Motivational Goals, Needs, and Passion for Graduate Education:

A Longitudinal Examination of the Prediction of Academic Burnout, Well-being, and Health

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Abstract

There is a growing interest in addressing graduate students' health and well-being, as recent survey research suggests that rates of stress and mental illness may be particularly high among this population. Recent cross-sectional research has begun to examine correlates of motivation, burnout, well-being, and health among university students. Using the dualistic model of passion (Vallerand 2010; 2015) and self-determination theory (Ryan & Deci, 2017) as motivational frameworks, the current study investigated the predictive utility of passion (harmonious and obsessive), aspiration (intrinsic and extrinsic), and psychological need satisfaction/frustration (autonomy, competence, and relatedness) for burnout, well-being, health-related behaviors, and self-neglect. As part of a larger, longitudinal study, two online surveys were administered to graduate students at the beginning and end of their first semester in graduate school, gathering 74 completed responses from both time points (90.5% White, 64.9% female). Despite most graduate students reporting above average well-being, there was a general trend for indicators of well-being to decline across the semester and indicators of ill-being to increase. Predictors of a number of psychological and health measures were examined using hierarchical multiple regression analyses. Two models were examined: 1) need frustration, obsessive passion, and extrinsic aspiration were proposed to predict maladaptive health and well-being outcomes, and 2) need satisfaction, harmonious passion, and intrinsic aspiration were proposed to predict adaptive health and well-being outcomes. Hypotheses were partially supported with need satisfaction and need frustration being the most consistent predictors in their respective models. It seems that entering graduate school with higher levels of need satisfaction is predictive of lower levels of sedentary behavior, physical symptoms, negative affect, and anxious and depressive symptoms, and higher ratings of well-being at the end of the first semester. In comparison, graduate students

in this sample entering the semester with higher levels of need frustration reported experiencing higher levels of cynicism, negative affect, and anxious and depressive symptoms at the end of the first semester. Based on previous research, we predicted that harmonious passion would be predictive of higher levels of well-being and health and obsessive passion would be predictive of poorer well-being and health. Although harmonious passion was protective against cynicism accompanying burnout, it was not predictive of adaptive outcomes as expected. As hypothesized, obsessive passion was predictive of poorer health behaviors (i.e., more weekly sedentary time and poorer diet quality) but was not predictive of other metrics of ill-being as expected. Intrinsic aspiration did not predict well-being but instead predicted higher self-neglect behaviors, whereas extrinsic aspiration predicted more anxious and depressive symptoms. Because this is one of the first longitudinal studies exploring intraindividual predictors of graduate student health and well-being, more research is needed to more clearly understand the factors associated with students' well-being. The current findings suggest that graduate programs and universities may want to consider ways to cultivate increased basic psychological need supportive environments as a possible strategy to optimize student functioning.

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Introduction

According to recent U.S. Census data, approximately 13.1% of Americans have a master's or doctoral degree, with the number of individuals aged 25 years and over obtaining these degrees doubling since 2000 (U.S. Census Bureau, 2019). Considering graduate students' commitment to their education (e.g., amount of time in educational activities, financial expenditures, and often relocation away from social supports) it is likely that many students pursue degrees for positive reasons such as personal and intellectual growth, financial returns, career opportunities, job security, and life-long learning (National Center for Education Statistics, 2007). However, most graduate students make sacrifices including increased financial burden and reduced social engagement, and often delay certain life events until they complete their program (e.g., having children, marriage, travel). Furthermore, students are typically expected to spend many hours learning new material in depth at a fast pace, receiving and applying critical feedback, and adapting to a challenging, competitive setting (Fernandez et al., 2019; Schlemper, 2011; Wendler et al., 2012).

Mental Health

In recent years, there has been growing attention to the health and well-being of graduate students. Regarding mental health, cross-sectional studies suggest that rates of anxiety and depression may be higher in graduate students than in the general population (Dyrbye et al., 2006; Levecque et al., 2017). A survey that collected responses from 3,335 graduate students during Summer 2020 found that 67% of participants scored low on a well-being measure, 33% reported at least moderate symptoms of anxiety, and 34% reported at least moderate symptoms of depression (Ogilvie et al., 2021). Prior to the COVID-19 pandemic, similar findings were reported as a survey study of over 2,000 graduate students across 26 countries found that 40% of

graduate students reported moderate to severe depression and anxiety symptoms on screening measures (Evans et al., 2018). Another recent study reported that nearly 50% of PhD students experience psychological distress (e.g., feeling constant strain, sleeping problems due to worry, unhappiness, inability to enjoy day-to-day activities), with approximately 30% at risk for developing a psychiatric disorder (Levecque et al., 2017). Moreover, data suggest that these students appear 2.4 times more likely to experience a psychiatric disorder in comparison to highly educated individuals in the general population (Levecque et al., 2017). However, levels of distress may vary across students, graduate programs, and degree types. At one large U.S. university, rates of depression on a screening survey were found to range from 64% of students in the Arts and Humanities, 43% to 46% in Biosciences, 37% in Law, 34% in Social Sciences, to 28% in Business programs (UC Berkeley Graduate Assembly, 2014). In another recent cross-sectional study, students within social work, arts and humanities, and behavioral and social sciences reported the highest levels of mental health problems (Allen et al., 2020).

Relatedly, studies have also identified high levels of burnout amongst graduate students, particularly medical and doctoral students (Boren, 2013; Dyrbye et al., 2014; Hunter & Devine, 2016). Burnout is described as a "psychological syndrome" that is comprised of three dimensions including: exhaustion (e.g., depletion of emotional energy), cynicism (e.g., negative attitude or perception of academic work or graduate program), and low efficacy (e.g., lack of confidence in one's academic abilities; Maslach & Leiter, 2016). Although these data might suggest that the demands and environment associated with graduate education make students more susceptible to burnout or mental health problems, it could also be that individuals who have preexisting mental health issues take longer to complete a program, or that other individual characteristics (e.g., motivational traits, psychological tendencies) may be contributing to mental health or burnout

challenges among graduate students. Without longitudinal data to follow graduate students over time, temporal sequence and causal factors are more difficult to ascertain. This highlights the importance of a baseline measurement of mental health to investigate possible changes resulting from progression through a graduate program.

Physical Health

Physical health problems may also be more common among graduate students than among the general population. To date, only one study was identified that examined physical health symptomology among graduate students. Rummel (2015) found approximately half of a sample of 110 psychology graduate students reported experiencing at least one physical symptom (e.g., back pain, easily fatigued, headache, irritable bowels) as often as biweekly, sometimes more frequently. Furthermore, the number of physical health symptoms reported were moderately positively correlated with hours spent doing schoolwork. When comparing graduate students' physical symptomology to the general population, it is difficult to draw any firm conclusions due to the lack of evidence currently available and differing measures.

Regarding graduate students' engaging in health behaviors such as physical activity and diet quality, these vary in comparison to non-graduate student populations. The Centers for Disease Control and Prevention (CDC, 2021) estimates that 90% of U.S. adults do not meet the fruit or vegetable recommendations and 77% do not get the recommended amount of weekly physical activity (Healthy People 2020, n.d.). Melnyk et al. (2016) found that 68% of a sample of graduate students in health professional programs (who might presumably be more health conscious) reported not consuming the recommended daily servings of fruits and vegetables. Furthermore, approximately 40% were considered obese and 56% did not engage in the recommended 30 minutes of moderate intensity physical activity five times a week.

In terms of the health behavior of sleep, recent studies (Allen et al., 2020; Allen et al., 2021) have identified sleep as a possible protective or risk factor for graduate student burnout (see mental health section). In general, over one-third of Americans fail to regularly get the recommended 7 hours or more of sleep per night (Liu et al., 2016). Cross-sectional data suggest that even fewer graduate students meet this recommendation, with one study finding that 51% of graduate students report getting less than 7 hours, sleeping 6.4 hours on average (Allen et al., 2021). Additionally, 38% reported that their sleep quality was *very poor* to *fairly poor*, whereas 62% rated their sleep as *fairly good* to *very good* (Allen et al., 2020). Students reporting good sleep quality slept about an hour more than the students with poor sleep quality and had lower levels of burnout and stress (Allen et al., 2021).

Predictors of Well-being

Despite graduate students making up 15% of the population for higher education degree-granting institutions, there is limited research exploring protective and causal factors, health behaviors, and health concerns among this population. Furthermore, even though master's students represent 74% of the graduate student program enrollment, the majority of the research focuses on doctoral students (Okahana et al., 2020) and specific sub-groups as samples of interest (e.g., medical, nursing, and psychology students). Additionally, all identified studies published to date have been cross-sectional and assessed students at mixed time points, making it difficult to examine change over time. Thus, it remains unclear as to what the primary causal factors of poorer mental and physical health are among graduate students. Therefore, a longitudinal examination of graduate students, accounting for predisposing factors would be more informative. In particular, it would be helpful to identify intrapersonal and interpersonal

factors that may predict resiliency versus deterioration over the course of one's graduate school education.

