health. *Annual Review of Public Health, 40*, 339–359. https://doi.org/10.1146/annurev-publhealth-040218-044150

Stevinson, C., & Hickson, M. (2014). Exploring the public health potential of a mass community participation event. *Journal of Public Health, 36*(2), 268–274. https://doi.org/10.1093/pubmed/fdt082

Stewart-Brown, S.L. (2021). *15 Years on: Insights and reflections on the Warwick-Edinburgh Mental Wellbeing Scales (WEMWBS).* https://whatworkswellbeing.org/wp-content/uploads/2021/11/Measuring-Wellbeing-Series-Sarah-Stewart-Brown_final.pdf

Stewart-Brown, S.L, & Janmohamed, K. (2008). Warwick-Edinburgh Mental Well-Being Scale (WEMWBS). *Warwick Medical School University of Warwick.* http://www.mentalhealthpromotion.net/resources/user-guide.pdf

Stewart-Brown, S.L., Platt, S., Tennant, A., Maheswaran, H., Parkinson, J., Weich, S., Tennant, R., Taggart, F., & Clarke, A. (2011). The Warwick-Edinburgh Mental Well-being Scale (WEMWBS): A valid and reliable tool for measuring mental well-being in diverse populations and projects. *Journal of Epidemiology & Community Health*, *65*(Suppl_2 Suppl 1), A38–A39. https://doi.org/10.1136/jech.2011.143586.86

Stewart-Brown, S.L, Samaraweera, P.C., Taggart, F., Kandala, N.B., & Stranges, S.

(2015). Socioeconomic gradients and mental health: Implications for public health. *The British Journal of Psychiatry, 206*, 461–465. https://doi.org/10.1192/bjp.bp.114.147280

Substance Abuse and Mental Health Services Administration. (2023). *What is mental health?* https://www.samhsa.gov/mental-health

Taggart, F., Stewart-Brown, S., & Parkinson, J. (2015). Warwick-Edinburgh Mental Well-being Scale (WEMWBS). *NHS Health Scotland.* https://s3.amazonaws.com/helpscout.net/docs/assets/5f97128852faff0016af3a34/attachments/5fe10a9eb624c71b7985b8f3/WEMWBS-Scale.pdf

Tennant, R., Hiller, L., Fishwick, R., Platt, S., Joseph, S., Weich, S., Parkinson, J., Secker, J., & Stewart-Brown, S. (2007). The Warwick-Edinburgh Mental Well-being Scale (WEMWBS): Development and UK validation. *Health and Quality of Life Outcomes, 5*, 63. https://doi.org/10.1186/1477-7525-5-63

Thompson, W., & Nequin, N. (1983). Ultrarunners-Who are they? *Ultrarunning, 3*, 22–23. https://subscriber.ultrarunning.com/archive/article/ultrarunners-who-are-they

Thompson, W.R., Sallis, R., Joy, E., Jaworski, C.A., Stuhr, R.M., & Trilk, J.L. (2020). Exercise is medicine. *American Journal of Lifestyle Medicine, 14*(5), 511–523. https://doi.org/10.1177/1559827620912192

Thomsen, J.M., Powell, R.B., & Monz, C. (2018). A systematic review of the physical and mental health benefits of wildland recreation. *Journal of Park & Recreation Administration, 36*(1), 123–148. https://doi.org/10.18666/JPRA-2018-V36-I1-8095

Tiller, N.B., Stewart, G.M., Illidi, C.R., & Levine, B.D. (2020). Exercise is medicine? The cardiorespiratory implications of ultra-marathon. *Current Sports Medicine Reports, 19*(8), 290–297. https://doi.org/10.1249/jsr.0000000000000738

Uhan, J. (2022). First principles approaches for ultrarunning challenges. *I Run Far.* https://www.irunfar.com/first-principles-approaches-for-ultrarunning-challenges

UltraRunning Magazine. (2023). *Events past 110 mi.* https://ultrarunning.com/calendar/?refinementList%5Bdistances.group%5D%5B0%5D=110%20mi.%20%2B

UltraRunning Magazine. (2013). *What is ultra running?* https://ultrarunning.com/features/what-is-ultra-running/

U.S. Department of Health and Human Services. (n.d.). *Health People 2030: Social determinants of health.* https://health.gov/healthypeople/priority-areas/social-determinants-health

Van Den Berg, A.E., Joye, Y., & de Vries, S. (2013). Health benefits of nature. In A.E. Van Den Berg, Y. Joye, & S. de Vries (Eds.), *Environmental Psychology: An Introduction* (pp.47–66). John Wiley & Sons, Inc.

VanderWeele, T.J., Hawkley, L.C., & Cacioppo, J.T. (2012). On the reciprocal association between loneliness and subjective well-being. *American Journal of Epidemiology, 176*(9), 777–784. https://doi.org/10.1093/aje/kws173

Veenhoven, R. (1996). The study of life satisfaction. In W.E. Saris, R. Veenhoven, A.C. Scherpenzeel, & B. Bunting (Eds.), *A Comparative Study of Satisfaction with Life in Europe* (11–48). Eotvos University Press.

Veldhuis, C.B., Stuart, E., & Fallin, M.D. (2021). Five urgent public health policies to combat the mental health effects of COVID-19. *Health Affairs.* https://www.healthaffairs.org/do/10.1377/forefront.20210122.959001

Walden University. (2023). *Social change.* https://www.waldenu.edu/why-walden/social-change

Warburton, D.E., & Bredin, S.S. (2017). Health benefits of physical activity: A systematic review of current systematic reviews. *Current Opinion in Cardiology, 32*(5), 541–556. http://dx.doi.org/10.1097/HCO.0000000000000437

Warwick Medical School. (2020). *The Warwick-Edinburgh Mental Wellbeing Scales – WEMWBS.* https://warwick.ac.uk/fac/sci/med/research/platform/wemwbs/

Waskiewicz, Z., Nikolaidis, P.T., Chalabaev, A., Rosemann, T., & Knechtle, B. (2019). Motivation in ultra-marathon runners. *Psychology Research and Behavior Management, 12*, 31–37. https://doi.org/10.2147/prbm.s189061

Watkins, R. (2017). *The far reaches of the mind: Psychological experiences that contribute to willpower and perseverance of runners during a 100-mile ultramarathon* (Publication No. 10286341) [Doctoral dissertation, Alliant International University]. https://www.proquest.com/dissertations-theses/far-reaches-mind-psychological-experiences-that/docview/1914893400/se-2

White, M. P., Alcock, I., Grellier, J., Wheeler, B.W., Hartig, T., Warber, S.L., Bone, A., Depledge, M.H., & Fleming, L.E. (2019). Spending at least 120 minutes a week in nature is associated with good health and wellbeing. *Scientific Reports, 9*, 7730. https://doi.org/10.1038/s41598-019-44097-3

Wilde, M.H. (1997). Long-term indwelling urinary catheter cares: Conceptualizing the research base. *Journal of Advanced Nursing*, *25*(6), 1252–1261.

Wirnitzer, K., Boldt, P., Wirnitzer, G., Leitzmann, C., Tanous, D., Motevalli, M., Rosemann, T., & Knechtle, B. (2022). Health status of recreational runners over 10-km up to ultra-marathon distance based on data of the NURMI Study Step 2. *Scientific Reports, 12*, 10295. https://doi.org/10.1038/s41598-022-13844-4

World Health Organization. (2023). *Coronavirus disease (COVID-19) pandemic.* https://www.who.int/europe/emergencies/situations/covid-19

World Health Organization. (2012). *The World Health Organization quality of life (WHOQOL).* https://www.who.int/publications/i/item/WHO-HIS-HSI-Rev.2012.03

World Health Organization. (2023). *WHOQOL: Measuring quality of life.* https://www.who.int/tools/whoqol

Yang, Z., Chen, S., Bao, R., Li, R., Bao, K., Feng, R., Zhong, Z., & Wang, X. (2022). Public health concern on sedentary behavior and cardiovascular disease: A bibliometric analysis of literature from 1990 to 2022. *Medicina*, *58*(12), 1764. https://doi.org/10.3390/medicina58121764

Yelpaze, I., Deniz, M.E., & Satici, B. (2021). Association between social connectedness and well-being: A study of the mediating role of psychological vulnerability. *Turkish Psychological Counseling and Guidance Journal*, *11*(62), 367–382. https://doi.org/10.17066/tpdrd.1001712

Zangirolami-Raimundo, J., de Oliveira Echeimberg, J., & Leone, C. (2018). Research

methodology topics: Cross-sectional studies. *Journal of Human Growth and Development, 28*(3), 356–360.