Interpersonal factors likely play an important role in graduate student health outcomes and well-being. Among graduate student samples, social support has been identified as an important factor in mitigating student stress with high levels of perceived social support being linked to positive program satisfaction, confidence, and receptiveness to feedback (Clark et al., 2009; Veilleux et al., 2012). Conversely, experiences of clinical/counseling doctoral students receiving discouraging feedback from faculty has been found to be negatively correlated with career self-efficacy (Bratton, 1997). Importantly, Tompkins et al. (2016) found that three sources of social support (e.g., friends/family, graduate program peers, faculty mentors) accounted for 28% of the variance in students' satisfaction with their program and 30% of the variance in their overall life satisfaction, with faculty mentors accounting for more unique variance than peers, family, or friends. Social support has been identified as a key factor in promoting health and restoring health (Gurung et al., 1997), but there is limited research that focuses on how social support affects graduate students' physical health symptoms and physical health behaviors.

Intrapersonal factors also likely contribute to graduate student health. Of particular interest in the proposed study is the role of motivational forces (e.g., passion for academics, intrinsic motivation/life goals) in determining graduate student well-being. Importantly, intrinsic motivation has been found to be related to improved health behaviors and self-regulation, whereas extrinsic motivation can lead to short-term positive outcomes that are typically not sustained over time (Mata et al., 2011; Silva et al., 2010). The type of aspiration one has for academic endeavors may also affect graduate student health outcomes. Intrinsic aspirations (e.g., self-acceptance, personal growth) have been found to be correlated with greater well-being and

reduced distress, whereas extrinsic aspirations (e.g., financial success, social recognition) have been linked to lower vitality and physical symptoms (Kasser & Ryan, 1996). These findings highlight the importance of accounting for intrapersonal factors when measuring health and well-being outcomes, thereby improving our understanding as to why some students thrive in graduate school settings and others encounter more difficulties.

Dualistic Model of Passion

Psychological energy that supports engagement in valued activities has been recognized as passion (Curran et al., 2015). Passion*,* innate to the human experience, has been increasingly identified as a vital ingredient for motivation that contributes to meaningful outcomes in numerous settings such as the workplace (Cardon et al., 2017), volunteer work (St-Louis et al., 2014), athletics (Verner-Filion & Vallerand, 2018), and academics (Bureau et al., 2017; Saville et al., 2018). Research suggests that passion also influences a variety of outcomes including cognitive processes (Forest et al., 2011), affect (Grenier et al., 2009), psychological well-being (Vallerand et al., 2007), health (Lafrenière et al., 2009), burnout (Bureau et al., 2017; Fernet et al., 2014; Saville et al., 2018; Vallerand et al., 2010), addiction (Ratelle et al., 2004), and performance (Mageau et al., 2009; Vallerand, 2010).

Robert Vallerand (2010) further defined passion as a form of motivation characterized by a strong propensity toward an activity, person, or object that a person loves, values, identifies with, and regularly invests resources in. It can fuel motivation, provide meaning, enhance well-being, and make life worth living (Vallerand et al., 2003). However, there can be a dark side to passion that is associated with negative emotions and inflexible persistence. Vallerand proposed the dualistic model of passion (DMP) to conceptualize passion and uncover its role in various contexts (e.g., athletics, careers, hobbies; Vallerand et al., 2003).

The DMP proposes two types of passion: harmonious and obsessive. Both types of passion are energizing, but they differ in their relationships with health, motivational, cognitive, and affective outcomes (Vallerand, 2015). The difference between the two relies on how a person internalizes the passion into their identity (discussed in more depth later; Vallerand et al., 2013). *Harmonious passion* develops when a person believes an activity is important, despite any contingencies attached to it, and it is in consonance with one's other life domains (Vallerand et al., 2003; Verner-Filion & Vallerand, 2018). Those who are harmoniously passionate are able to experience desirable outcomes (e.g., positive affect, well-being, psychological health) while engaging in the activity they are passionate about and when they are not engaging in it (Vallerand, 2012). A graduate student who is harmoniously passionate about academics is one who enjoys engaging in their graduate work for more intrinsic reasons and is able to fully engage in both their studies and other areas of their life (Orsini et al., 2019).

Obsessive passion is characterized by a rigid persistence, often interfering with other goals, values, or life domains, and taking an overbearing place in one's identity (Vallerand et al., 2003; Vallerand, 2012). Contrary to harmonious passion, this form of passion for an activity develops through a more controlled internalization; meaning that the activity has been personally chosen, but with the caveat that it serves to fulfil some important ego-involved condition of worth or reward (e.g., garner approval from others; Mageau et al., 2011). In the case of pursuing graduate education, a student who is obsessively passionate about academics would likely engage in academic activities more for the external rewards or recognition from others than for the internal enjoyment of learning or sense of curiosity for the material. Moreover, students driven by this type of passion would likely have a more difficult time stepping away from their

work and if they do engage in other activities, they might be distracted by thoughts about their academic activities or feel guilty for doing a non-academic activity (Orsini et al., 2019).

Both types of passion have been linked to high levels of performance, but the two differ in their contributions to an individual's psychological well-being. Research suggests that harmonious passion is positively related to psychological well-being, optimal functioning, and need satisfaction (Vallerand et al., 2003; Verner-Filion et al., 2017), and protects one from psychological ill-being (Vallerand, 2012). It is proposed that harmonious passion leads to well-being because individuals engage in the activity openly, wanting to experience the activity in a mindful way that is non-defensive, whereas those who are obsessively passionate engage in activities in a way that is defensive and prevents them from fully experiencing the positive outcomes (Vallerand, 2015). The rigid manner in which obsessively passionate individuals engage in activities can also lead to feelings of guilt, shame, negative affect, stress, and anxiety (Vallerand, 2012). Thus, obsessive passion is associated with negative outcomes and psychological ill-being (Vallerand et al., 2003; Verner-Filion et al., 2017).

Due to individuals typically engaging in the passion activity frequently, these outcomes are sustained over time. In a study examining people who were passionate about physical activity, Rousseau and Vallerand (2008) found that after participants finished engaging in the activity, harmonious passion led to increased positive affect which contributed to increases in psychological well-being over time. Conversely, obsessive passion predicted negative affect and directly predicted decreases in well-being over time (Rousseau & Vallerand, 2008). Harmonious passion has also been found to predict improvements in health over a 3-month period for individuals volunteering with an important cause (i.e., international humanitarian mission work), whereas obsessive passion contributed to an increase in physical symptoms and a decline in

health (St-Louis et al., 2014). A path analysis of these data further revealed that obsessive passion positively predicted self-neglect behaviors, which then predicted physical symptoms (e.g., headaches, stomach pain). Given previous research suggesting that physical symptoms (e.g., viral infections, digestive disorders, sleeplessness) are more likely to occur when the body is routinely responding to real or perceived stress (El-Ghoroury et al., 2012), it seems plausible that those who are obsessively passionate about academics may engage in more self-neglect behaviors and experience more physical symptoms.

To date, there are a number of research studies that have explored passion for a variety of activities (including athletics, jobs, and hobbies); however, there is limited research that examines the outcomes of academic passion, and no studies were identified that included graduate students. Previous findings with undergraduates suggest that both obsessive and harmonious passion for academics were positively correlated with academic engagement (Stoeber et al., 2011). Among a sample of dental students, both obsessive and harmonious passion positively predicted the usage of deep study strategies (i.e., maximizing meaning and understanding), with harmonious passion being more strongly associated. Conversely, obsessive passion was positively associated with the usage of surface study strategies (i.e., rote learning and memorization), whereas harmonious passion was associated with lower use of surface study approaches (Orsini et al., 2019). This is consistent with previous research that suggests that both types of passion can lead to positive learning outcomes, but students who are more harmoniously passionate for studying are more likely to study in a way that aims to find meaning and comprehension of the material versus rote learning and memorizing content (Curran et al., 2015; Justicia et al., 2008).

Obsessive passion for academics has also been found to be associated with a number of unhealthy behaviors in undergraduate students, including excessive drinking, disordered eating, and exercise addiction, whereas harmonious passion was negatively correlated with excessive drinking and sleep deprivation (Bureau et al., 2017). Due to the cross-sectional nature of this study, the temporal precedence of academic passion type is unknown. Harmonious passion for academics was also found to be negatively correlated with the components of burnout including exhaustion and cynicism (Saville et al., 2018; Stoeber et al., 2011). Furthermore, individuals who were harmoniously passionate had lower ratings of exhaustion and cynicism in comparison to the obsessively passionate and non-passionate individuals (Saville et al., 2018). Undergraduate students who were harmoniously passionate for academics also had the highest ratings of efficacy for academics, whereas non-passionate students had the lowest (Saville et al., 2018). Unexpectedly, Stoeber et al. found in a cross-sectional observation that obsessive passion for studying and academic engagement negatively correlated with cynicism and inefficacy

There has been considerable research that focuses on burnout in the workplace (e.g., Childs & Stoeber, 2012; Pollack et al., 2020; Prasad-Reddy et al., 2020), yet a limited amount that examines burnout among graduate students (e.g., Clark et al., 2009) — and none that explores the relationship between graduate students' passion and academic burnout. There is a clear need for longitudinal observations to establish temporal precedence and more fully understand the relationship between burnout and passion.