Zastrow, R.I. (2011). Emerging infectious: The contact precautions controversy. *American Journal of Nursing, 111*(3), 47–53.

Zong, Z. (2023). How often should you use email reminders? *Momentive.* https://www.surveymonkey.com/curiosity/how-often-should-you-use-email-reminders/

Zurawik, M.A. (2020). Socio-environmental influences on Nordic walking participation and their implications for well-being. *Journal of Outdoor Recreation and Tourism, 29,* 100285. https://doi.org/10.1016/j.jort.2020.100285

Appendix A: Invitation Template for Email, Social Media, and Flyers

There is a new study about participation in competitive and non-competitive running and how it can improve subjective well-being and life satisfaction. This study seeks to examine the relationship between ultrarunning status, subjective well-being and life satisfaction among adult runners in the United States. You are invited to complete a 15-minute anonymous survey.

Seeking volunteers that meet these requirements:

- 18 years old or older
- Resides in the United States
- Study participants must either:
    a) identify as "runners," for example, have been running for at least one year recreationally or non-competitively in any distance under the marathon; or
    b) identify as "ultrarunners," for example, have completed one or more races longer than the marathon in the past year.

This study is part of the doctoral program for Raquel Ramirez Hernandez, a doctoral student at Walden University. The survey will be open until the end of November. Questions should be directed to raquel.hernandez@waldenu.edu

Please click here to view the consent form and begin the survey.

Appendix B: Participant Eligibility Questions

1. Are you age 18 or older?
    - ☐ Yes (If selected, please answer question 2)
    - ☐ No (If selected, thank you for your time. However, you do not meet the eligibility criteria.)
2. Do you reside outside the United States?
    - ☐ Yes (If selected, thank you for your time. However, you do not meet the eligibility criteria.)
    - ☐ No (If selected, please answer question 3)
3. Do you identify as a "runner" for example, have been running for at least one year recreationally or non-competitively or competitively in any distance under the marathon?
    - ☐ Yes (If selected, please proceed to inform consent)
    - ☐ No (If selected, please answer question 4)
4. Do you identify as an "ultrarunner" for example, have completed one or more race longer than the marathon in the past year?
    - ☐ Yes (If selected, please proceed to inform consent)
    - ☐ No (If selected, thank you for your time. However, you do not meet the eligibility criteria.)

Appendix C: Participant Demographic Questionnaire

1. What is your sex?
    - □ Male
    - □ Female
    - □ Prefer not to answer
    - □ Other
2. What is your age?
    - □ 18 to 40 years
    - □ 41 years and older
3. What is your race/ethnicity?
    - □ Hispanic
    - □ Black
    - □ White
    - □ Other
4. What is your income level?
    - □ Less than $50,000 a year
    - □ More than $50,000 a year
5. What is your level of education?
    - □ Less than high school
    - □ High school diploma
    - □ Undergraduate degree
    - □ Graduate degree or above

Appendix D: Warwick Edinburgh Mental Well-Being Scale

Below is a survey that includes 14 statements with a rating from 1 to 5. Please complete the survey using a 5-point system with 1 being "None of the time" and 5 being "All of the time."

The Warwick-Edinburgh Mental Well-being Scale (WEMWBS)

Below are some statements about feelings and thoughts.
Please tick the box that best describes your experience of each over the last 2 weeks

STATEMENTS	None of the time	Rarely	Some of the time	Often	All of the time
I've been feeling optimistic about the future	1	2	3	4	5
I've been feeling useful	1	2	3	4	5
I've been feeling relaxed	1	2	3	4	5
I've been feeling interested in other people	1	2	3	4	5
I've had energy to spare	1	2	3	4	5
I've been dealing with problems well	1	2	3	4	5
I've been thinking clearly	1	2	3	4	5
I've been feeling good about myself	1	2	3	4	5
I've been feeling close to other people	1	2	3	4	5
I've been feeling confident	1	2	3	4	5
I've been able to make up my own mind about things	1	2	3	4	5
I've been feeling loved	1	2	3	4	5
I've been interested in new things	1	2	3	4	5
I've been feeling cheerful	1	2	3	4	5

Appendix E: Satisfaction With Life Scale

Below is a short survey that includes five statements. Please complete the survey using a 7-point system with 1 being “strongly disagree” and 7 being “strongly agree.”

Below are five statements that you may agree or disagree with. Using the 1 - 7 scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding.

- 7 - Strongly agree
- 6 - Agree
- 5 - Slightly agree
- 4 - Neither agree nor disagree
- 3 - Slightly disagree
- 2 - Disagree
- 1 - Strongly disagree

____ In most ways my life is close to my ideal.

____ The conditions of my life are excellent.

____ I am satisfied with my life.

____ So far I have gotten the important things I want in life.

____ If I could live my life over, I would change almost nothing.

- 31 - 35 Extremely satisfied
- 26 - 30 Satisfied
- 21 - 25 Slightly satisfied
- 20 Neutral
- 15 - 19 Slightly dissatisfied
- 10 - 14 Dissatisfied
- 5 - 9 Extremely dissatisfied

Diener, E., Emmons, R.A., Larsen, R.J., & Griffin, S. (1985). The Satisfaction With Life Scale. *Journal of Personality Assessment, 49*(1), 71–75. https://doi.org/10.1207/s15327752jpa4901_13

Appendix F: Survey Exit Pages

Exit Page for Ineligible Participants

Thank you for your interest and time seeking to participate in the research study. Unfortunately, at this time, you do not meet the inclusion criteria for continued participation.

Exit Page for Eligible Participants

Thank you for your time and effort in completing this research survey. While your personal benefit from its completion may have been minimal, your participation will offer a better understanding of the relationship between running, subjective well-being, and life satisfaction. I wish you health and happiness.

Appendix G: Notification Message for WEMWBS Survey

Dear Licensure Team,
I am a doctoral student from Walden University writing my dissertation tentatively titled, *More than Miles: The Relationship Between Ultrarunning Status, Subjective Well-Being, and Life Satisfaction*, under the direction of my dissertation committee chair. I have found your survey, the Warwick Edinburgh Mental Wellbeing Scale (WEMWBS) as a fitting survey to use for my study. With this letter, I am requesting that I may use your survey instrument. I will provide full credit to the original source. I have found the registration to use your survey instrument for non-commercial use at this link: https://warwick.ac.uk/fac/sci/med/research/platform/wemwbs/using

I plan to follow the steps of registration, obtain the appropriate license for intended use, and follow appropriate Commercial License Terms and Conditions.

In seeking my degree in Public Health Epidemiology, the potential benefits of using your survey with my study will include a better understanding of the relationship between ultrarunning status and subjective well-being. Based on my research, there is a gap in the literature that illustrates the relationship between these variables, and thus, the 14-item scale WEMWBS is the perfect survey to measure the full picture of mental well-being for my target population. I look forward to next steps in the use of your survey.

Thank you,

Raquel R. Hernandez, MPH
Doctoral Candidate, Walden University
[redacted]
Raquel.hernandez@waldenu.edu

Appendix H: Taylor and Francis Group LLC Permission Agreement

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NEW WORK DETAILS

Title	Relationship between ultrarunning status, subjective well-being, and life satisfaction	**Institution Name**	Walden University
		Expected Presentation Date	2023-06-26
Instructor Name	Dr. Shawn Munford		

ADDITIONAL DETAILS

Order Reference Number	N/A	**The Requesting Person/Organization to Appear on the License**	Raquel R. Hernandez, PhD Doctoral student at Walden University