Motivation, Goals, and Need Satisfaction and Frustration

Recently, researchers have begun using a macro-theory of human motivation, self-determination theory (SDT), to identify possible determinants of obsessive and harmonious passion (Tóth-Király et al., 2019). Although SDT provides a broad framework to understanding

human motivation, personality, and development, it also articulates several mini-theories related to human motivation and psychological needs (Ryan & Deci, 2000; 2017). Based upon SDT's organismic integration theory, motivation is conceptualized as multidimensional with different types of regulation that vary along a continuum of self-determination. The validity of this continuum in education and other life domains is well documented in the literature (see Vallerand, 1997). Within this continuum, more self-determined motivation characterizes behavior that is carried out based on one's choice and sense of autonomy, whereas less self-determined behavior is engaged in for more external (less internalized) reasons and controlled contingencies (Ryan & Deci, 2017). Intrinsic motivation represents the highest level of self determination and denotes involvement in the activity for the pleasure and satisfaction that the individual inherently experiences with participation (i.e., "for its own sake"). In contrast, when one is extrinsically motivated the activity is performed as a means to some other end (Ryan & Deci, 2000; 2017).

According to SDT, different types of extrinsic regulatory styles exist that represent different levels of self determination ranging from external regulation, introjected regulation, and identified regulation. On this continuum, *externally regulated* behavior is controlled by an outside source, such that a student with this form of regulation may attend school because their parents compel them to or for the purpose of making more money. In other words, students engaging in externally regulated behavior are motivated by the expected contingencies of reward or punishment. Further along the spectrum is *introjected regulation*, which is when a person partially identifies with the behavior they are engaging in, but they primarily engage in the behavior to avoid shame or guilt (Ryan & Deci, 2017). In the case of education, the student with this form of regulation engages with activities to avoid the guilt associated with poorer

performance. A higher, more internalized form of self-determined motivation, *identified regulation*, entails some personal value and importance assigned to the activity. Thus, the student with this form of motivation attends graduate school because they value what they are doing.

Goal contents theory, another SDT mini-theory relevant to the current research study, maintains that humans hold a wide array of life goals that can be classified as intrinsic (e.g., personal growth, close relationships, contributing to one's community) or extrinsic (e.g., money, power, fame, physical attractiveness). Goals that directly satisfy psychological needs and are rewarding, in their own right, are considered intrinsic aspirations (e.g., personal growth, community contribution; Kasser & Ryan, 1996). Goals that are focused on attaining contingent rewards are considered extrinsic aspirations because the goal itself is not the primary thing considered satisfying, rather receiving a reward of some sort in exchange for accomplishing the goal is the reward (e.g., fame, wealth; Ryan & Deci, 2008). Previous research suggests that when individuals find their intrinsic aspirations highly important, it is associated with vitality, less depression, and fewer problematic physical symptoms (Kasser & Ryan, 1996). In comparison, placing high importance on extrinsic aspirations is associated with lower vitality and more problematic physical symptoms.

A more recently developed SDT mini-theory, basic psychological needs theory (Ryan & Deci, 2017; Vansteenkiste et al., 2020) proposes the existence of the essential psychological needs of competence (i.e., one's sense of effectiveness and mastery within various contexts), relatedness (i.e., one's sense of belonging and feeling cared for by others), and autonomy (i.e., one's sense of freedom and being the initiator of a chosen activity). The satisfaction of these three needs is crucial to optimal functioning and psychological well-being. That is, when a person has their basic needs satisfied, they have a foundation of wellness. This can lead to a

person experiencing high levels of vitality, meaning they are able to harness their psychological and physical energy and engage in activities they value. Conversely, if one is deprived of the satisfying of these needs (i.e., need is actively thwarted or undermined), the individual is likely to experience psychological harm or ill-being (Ryan & Deci, 2017). Evidence also suggests that individuals experiencing need thwarting may disengage from the activity/context or engage in compensatory behaviors (Vansteenkiste et al., 2020). Such behavior may take on a rigid pattern that serves to provide the individual with a sense of predictability and security yielding short-lived relief and contingent self-worth, yet ultimately undermining well-being by evoking intense self-criticism and guilt. Importantly, this pattern and sense of self-worth may ultimately result in greater distress and poorer persistence in the face of adversity (Van der Kaap-Deeder et al., 2016).

Overlap Between the Dualistic Model of Passion and Self Determination Theory

More recently, research efforts have highlighted the conceptual overlap between the dualistic model of passion and SDT. Although individuals may be intrinsically motivated to engage in an activity they are passionate about, the type of passion one holds for the activity appears influenced by how one internalizes the activity into one's sense of self (Vallerand, 2012). More specifically, obsessive passion is internalized to function through introjected regulation and take on a more controlling role, meaning the individual feels pressured to perform the activity, and that contingencies (e.g., self-worth, social acceptance) are attached to performance outcomes (Lalande et al., 2017). Conversely, harmonious passion is internalized more autonomously, which is associated with more optimal outcomes due to the individual engaging in behaviors that are more congruent with their personal values and fulfilling of their basic psychological needs.

The temporal relationship between need satisfaction/frustration and passion is somewhat unclear. Some studies have found harmonious passion to be positively related to need satisfaction and obsessive passion negatively related to need satisfaction (e.g., Przybylski et al., 2009; Verner-Filion & Vallerand, 2018). Other studies provide conflicting findings, suggesting that obsessive passion may be positively associated with need satisfaction (Forest et al., 2011; Parastatidou et al., 2012). Need satisfaction has also been identified as a mediator between passion and outcomes (Vallerand et al., 2007, 2008; Verner-Filion et al., 2017). In general, research suggests that harmonious passion is related to need satisfaction (e.g., Curran et al., 2013; Houlfort et al., 2015; Verner-Filion et al., 2017).

To date, most of the literature has identified passion as a predictor of need satisfaction, but only a handful of studies have investigated whether or not need satisfaction or need frustration predict passion type (Akehurst & Oliver, 2014; Lalande et al., 2017; Orsini et al., 2019; Tóth-Király et al., 2019). As Vallerand and colleagues (2003; 2015) propose, in order to internalize passion in the most optimal way, autonomously, one must first experience the satisfaction of their basic psychological needs. Conversely, when one does not experience need satisfaction, a controlled and less optimal form of internalization may occur. Although studies have investigated need satisfaction as a predictor of passion type, research has less often taken into account the "dark side" of basic psychological needs (i.e., need frustration). Two recently published studies (Orsini et al., 2019; Tóth-Király et al., 2019) have made an initial effort to clarify this gap in the literature. In the context of passion for screen-based activities (e.g., TV series watching, Facebook use, online gaming, smartphone gaming), Tóth-Király et al. used four cross-sectional samples to explore the differentiating roles that need satisfaction and frustration play in (mal)adaptive outcomes. Using structural equation modeling, they found that need

satisfaction negatively predicted obsessive passion and was unrelated to harmonious passion. On the other hand, need frustration was positively associated with obsessive passion and unrelated to harmonious passion. Further, harmonious passion led to adaptive outcomes (e.g., self-expression, persistence, skill development, relaxation), whereas obsessive passion led to maladaptive outcomes (e.g., overuse, problematic gaming, procrastination).

More specific to the context of the proposed study, Orsini et al. (2019) examined course experiences among undergraduate dental students in Chile, and how need satisfaction and frustration were associated with students' passion for studying and their learning strategies. Structural equation modeling revealed that perceptions about optimal teaching and the curriculum (e.g., clear goals and standards, appropriate workload) negatively predicted need frustration and positively predicted need satisfaction. In turn, the satisfaction of needs positively predicted a passion for studying, favoring harmonious passion, whereas need frustration negatively predicted harmonious passion and positively predicted obsessive passion. Passion type then predicted academic engagement. Although the findings suggest a path through which psychological need satisfaction and frustration may influence passion and academic engagement, this study also relied upon a cross-sectional design and cannot adequately establish the temporal order of factors and their respective influence on outcomes. Moreover, neither of these studies examined the potential contribution of participants' life aspirations and goals. Other cross-sectional research with adolescent females has, however, suggested intrinsic (i.e., personal growth) goals are associated with psychological need satisfaction, whereas extrinsic goals (i.e., image) are unrelated to need satisfaction and may lead to unhealthy weight control behaviors (Thøgersen-Ntoumani et al., 2010). Collectively, the cross-sectional studies reviewed suggest a relationship between passion type, need satisfaction/frustration, aspirations, and (mal)adaptive

outcomes. Nevertheless, longitudinal research examining the relative contribution of each of these variables to well-being, burnout, and health outcomes is direly needed.

Specific Aims and Hypotheses

Research suggests that a notable percentage of graduate students report poor mental and physical health symptoms. Likely, the well-being of graduate students is determined by a variety of intrapersonal, interpersonal, and contextual factors. Most of the existing research examining graduate student health is based upon cross-sectional data, leaving it undetermined as to when these health problems began and if they are indeed related to academic stressors. Thus, it is important to clarify the potential causal and risk factors. There is also limited research regarding academic passion and none that focuses specifically on graduate students' academic passion. Furthermore, to our knowledge, no studies exist that have longitudinally examined the relationships among passion, need satisfaction and frustration, goal contents (aspiration), and physical and psychological health outcomes among this population. Greater understanding of the role of academic passion (particularly obsessive passion) among these highly motivated students could assist in better identification of individuals at risk for negative outcomes and the design of targeted interventions to reduce academic burnout, physical symptoms, mental health struggles, and lower levels of well-being.

In this study, we assessed a sample of graduate students upon starting their graduate program (Time 1), again 10 weeks after the start of their first semester (Time 2), and at the end of their first year (Time 3). This paper reports on changes in passion type, need satisfaction and frustration, aspiration/goals, and health and well-being over the first 10 weeks of graduate school. The data from Time 3 (that will allow for better modeling of the temporal relationship

between need satisfaction, passion type, and other outcomes) was not analyzed as part of this report.

Based on the existing literature, the following a priori hypotheses were made:

H1: Graduate students identified as being passionate (obsessive or harmonious) about academics at Time 1 will report spending significantly more time engaging in academic activities at Time 2 than individuals identified as non-passionate.

H2: Obsessive passion, extrinsic life aspirations (wealth), and psychological need frustration at Time 1 will predict more maladaptive outcomes. That is, these factors will predict greater burnout, negative affect, self-neglect behaviors, physical symptoms, anxiety and depression, as well as lower levels of overall well-being, diet quality, physical activity, and positive affect at Time 2.

H3: Harmonious passion, intrinsic life aspirations (personal growth), and psychological need satisfaction at Time 1 will predict more adaptive outcomes. That is, these factors will predict higher levels of positive affect, overall well-being, physical activity, and diet quality as well as lower levels of self-neglect behaviors, anxiety, depression, burnout, physical symptoms, and negative affect at Time 2.

Methods

Study Design

A longitudinal design was used for this study, with graduate students being surveyed in the week prior to starting their graduate education (Time 1), 10 weeks later (Time 2), at the end of their first year (Time 3). The second time point allows for evaluation of possible changes as well as (mal)adaptive outcomes after enrollment in graduate school for some time. As noted, this project is only including data analysis of the two time points from the Fall 2020 semester. It is

important to note that the data collection occurred amid the COVID-19 pandemic, and for this particular sample, approximately 70% of classes were moved online meaning that face-to-face interaction greatly declined. The rationale for conducting a longitudinal study is to gain a clearer understanding of the change over time in graduate student well/ill-being as well as the motivational process model that may identify potential intrapersonal and interpersonal factors that may contribute to students' functioning and performance.

Participants

A recruitment email was sent to 228 incoming graduate students at a mid-sized university located in the upper Midwest one week before they began their first semester of graduate school; 93 students enrolled in the study and completed the Time 1 survey (response rate = 40.8%). Of these, 78 completed the Time 2 survey in November 2020 (attrition rate = 16.1%). Two participants were removed because they were not enrolled in 5 or more semester credits to qualify as a full-time student. After assessing the data for survey completion at both time points and correct answers to the random responder items (i.e., attention check questions) at both time points, 74 participants (32% of the incoming students) were included in the analyses. The sample primarily consisted of White (n = 67, 90.5%), female (n = 48, 64.9%) participants, who had an average age of 25.1 years (SD = 5.3). More than half the sample (56.8%) reported being in a committed relationship and 6.8% of the sample reported having children. Most students (71.6%, n = 53) were enrolled in a research-based graduate program and the remaining 28.4% (n = 21) were enrolled in a professional program (see Table 1 for the programs included), taking an average of 9.7 (SD = 2.6) credits during their first semester. On average, participants anticipated spending 28.9 hours per week (SD = 11.4) on academic activities at the beginning of the

semester, which was less than their actual estimated time (M = 33.6, SD = 15.2) when assessed at the end of their first semester. See Table 1 for comprehensive demographic information.

Procedures

Approval from the university's institutional review board for human subjects research was obtained prior to the beginning of recruitment and data collection. First year graduate students from all programs at a mid-sized Midwestern university were recruited via a brief presentation at the required online orientation that occurred a week before classes began. Additionally, all first-year master's level graduate students received an email with a link to the baseline survey administered via the Qualtrics online survey platform. The email was sent on the same day as the orientation meeting. Over the course of 2 weeks, three reminders were sent to non-responding students. Those who consented to participate and completed the baseline survey were emailed again 10 weeks later to complete the follow-up survey. At Time 2, all participants who completed the surveys at both timepoints were entered into a drawing to win one of 10 $25 gift cards.

Measures

At both Time 1 and Time 2, basic need satisfaction, need frustration, harmonious passion, obsessive passion, intrinsic aspiration, and extrinsic aspiration were measured as predictor variables. Demographic and background information was also collected at Time 1. Participants were asked about weekly time spent on academic activities at Time 1 and Time 2. Physical activity, sedentary behavior, physical symptoms, diet quality, body mass index, mental health symptoms, positive and negative affect, and overall well-being were measured as outcome variables. Self-neglect behaviors, burnout dimensions, perceived graduate advisor socioemotional support, and sleep duration and quality were added outcome measures at Time 2.

Demographics and Background Information

Respondents were asked to indicate their graduate program, gender, age, ethnicity/race, international student status, semester course credit enrollment, marital/relationship status, parenthood status, employment status, financial aid, and living situation (see Table 1). Two random responding items were embedded to assess attention to the survey.

The Passion Scale

Participants were asked to complete the Passion Scale (Vallerand et al., 2003) with their "typical academic activities" in mind. This 16-item self-report questionnaire uses a 7-point scale (1 = *do not agree at all* to 7 = *very strongly agree*). The last four items of the scale measured overall passion for academics (e.g., "I like engaging in academic activities"). Respondents were classified as passionate about academics if they rated 4 or higher (on the 7-point scale) on these items, following procedures demonstrated in previous research (Philippe et al., 2009; Saville et al., 2018). The remaining 12 items include six items assessing harmonious passion (e.g., "Academic activities are in harmony with my life") and six items assessing obsessive passion (e.g., "I have a difficult time controlling my urge to engage in academic activities"). The four passion criterion items had adequate internal consistency at both Time 1 ($\alpha = .83$) and Time 2 ($\alpha = .81$). The subscales for harmonious passion ($\alpha = .83$ - $.86$) and obsessive passion ($\alpha = .81$ - $.83$) also had good internal consistency.

Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS)

The 24-item BPNSFS (Chen et al., 2015) was used to assess need fulfillment and need frustration on a global level. Each of the basic psychological needs: autonomy (e.g., "I feel a sense of choice and freedom in the things I undertake"), relatedness (e.g., "I feel that the people I care about also care about me"), and competence (e.g., "I feel confident that I can do things

well") were assessed with eight items, with four of the items focused on need frustration and four being focused on need satisfaction. Participants rated the items on a 7-point scale (1= *not true at all* to 7 = *very true*). Adequate internal consistency was found for Autonomy Satisfaction (α = .80 - .83), Autonomy Frustration (α = .75 - .78), Relatedness Satisfaction (α = .83 - .87), Relatedness Frustration (α = .66 - .79), Competency Satisfaction (α = .90 - .91), and Competency Frustration (α = .86 - .87). For analyses, an overall average Needs Satisfaction score was calculated (α = 0.86 - 0.89), as was an overall Need Frustration score (α = 0.87 - 0.88).

Aspiration Index

The Aspiration Index (Kasser & Ryan, 1996) was included to assess the broad goals participants hold for their lives. Participants rated on a 7-point scale the degree to which the goals were important to them (1 = *not at all* to 7 = *extremely*). Intrinsic aspirations were measured using the 5-item Personal Growth subscale from the Aspiration Index (e.g., "at the end of my life, to be able to look back on my life as meaningful and complete"). This scale was developed to measure the degree to which a person is pursuing something to be competent and autonomous (Kasser, 2019). Extrinsic goals were measured using the 4-item Financial Success subscale (e.g., "to have many expensive possessions."). This subscale measures the degree to which a person is pursuing a goal to be wealthy and materially successful (Kasser, 2019). Both the extrinsic aspiration scale (α = .65 - .80) and the intrinsic aspiration (α = .68 - .79) scales demonstrated acceptable internal reliability.

Time spent engaging in the activity

In previous passion research, time spent engaging in the activity has been an indicator of passion. In the first survey, the participants were asked to estimate how many hours they anticipated they would spend engaging in academic and graduate program related activities per

week (e.g., studying, reading, completing assignments, research, teaching assistantships). At the second survey time point, participants were asked how many hours per week they actually spent engaging in academic and graduate program related activities.

International Physical Activity Questionnaire (IPAQ)

The IPAQ (Craig et al., 2003) was used to measure physical activity. Participants reported how much time they spent engaging in vigorous, moderate, and walking activities over the past 7 days. The IPAQ also measures minutes of sedentary behavior per week. Participants were asked how much time they spent sitting over the past 7 days on both a typical weekday and a weekend day. Test-retest reliability, as well as criterion and concurrent validity for the IPAQ short-form version have been found to be acceptable for adult samples (Craig et al., 2003; van der Ploeg et al., 2010).

Physical Symptoms Checklist.

An adapted 13-item symptom checklist (Knäuper et al., 2004; St-Louis et al., 2014) was used to assess the occurrence of problematic physical symptoms. Participants indicated on a 5-point scale (1 = *not at all* to 5 = *every day*) how often they experience the listed physical symptoms (e.g., headache, back pain, irritable bowels, muscle soreness, nausea) over a 2 week period. The internal consistency of the items was adequate at both Time 1 ($\alpha = .77$) and Time 2 ($\alpha = .79$).

Diet Quality

Participants were asked to indicate their overall diet quality, using a single-item ranging from 1 = *poor* to 5 = *excellent*, over the past month. Single-item, self-report dietary measures have been found to have good construct validity and are significantly related to objective dietary measures (Loftfield et al., 2015).

Body Mass Index (BMI)

Respondents were asked to indicate their height and weight for body mass index (BMI) to be calculated as kg/m^2. Self-reported and measured BMI values have been found to be highly correlated (r = .95 - .98) for both males and females (Berge et al., 2011).