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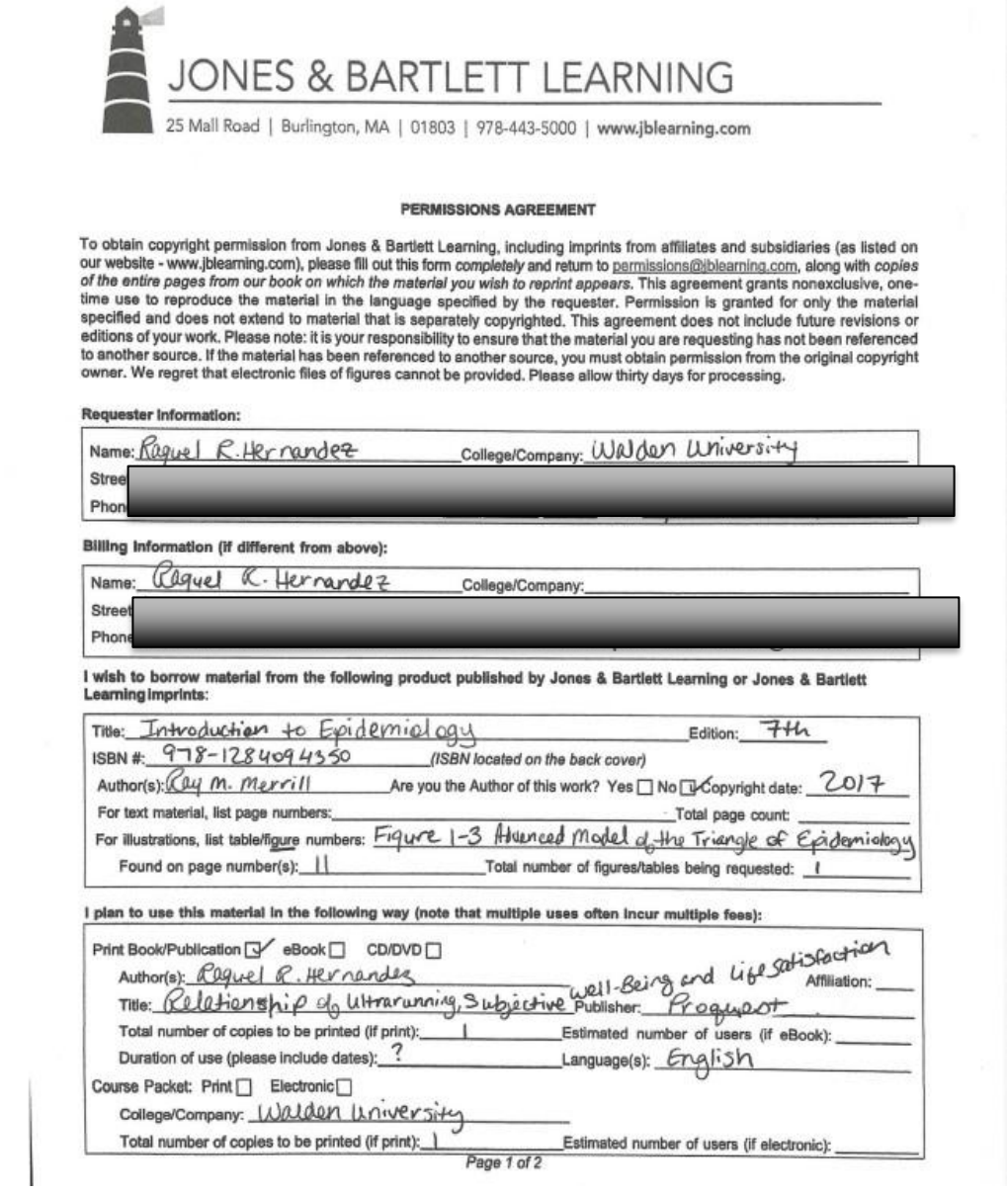

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Appendix J: WEMWBS Non-Commercial License

Submission (ID: 586442747) receipt for the submission of /fac/sci/med/research/platform/wemwbs/using/non-commercial-licence-registration

no-reply@warwick.ac.uk <no-reply@warwick.ac.uk>
Fri 9/8/2023 2:00 PM
To:Raquel Hernandez [redacted]

Thank you for completing the registration for a Licence to use WEMWBS for non-commercial purposes.
You now have access to the scales and the associated resources here on our website: https://warwick.ac.uk/wemwbs/using/register/resources
We suggest you bookmark this page for future reference.
The information declared on your Registration Form is documented below. Please retain a copy of this email as a record of your Licence together with the Terms and Conditions you have accepted.
https://warwick.ac.uk/wemwbs/using/non-commercial-licence-registration/shrink-wrap_licence_-wemwbs_non-_commercial_v3_8.9.20.pdf.
If you have any questions please contact us via email: wemwbslicence@warwick.ac.uk

Question: Type of use
Answer:
Survey

Question: If other, please specify
Answer:

Question: Type of intervention (if applicable) *Tick all that apply*
Answer:

Question: If other, please specify
Answer:

Question: Field of Use
(Tick all that apply)
Answer:
University or college

Question: Preferred version of WEMWBS
(Note – both versions of WEMWBS can be used under a single licence)
Answer:
WEMWBS - 14 item scale

Appendix K: Participant Recruitment Invitation

Invitation Template for Email, Social Media, and Flyers

There is a new study about participation in competitive and non-competitive running and how it can improve subjective well-being and life satisfaction. This study seeks to examine the relationship between ultrarunning status, subjective well-being and life satisfaction among adult runners in the United States. You are invited to complete a 15-minute anonymous survey.