Anxious and Depressive Symptoms (PHQ-4)

The Patient Health Questionnaire-4 item (PHQ-4; Kroenke et al., 2009) combines the two item Patient Health Questionaire-2 (PHQ-2; Kroenke et al., 2003), which assesses depressive symptoms, and the two item Generalized Anxiety Disorder scale (GAD-2; Spitzer et al., 2006) to measure symptoms of anxiety. Participants were asked to identify how often they have been experiencing depressive and anxious symptoms over the past 2 weeks on a 4-point scale (0 = *not at all*, 1= *several days*, 2 = *more than half the days*, 3 = *nearly every day*). These items were also used in a recent survey of University of Minnesota graduate students administered in the spring of 2019 and serve as a useful comparison. In this study, the scale had good internal consistency at both Time 1 (α = .88) and Time 2 (α = .72).

Positive and Negative Affect Scale (PANAS)

The PANAS assesses self-reported mood states and consists of two 10-item subscales, one measuring positive affect (i.e., how enthusiastic, alert, active a person feels) and the other measuring negative affect (i.e., how angry, guilty, fearful a person feels), (Watson et al., 1988). An emotion word (e.g., interested, guilty) was presented and participants were asked to rate on a 5-point scale (1 = *not at all* to 5 = *very much*) the degree to which they experienced the emotion over the past month. This scale had good internal consistency for both positive affect (α = .87) and negative affect (α = .84).

Multicultural Quality of Life Scale (MQLI)

The MQLI (Mezzich et al., 2011**)** was used to measure participants' self-reported well-being. Ten items assess various aspects of life quality (physical well-being, psychological/ emotional well-being, self-care and independent functioning, occupational functioning, interpersonal functioning, social-emotional support, community and services support, personal fulfillment, spiritual fulfillment, global perception quality of life) and participants were asked to rate the items on a 11-point scale (0 = *poor* to 10 = *excellent*). It should be noted that this scale is typically a 10-point scale, ranging from 1 to 10. The scale had high internal consistency at both Time 1 ($\alpha = .88$) and Time 2 ($\alpha = .89$).

Self-Neglect Scale

Three items that were previously used to measure self-neglect behaviors and two additional items were included to assess the degree to which graduate students may be neglecting aspects of their health (e.g., I neglect my physical activity engagement to complete academic activities"), time commitment (e.g., "I work more hours than necessary for the sake of my academics"), and relationships ("I neglect time spent with significant others to engage in academic activities;" St-Louis et al., 2014). The two additional items were added to measure diet neglect ("I neglect my diet quality to complete academic activities") and sleep neglect ("I neglect my sleep to engage in or complete academic activities"). Participants rated items on a 7-point scale (1 = *never* to 7 = *almost always*) the degree to which they engage in self-neglect behaviors. The scale had good reliability ($\alpha = .84$).

Maslach Burnout Inventory-Student Survey (MBI-SS)

The 15-item MBI-SS (Schaufeli et al., 2002) was incorporated to assess burnout in graduate students. The measure uses a 7-point scale (1= *do not agree at all* to 7 = *very strongly*

agree). Four items assess cynicism (e.g., "I am increasingly less enthusiastic about my studies"), five items assess exhaustion (e.g., "I feel emotionally drained by my academic activities"), and six items assess efficacy (e.g., "I am a good student") in relation to their feelings resulting from their graduate work. However, the item, "I feel tired when I get up in the morning and I have to face another day at the university," was accidentally left out of the exhaustion subscale. Despite this, internal consistency was found to be adequate amongst our sample for exhaustion (α = .81), cynicism (α = .82), and efficacy (α = .80).

Graduate Advisor Socioemotional Support

The 10-item socioemotional subscale from the Mentoring Relationships in Graduate School scale (Tenenbaum et al., 2001) was used to measure graduate students' perceived socioemotional academic support from their faculty advisors. The measure uses a 7-point scale (1= *strongly disagree* to 7 = *strongly agree*). Participants were asked to rate the extent to which they feel their advisor does various support tasks (e.g., "Conveyed feelings of respect for you as an individual" and "Encouraged you to talk openly about anxiety and fears that detract from your work?"). The measure was highly reliable (α = .94).

Sleep Quality and Hours (PSQI)

Two items from the Pittsburgh Sleep Quality Inventory (PSQI; Buysse et al., 1989) were used to measure sleep quality and duration. Participants were asked, "During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed.)" Response were transformed into the following: *less than 5 hours* = 0, *5 hours to less than 6 hours* = 1, *6 hours to less than 7 hours* = 2, *7 hours or more* = 3 in accordance with PSI scoring guidelines. The second question was, "During the past month, how would you rate your sleep quality overall?" which was measured by a 4-point scale (0 = *very bad*

to 3 = *very good*). The item scores were then added together to a composite total score and divided by 2 to produce an average sleep score. It should be noted that both items were reverse coded in comparison to the typical PSI scoring guidelines, so that a higher score here reflects better sleep quality. The PSI has good reliability and validity for both clinical and non-clinical populations (Mollayeva et al., 2016).

Statistical Analyses

Data were analyzed using SPSS (v. 26). Only participants who completed the first survey, providing their name and email at the end of the survey, were enrolled in the study and included in the analyses. There were little missing data (< .001%) from those enrolled. Data was either left as missing (in the case of single item measures) or a subscale total score was imputed using the average of the other items in that scale. Two random responder items were included in both surveys. If participants answered one or more random responder items wrong on either survey they were removed from the analyses, which resulted in 4 participants being removed. Following this, data were assessed for outliers and skewness and adjusted accordingly by first winsorizing the outliers and if the data were still skewed, log and square root transformations were utilized. Bivariate correlations were calculated to determine the relationships between variables at both Time 1 and Time 2. Multicollinearity was assessed via the correlation matrix (i.e., > 0.70 among two or more predictors) and the variance inflation factor (i.e., VIF > 10); multicollinearity was not detected for any of the variables. An independent samples *t*-test was used to assess if the participants identified as passionate about academics spent more time on academic activities than the group identified as non-passionate about academics. Paired samples *t*-tests were used to compare the data from Time 1 to Time 2 to observe possible changes across the semester. Additionally, effect sizes (Cohen's *d*) were calculated to estimate the magnitude of change for

the variables across the semester. Typically, Cohen's *d* effect sizes are interpreted as being small (*d* = 0.2), moderate (*d* = 0.5), or large (*d* = 0.8). Hierarchical multiple regression analyses were used to test the hypothesized relationships between the Time 1 predictor variables and the various outcome variables at Time 2. This statistical approach allowed for predictor variables to be entered into the regression equation (at step 2) following the inclusion of the covariates of identified gender and BMI (at step 1). Gender differences are consistently found for anxious and depressive symptoms and well-being (Conley et al., 2020; Löwe et al., 2010), and BMI is a known predictor of health metrics (Ng et al., 2020). Three participants who identified as nonbinary were removed from the regression analyses because we controlled for gender (male vs. female). Following the hypotheses, need frustration, obsessive passion, and extrinsic aspiration served as predictor variables in one regression model and need satisfaction, harmonious passion, and intrinsic aspiration were used as predictor variables in the other model. A separate regression model was calculated for each of the outcome variables: time spent engaging in academic activities per week, burnout, physical activity, sedentary behavior, physical symptoms, diet quality, self-neglect behaviors, anxious and depressive symptoms, positive affect, negative affect, and overall well-being.

Results

Primary Analyses

Passionate vs. Non-passionate Individuals and Outcomes

We hypothesized that passionate students would spend more time involved with academic activities per week than nonpassionate students in accordance with the DMP theory demonstrating that passion is characterized by significant time spent on the activity. Participants were grouped into either "passionate" (*n* = 54) or "non-passionate" (*n* = 15) groups at Time 1

based on their self-ratings of 4 or higher on the three general passion items. The fourth general passion item was removed because it asks if the respondent "spends a great deal of time" engaging in the activity, risking redundancy when measuring the outcome variable of time spent per week on academic activities. Participants who rated themselves as passionate for academics did not spend significantly more hours per week on academics (M = 34.57, SD = 14.73) when compared to non-passionate participants (M = 30.27, SD = 17.08) at Time 2, $t(67) = 0.97$, p = .34, d = 0.28. Thus, the hypothesis that more passionate students would report more time involved with academic activities was not confirmed.

Time 1 and Time 2 Bivariate Correlations

Bivariate correlations were calculated to understand cross-sectional relationships between variables at both Time 1 and Time 2, as well as help identifying if multicollinearity was present among the predictor variables from Time 1. A review of Table 2 reveals that none of the planned predictors exceeded the $r > .70$ threshold, suggesting multicollinearity was not a concern for the multiple regression analyses presented later.

Time 1. At Time 1 (see Table 2) need satisfaction was negatively related to need frustration (r = -.72), physical symptoms (r = -.29), negative affect (r = -.32), and anxious and depressive symptoms (r = -.35) and positively related to harmonious passion (r = .58), intrinsic aspiration (r = .30), positive affect (r = .48), and overall well-being (r = .56). Need frustration, on the other hand, was negatively related to harmonious passion (r = -.36), diet quality (r = -.32), positive affect (r = -.44), and overall well-being (r = -.52) and positively related to physical symptoms (r = .48), negative affect (r = .58), and anxious and depressive symptoms (r = .60). Harmonious passion was positively related to how much time the students anticipated they would spend on academic activities per week (r = .24) as well as positive affect (r = .36) and

overall well-being (r = .40). Obsessive passion was only found to be related to positive affect at Time 1 (r = .29). Intrinsic aspiration was related to how much time participants anticipated spending on academics per week (r = .25) and positive affect (r = .28), whereas extrinsic aspiration was negatively related to diet quality (r = -.31) and positively related to negative affect (r = .27) at the beginning of the semester.

Time 2. Although similar patterns were generally detected at Time 2 (as seen at Time 1), additional outcomes (e.g., burnout) were assessed at Time 2 and those appeared related, at the bivariate level, with SDT and DMP constructs. More specifically, need satisfaction was negatively related to need frustration (r = -.74), physical symptoms (r = -.26), negative affect (r = -.45), anxious and depressive symptoms (r = -.44), burnout - exhaustion (r = -.34), burnout - cynicism (r = -.43) and positively related to harmonious passion (r = .51), positive affect (r = .50), overall well-being (r = .67), and burnout - perceived efficacy (r = .32). Need frustration was negatively related to harmonious passion (r = -.32) and positively related to obsessive passion (r = .41). Need frustration was negatively related to diet quality (r = -.31), positive affect (r = -.42), overall well-being (r = -.70), burnout - efficacy (r = -.27), and sleep quality (r = -.35) and positively related to weekly sedentary time (r = .23), physical symptoms (r = .42), negative affect (r = .53), anxious and depressive symptoms (r = .52), burnout - exhaustion (r = .39), burnout - cynicism (r = .30), and self-neglect behaviors (r = .41). Harmonious passion was associated with positive affect (r = .37), overall well-being (r = .34), burnout - efficacy (r = .36), and sleep quality (r = .24) and negatively related to burnout - exhaustion (r = -.40), burnout - cynicism (r = -.54), and self-neglect behaviors (r = -.28). Obsessive passion was associated with weekly sedentary time (r = .24), physical symptoms (r = .36), negative affect (r = .43), anxious and depressive symptoms (r = .45), burnout - exhaustion (r = .32), and self-neglect behaviors (r

= .52) and negatively associated with diet quality (r = -.25), sleep (r = -.23), positive affect (r = -.24), and overall well-being (r = -.43). Intrinsic aspiration was positively associated with physical symptoms (r = .25) and negatively related to sleep quality (r = -.23), whereas extrinsic aspiration was negatively related to diet quality (r = -.24) and graduate advisor socioemotional support (r = -.24).

Time 1 Variables Predicting Time 2 Outcomes

Need Frustration, Obsessive Passion, and Extrinsic Aspiration Model. To test the second hypothesis several multiple regression analyses are presented below and in Tables 4 – 16 that correspond to the Time 2 outcomes of lower levels of physical activity, diet quality, sleep, well-being, and positive affect as well as higher levels of burnout, negative affect, anxiety and depression, self-neglect behaviors, and physical symptoms. As seen in Tables 4 – 5, the overall model was not statistically significant for physical activity, $F(5, 65) = 0.24$, $p = .94$, $R^2 = .02$, nor sedentary time per week, $F(5, 65) = 1.85$, $p = .12$, $R^2 = .12$. However, as seen in Table 5, obsessive passion at Time 1 positively predicted sedentary behavior at Time 2 ($\beta = .31$, $p = .02$). The overall model was statistically significant, $F(5, 65) = 3.23$, $p = .01$, $R^2 = 0.20$, for predicting physical symptoms at Time 2 and accounted for 9.4% of the variance. As seen in Table 6, need frustration, however, was the only significant predictor of physical symptoms ($\beta = .30$, $p = .01$). In terms of self-neglect behaviors, $F(5, 65) = 1.38$, $p = .24$, $R^2 = .10$ (see Table 7), and sleep, $F(5,65) = 1.36$, $p = 0.25$, $R^2 = .10$ (see Table 8), the overall predictive models were not statistically significant. The model was, however, significantly predictive of diet quality, $F(5, 65) = 3.19$, $p = .01$, $R^2 = .20$, accounting for 12.8% of the variance. As seen in Table 9, obsessive passion negatively predicted diet quality ($\beta = -.27$, $p = .03$).

The overall model was statistically significant, $F(5, 65) = 4.58$, $p < .001$, $R^2 = .26$, for predicting depressive and anxious symptoms and accounted for 16.7% of the variance. As seen in Table 10, extrinsic aspiration ($\beta = .24$, $p = .03$) and need frustration ($\beta = .26$, $p = .02$) at Time 1 significantly predicted students' higher endorsement of depression and anxiety symptoms at Time 2. Overall quality of life and well-being, as measured by the MQLI, was significantly predicted, $F(5, 65) = 4.73$, $p < .01$, $R^2 = .27$, by the model with need frustration negatively associated ($\beta = -.41$, $p < .01$) with well-being. See Table 11. Considering affect, the overall models were significant for both positive, $F(5, 65) = 2.51$, $p = .03$, $R^2 = .16$, and negative affect, $F(5, 65) = 3.72$, $p < .01$, $R^2 = .22$ (see Tables 12 – 13). Of note, need frustration at Time 1 predicted negative affect ($\beta = .36$, $p < .001$) at Time 2, but was marginally significant ($\beta = -.22$, $p = .06$) for positive affect. Levels of burnout were measured by three burnout subscales, cynicism, exhaustion, and efficacy. The prediction models for burnout, which entail the three dimensions of cynicism, exhaustion, and perceived efficacy, are presented in Tables 14 – 16. Although none of the overall models were statistically significant for the three dimensions (ps = .13 - .30), need frustration was predictive of cynicism ($\beta = .28$, $p = .03$) at Time 2.

In summary, we hypothesized that psychological need frustration, obsessive passion, and extrinsic life aspirations at Time 1 would predict more maladaptive outcomes at Time 2. This prediction was partially supported with need frustration associated with higher levels of physical symptoms, cynicism, negative affect, depressive and anxious symptoms, and well-being. Moreover, obsessive passion predicted more weekly sedentary time and poorer diet quality at Time 2, whereas an extrinsic aspiration at the onset of graduate school predicted only higher levels of depression and anxiety at Time 2.

Need Satisfaction, Harmonious Passion, and Intrinsic Aspirations. To test the third hypothesis several multiple regression analyses are presented below and in Tables 17 – 29 that correspond to the Time 2 outcomes of higher levels of physical activity, diet quality, sleep, well-being, and positive affect as well as lower levels of burnout, negative affect, anxiety and depression, self-neglect behaviors, and physical symptoms.

The overall model did not predict weekly physical activity at Time 2, $F(5, 65) = 1.09$, $p = .38$, $R^2 = .08$, nor sedentary time, $F(5, 65) = 1.94$, $p = .10$, $r^2 = .13$ (see Tables 17, 18). However, need satisfaction at Time 1 predicted less sedentary behavior ($\beta = -.35$, $p = .02$) at Time 2. The overall model accounted for 6.7% of the variance in physical symptoms at Time 2 and was significant, $F(5, 65) = 2.69$, $p = .03$, $R^2 = .17$ (see Table 19). Need satisfaction predicted students endorsing fewer physical symptoms ($\beta = -.29$, $p = .05$) at Time 2. As for self-neglect behaviors, the model was significant, $F(5, 65) = 2.42$, $p = .05$, $R^2 = .16$, with intrinsic aspiration at Time 1 being predictive of more self-neglect ($\beta = .26$, $p = .04$) at Time 2 (see Table 20). Regarding overall diet quality, $F(5, 65) = 1.59$, $p = .18$, $R^2 = .11$, and sleep, $F(5,65) = 1.00$, p = 0.43, $R^2 = .07$, the models were not statistically significant, nor were the hypothesized predictors (see Tables 21, 22).

The overall model of predictors was significant, $F(5, 65) = 3.19$, $p = .01$, $R^2 = .20$, and accounted for 10.3% of the variance in anxious and depressive symptoms (measured by the PHQ-4), with harmonious passion ($\beta = .29$, $p = .04$) and need satisfaction ($\beta = -.33$, $p = .02$) predicting symptoms (see Table 23). In terms of overall quality of life and well-being, the model was statistically significant, $F(5, 65) = 4.75$, $p < .01$, $R^2 = .27$, with need satisfaction ($\beta = .46$, $p < .01$) associated with higher quality (see Table 24). In terms of affect, the predictive models significant for both positive affect, $F(5, 65) = 2.68$, $p = .03$, $R^2 = .17$, and negative affect, $F(5,$

65) = 2.69, p = .03, R^2 = .17 (see Tables 25, 26). However, none of the hypothesized variables were significant for positive affect, whereas harmonious passion (β = .29, p = .04), and need satisfaction (β = -.42, p < .01) were predictive of negative affect at Time 2. The burnout subscale of cynicism at Time 2 was significantly, F(5, 65) = 3.01, p = .02, R^2 = .19, predicted by the model and accounted 17.7% of the variance with harmonious passion appearing to be a protective factor (β = -.41, p < .01; see Table 28). Although the model did not predict exhaustion ratings at Time 2, F(5, 65) = 1.09, p = .38, R^2 = .08 (see Table 27), it did predict participants' perceived efficacy at Time 2, F (5, 65) = 3.81, p < .01, R^2 = .23, with intrinsic aspirations marginally predicting (β = .20, p = .09) higher levels of perceived efficacy in academic activities, protecting against burnout (see Table 29).