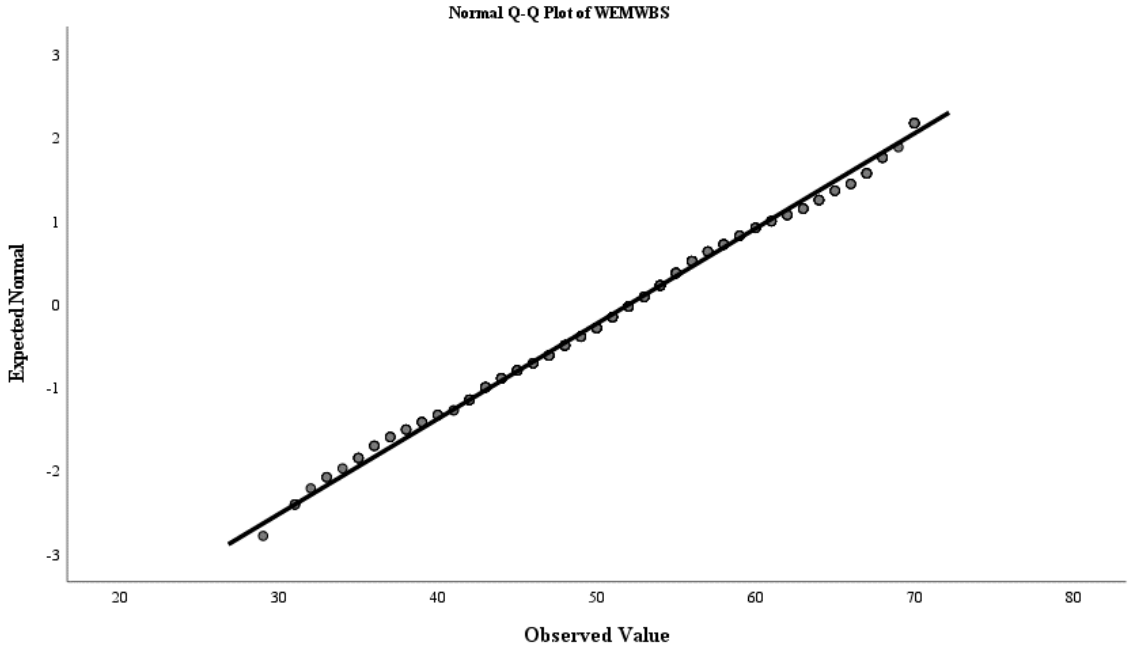
Seeking volunteers that meet these requirements:

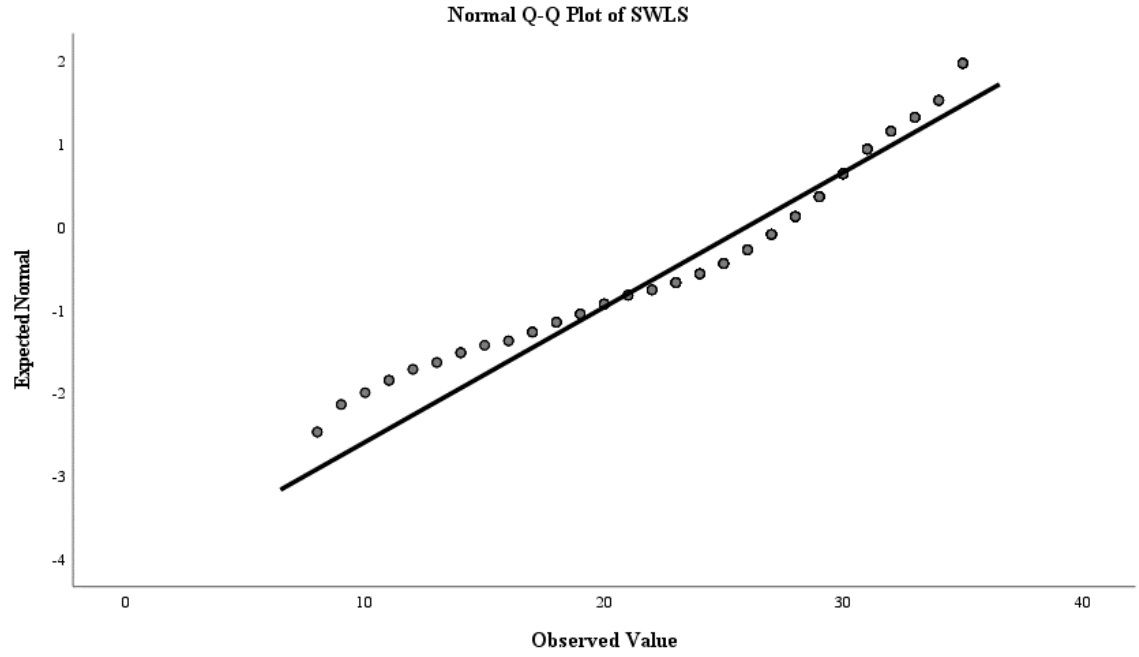
- 18 years old or older
- Resides in the United States
- Study participants must either:
    a) identify as "runners," for example, have been running for at least one year recreationally or non-competitively in any distance under the marathon; or
    b) identify as "ultrarunners," for example, have completed one or more races longer than the marathon in the past year.