In summary, we hypothesized that higher levels of need satisfaction, harmonious passion, and intrinsic aspiration at Time 1 would predict more adaptive outcomes later in the semester, such as positive affect, overall well-being, more physical activity and sleep, higher diet quality, and lower levels of self-neglect behaviors, anxious and depressive symptoms, burnout, negative affect, and physical symptoms. These hypotheses are partially supported by the results. That is, need satisfaction at Time 1 predicted higher levels of overall well-being and lower levels of weekly sedentary behavior, physical symptoms, negative affect, and anxious and depressive symptoms. The presence of harmonious passion at the beginning of the semester predicted lower levels of cynicism at Time 2, but higher levels of anxious and depressive symptoms and negative affect (contrary to our predicted direction). Intrinsic aspiration at Time 1 predicted a higher occurrence of self-neglect behaviors at Time 2 (contrary to our predicted direction).

Supplementary Analyses

Examining Changes Across the Semester

To explore changes from the beginning of the semester to its conclusion, we conducted supplemental analyses with paired samples *t*-tests. The means, standard deviations, statistical significance levels, and effect sizes are presented in Table 30. Beginning with predictor variables, intrinsic aspiration did not significantly change across the semester, nor did extrinsic aspiration. Participants reported lower levels of need satisfaction ($p < .001$, $d = 0.56$), and higher levels of need frustration ($p = 0.03$, $d = 0.27$), at Time 2. Harmonious passion for academics decreased as the semester progressed ($p < .001$, $d = 0.50$), whereas obsessive passion remained stable.

As for outcome variables, students reported spending significantly more time than they anticipated on academic activities, ($p = 0.02$, $d = 0.30$). Overall well-being decreased across the semester, $p < .001$, $d = 0.57$, as did positive affect, $p < .001$, $d = 0.64$. Symptoms of anxiety and depression increased across the semester, $p = 0.02$, $d = 0.27$. At both time points, participants were asked how frequently they were bothered by anxious or depressive symptoms over the past two weeks. At Time 1, 25.8% of participants reported experiencing moderate symptoms (i.e., scored at least 6 out of 12 possible points on the PHQ-4); at Time 2 the number of students scoring at this level rose to 35.3%.

In regard to the occurrence of physical symptoms (i.e., nausea, backaches, difficulty sleeping, headaches, eyestrain, and fatigue), these increased somewhat from Time 1 to Time 2, $p = 0.004$, $d = 0.30$. Students' self-reported physical activity decreased considerably across the semester, $p < .001$, $d = 0.84$. When asked how many minutes per day they engaged in some sort of physical activity over the past 7 days (e.g., walking, vigorous or moderate exercise), on

average participants at Time 1 were engaged in physical activity for 192 minutes per week vs. 107 minutes per week at Time 2. At Time 1, 45.9% of the sample did not engage in the recommended 150 minutes of physical activity per week, whereas at Time 2, 68.9% of the sample failed to meet the recommended levels. Sedentary behavior trended, $p = 0.06$, $d = 0.22$, toward a small increase across the semester. At Time 1, participants reported spending an average of 6 hours and 50 minutes being sedentary per weekday and 6 hours per weekend day. At Time 2, participants spent an average of 9 hours and 30 minutes per weekday engaging in sedentary behavior and 8 hours and 20 minutes per weekend day. Reported diet quality also worsened considerably across the semester, $p < 0.001$, $d = 0.72$.

Discussion

The current study examined changes in health and well-being across the first semester of graduate school and the potential for basic need satisfaction and frustration, passion, and life aspiration at the beginning of the semester to predict these outcomes at the end of the semester. A primary aim of this research is to explore a possible theoretical framework for understanding and predicting graduate student health and well-being. The hypotheses for psychological need frustration, obsessive passion, and extrinsic life aspirations to predict more maladaptive outcomes and need satisfaction, harmonious passion, and intrinsic life aspiration to predict more adaptive functioning were partially supported. In particular, need frustration prior to entering one's graduate program appeared to be the most consistent predictor of poorer functioning at the end of the first semester in this graduate student sample (i.e., higher levels of physical symptoms, cynicism, negative affect, distress, lower well-being), whereas need satisfaction more clearly predicted better functioning (i.e., well-being and lower levels of weekly sedentary behavior, physical symptoms, negative affect, and anxious and depressive symptoms). Although need

frustration did predict cynicism (a component of burnout), it did not predict higher levels of exhaustion and lower levels of efficacy as we expected. However, need frustration at the end of the first semester (Time 2) did correlate with exhaustion (r = .39), cynicism (r = .30), and less efficacy (r = -.27), and need satisfaction at Time 2 associated with less exhaustion (r = -.34) and cynicism (r = -.43), and greater efficacy (r = .32). One possible explanation for this is that need satisfaction and frustration levels at the beginning of the semester may not be adequate in identifying which students will experience higher levels of all of the manifestations of burnout at the end of the semester, but that there is some sort of relationship between the variables. Previous research that has cited need frustration and satisfaction as predictors of burnout dimensions often identify them as mediators (Ariani, 2019; Fernet et al., 2013; Kusurkar et al., 2021) which could also explain our unexpected findings.

When examining predictors of students' well-being and ill-being (Kasser & Ryan, 1996; Rijavec et al., 2011) and learning (Janke & Dickhäuser, 2019), it is important to consider goal contents, which is why graduate students' intrinsic and extrinsic aspirations were assessed. Intrinsic aspiration is typically predictive of positive outcomes; however, in this study it rarely predicted more adaptive outcomes (when examined within multiple regression models) with a trend toward more efficacy (i.e., an aspect of lower burnout) and an unexpected specific predictor of self-neglect behaviors. Extrinsic aspiration is often, but not always, predictive of poorer outcomes (Rijavec et al., 2011). In this study extrinsic motivation predicted anxious and depressive symptoms at the end of the semester. A possible explanation for our unexpected findings could be that we used an intrinsic aspiration subscale (personal growth) and an extrinsic aspiration subscale (financial goals), rather than the entire Aspiration Index. Future research may benefit from fully assessing graduate students' aspirations to more clearly understand how it

affects health and well-being. Another possible explanation for intrinsic aspiration being predictive of self- neglect behaviors is that graduate students may be willing to neglect certain aspects of their health (e.g., sleep, healthy meals, exercise) to pursue their academic passion because they have autonomously internalized their graduate work, meaning it is in alignment with their personal values. Therefore, they neglect aspects of their health and self-care because they feel that their needs are satisfied via academic passion and in the graduate program environment.

Academic passion is conceptualized as motivation to engage in academic activities because an individual loves, identifies with, and regularly invests resources in their academic endeavors (Vallerand, 2010). The dualistic model of passion is frequently used to identify and explain types of passion (i.e., harmonious and obsessive) and predict outcomes based on what type of passion the person holds. Consistent with Saville et al.'s (2018) findings among undergraduate students, higher baseline levels of harmonious passion were predictive of lower cynicism (a dimension of burnout) at Time 2. However, harmonious passion was also predictive of anxious/depressive symptoms and negative affect, which is atypical compared to previous research (Vallerand, 2012; Verner-Filion & Vallerand, 2018), and did not appear in the Time 1 and Time 2 bivariate correlations. In fact, the bivariate correlations at Time 2 were more consistent with the overall hypothesized patterns (e.g., harmonious passion associated with positive affect, well-being, and efficacy, and negatively associated with exhaustion, cynicism, and self-neglect). In terms of baseline obsessive passion for academics, it predicted more weekly sedentary time and poorer diet quality at the conclusion of the first semester, but it was not predictive of other metrics of ill-being which does not align with anticipated results and previous research (St-Louis et al., 2014; Vallerand, 2015). Again, Time 2 bivariate correlations were more

consistent with the overall hypothesized patterns (e.g., obsessive passion associated with higher sedentary behavior, self-neglect, physical symptoms, exhaustion, and negative affect, and negatively associated with positive affect, well-being, diet quality, and sleep).

The DMP proposes that individuals who are passionate about an activity will spend a significant amount of time engaging in the activity. Because of this, it was hypothesized that graduate students who are passionate about their academic activities will spend more time per week engaging in them than non-passionate individuals (Vallerand, 2015). Students identified as passionate about academic activities spent approximately 4 more hours per week than students not identified as passionate, which was a nonsignificant difference with a small effect ($d = 0.28$). It is notable that the sample size of non-passionate students was small ($n = 15$) and yielded rather uneven sized groups (i.e., passionate students $n = 54$), which likely limited our ability to detect statistical significance and potential differences. A notable collateral finding of interest was that the graduate students reported spending about 5 hours more on academic activities per week than they anticipated. It is worth exploring how students' expectations may affect their perceptions of their graduate work and well-being. For example, we found that students who were passionate about academics had lower levels of cynicism than non-passionate students, which is consistent with previous findings of passion (either type) being protective against burnout (Bélanger & Ratelle, 2021; Stoeber et al., 2011). Perhaps this is due to passionate students wanting to spend more time pursuing their academic passion, making passion protective against burnout and expectation violation.