This study is part of the doctoral program for Raquel Ramirez Hernandez, a doctoral student at Walden University. The survey will be open until the end of November. Questions should be directed to [redacted]

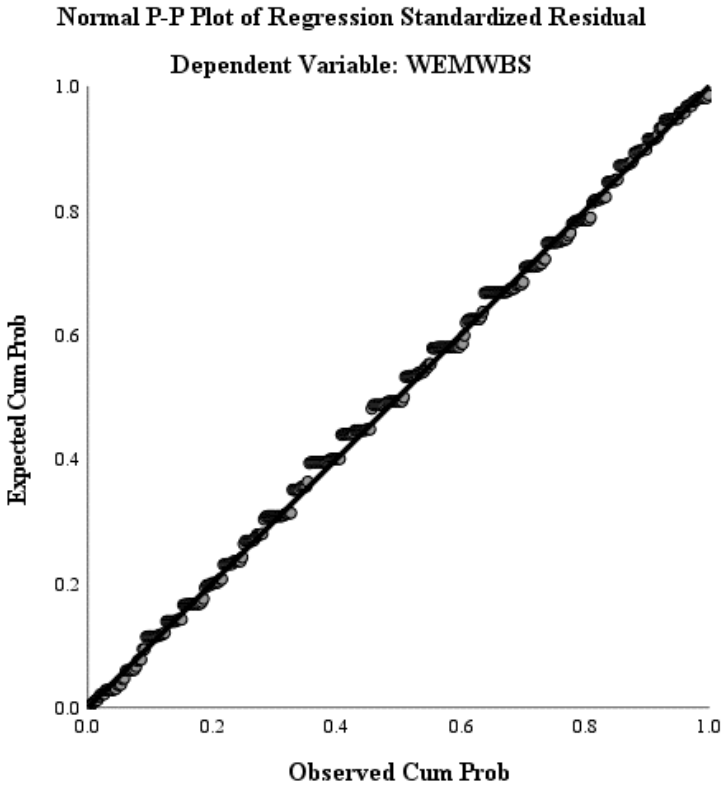
Please click here to view the consent form and begin the survey.

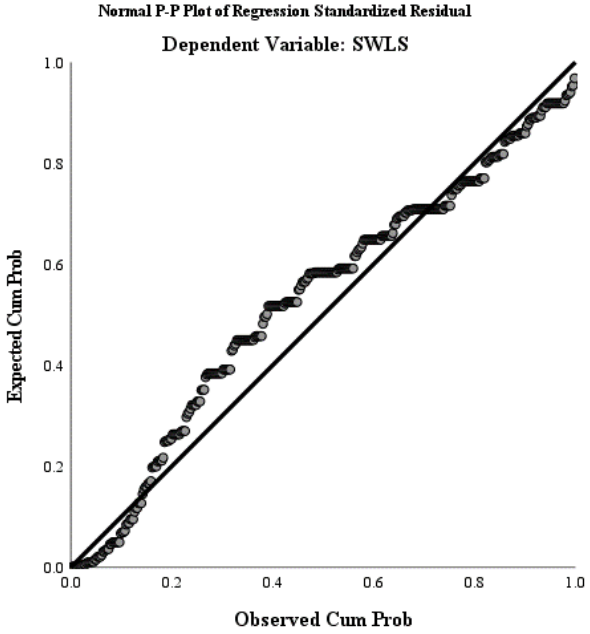
Appendix L: Normal Q-Q Plots





Appendix M: Normal P-P Plots





Appendix N: Scatterplots