As noted, the predictor variables performed in both expected and unexpected ways. Some of the Time 1 predictor variables were not related to the Time 2 outcome variables as hypothesized. This may be due to the variables fluctuating from Time 1 to Time 2, or possibly

the variables being more distal to the outcomes, requiring more than a semester to fully understand the relationship. Intrinsic aspiration, extrinsic aspiration, need satisfaction, overall well-being, positive affect, diet quality, physical activity, and harmonious passion decreased across the semester, rendering small to medium effect sizes. Need frustration, negative affect, anxious and depressive symptoms, physical symptoms, and sedentary time increased across the semester, with small to medium effect sizes and obsessive passion stayed the same.

Although some of our Time 1 variables did not predict outcomes as anticipated, many of the Time 2 predictor variables were highly correlated with the Time 2 outcome variables (as noted earlier). Therefore, the changes at Time 2 may be explained by the stress of graduate work influencing health and well-being outcomes, although causation cannot be concluded without a control group of non-graduate students. As the semester progresses and students become busier, it is likely that they have less time for sleep, physical activity, preparing healthy meals, and self-care—especially when compared to the beginning of the semester (or their summer or undergraduate schedules/workload). Furthermore, as stress increases students may be more susceptible to anxious and depressive symptoms. It is also important to note that this data was collected in the upper Midwest in a particularly cold region, therefore, seasonal factors such as colder weather and shorter days could have affected health behaviors and mood toward the end of the Fall semester (Beecher et al., 2016; Tucker & Gilliland, 2007). Moreover, Time 2 data was collected in the midst of the 2020 election season, the holiday season was approaching, and COVID-19 cases were rising—all of which could have influenced our findings. As outlined, the primary purpose of this study was to examine intrapersonal factors, but clearly more research is needed to determine the possible influence of contextual factors.

Although it may initially be concerning that positive factors decreased as the semester progressed negative ones increased, it is important to emphasize that most graduate students reported good general health, adequate engagement in healthy behaviors, and moderately low mental health symptoms. For example, our sample reported above average well-being at both Time 1 (M = 7.10, SD = 1.60) and Time 2 (M = 6.39, SD = 1.68). This is consistent with Hoying et al.'s (2020) research on incoming graduate students. Because this is one of the first longitudinal studies looking at graduate students' intraindividual factors, health, and well-being it is important to continue conducting longitudinal research with a variety of graduate samples to more clearly identify robust risk and protective factors.

Amongst our sample, good quality of life scores were predicted by higher levels of need satisfaction and lower levels of need frustration. As noted earlier, need satisfaction and need frustration were our most consistent predictors and it seems future research could possibly benefit from using the self determination theory framework to understand how, why, and when some graduate students thrive while others experience distress and less optimal functioning. With the growing number of individuals seeking out advanced degrees, there is notable variation in what the "typical" graduate student looks like or experiences due to the different coursework modalities, scholarly activities, training requirements, personal values of the student, values of the programs and departments, and so forth (Council of Graduate Schools & The Jed Foundation, 2021). Therefore, supporting graduate students via practices, policies, and programs could look quite different across programs and universities.

As outlined, this study focused primarily on intraindividual factors. However, we also measured two interpersonal constructs including the basic psychological need of relatedness as well as graduate advisor socioemotional support (both on a 1-7 scale), finding that students

reported high levels of relatedness satisfaction at both Time 1 (M = 6.00, SD = 0.85) and Time 2 (M = 5.82, SD = 0.93), as well as good socioemotional support from their graduate advisor (M = 5.27, SD = 1.20). The Council of Graduate Studies (2021) identified graduate faculty members and advisors, as well as graduate student peers as likely the best people to identify mental health symptoms in students because of proximity and social frequency. Therefore, training faculty and peers to recognize and respond to symptoms of ill-being, as well as self-neglect behaviors, and poor health behaviors could be the beginning steps towards more personalized support for graduate students. Moreover, faculty can connect with sources outside the department to facilitate student well-being such as the campus counseling center, the wellness center, student affairs, and so on. It is likely that an approach that is both collaborative and personalized could be most effective.

This study is one of the few that examines graduate students longitudinally and specifically explores intraindividual factors to better understand why some graduate students thrive and why some may experience increased health and well-being difficulties while in graduate school. However, it should be noted that this study had a small sample size (n = 74), of only Master's level students from one university, so the findings may not be generalizable to the population of graduate students more broadly. Additionally, data were collected during the ongoing COVID-19 pandemic, meaning that this graduate samples' first semester experience likely differed in multiple ways from previous cohorts (e.g., online coursework, less face-to-face interaction with peers and faculty, COVID-related anxiety). Nonetheless, the results indicate that basic psychological need satisfaction is a fundamental protective factor. Therefore, understanding how to promote a graduate program environment that promotes autonomy, relatedness, and competency could be advantageous because students typically perform and learn

better when these needs are met (Orsini et al., 2019; Vansteenkiste & Ryan, 2013). Further, given the trend for most health behaviors to decline over the first semester and the known association between overall well-being, physical and mental health, and healthy behaviors (e.g., adequate sleep, diet quality, exercise), graduate programs might consider strategies to promote continuation of healthy lifestyle behaviors in a realistic way (e.g., going on walks between classes, only doing work at the university, meal-prepping). Ultimately it is the graduate student's responsibility to incorporate self-care skills and health behaviors, and programs can support these behaviors by further modeling and encouraging them.

In conclusion, research examining graduate student health is limited which contributes to a lack of evidence-based interventions, policies, and programs. Future research would benefit from larger sample sizes from diverse populations, specifically BIPOC, LGBTQ+, and international students as these groups experience more distress (i.e., anxious and depressive symptoms), and fewer culturally-informed support services (Barreira et al., 2018). Additionally, it could be important to assess differences between programs and degree progress within the given program. It is important to understand the health and well-being of students at various points in their education and compare samples in order to fully contextualize the situation. With the growing interest in graduate student health and well-being, efficacious trainings, policies, and interventions are needed at all levels to promote student health and academic performance.

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Table 1

Participant Characteristics at Baseline

	%	*M (SD)*	Range
Gender			
Male	31.1		
Female	64.9		
Nonbinary	4.1		
Age, years		25.1 (5.3)	20-45
Body mass index		25.9 (5.6)	
Ethnicity			
White	90.5		
Asian or Pacific Islander	4.1		
Indigenous American	3.1		
Hispanic	1.4		
Partner, yes	56.8		
Children, yes	6.8		
International student, yes	2.7		
Academic information			
Semester credits		9.7 (2.6)	5-15
Anticipated academic time (hrs/wk) Time 1		28.9 (11.4)	5-60
Actual academic time at Time 2		33.6 (15.2)	2-70
% of classes face-to-face	29.6		0-100
Program type			
Graduate	71.6		
Professional	28.4		
Programs included			
Applied Material Sciences	1.1%		
Business Administration	3.4%		
Chemistry	2.3%		
Communication Sciences and Disorders	10.2%		
Computer Science	3.4%		
Engineering	12.5%		
Environmental Education	4.5%		
Environmental Health & Safety	1.1%		
Geology	2.3%		
Integrated Biosciences	9.1%		
Mathematics	3.4%		
Music Education	3.4%		
Physics	4.5%		
Psychological Science	15.9%		
Social Work	9.1%		
Tribal Administration and Governance	5.7%		
Tribal Resource and Environmental Stewardship	1.1%		

Water Resource Science	6.8%		
Assistantship			
Research assistant	17.6		
Teaching assistant	52.7		
Other assistant	2.7		
Estimated assistantship hours		11.25 (10.42)	
Financial information			
Fellowship/scholarship recipient	17.6		
Out of state tuition waiver	10.8		
Federal financial aid loan	40.5		
Personal loan	5.4		
Recipient of parental financial support	14.9		
Employment (hours per week)			
Currently employed outside of assistantship, yes	36.5		
Time spent at outside employment (hrs/wk)		8.5 (14.1)	0-45

Note. $n = 74$

Table 2

Bivariate Correlations between Study Variables at Time 1

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Need Satisfaction	--														
2. Need frustration	-.72**	--													
3. Harmonious passion	.58**	-.36**	--												
4. Obsessive passion	.03	.20	.22	--											
5. Intrinsic aspiration	.30**	-.14	.20	.20	--										
6. Extrinsic aspiration	.07	.10	.01	.21	.06	--									
7. Predicted academic time	.21	-.12	.24*	.16	.25*	.02	--								
8. METs – min/wk	.22	.01	.03	-.02	.12	.01	-.06	--							
9. Sedentary time	-.12	.05	-.09	.10	-.13	.22	-.07	-.35**	--						
10. Diet quality	.22	-.32**	.05	.13	.17	-.31**	.09	.24*	-.28**	--					
11. Physical symptoms	-.29*	.48**	-.10	.20	.05	.07	.09	.04	.10	-.29**	--				
12. Positive affect	.48**	-.44**	.36**	.29*	.28*	-.13	.18	.24*	-.20	.25*	-.16	--			
13. Negative affect	-.32**	.58**	-.12	.23	.06	.27*	.07	-.02	.06	-.23	.64**	-.10	--		
14. MQLI	.56**	-.52**	.40**	.03	-.01	-.22	.09	.20	-.18	.38*	-.51**	.43**	-.43**	--	
15. PHQ-4	-.35**	.60**	-.14	.20	-.00	.22	.03	-.06	.04	-.29*	.56**	-.34**	.76**	-.58**	--

Note. METs = metabolic equivalency, minutes of physical activity per week; MQLI = Multicultural Quality of Life Inventory; PHQ-4 = Patient Health Questionnaire 4-item.
* $p < .05$, **$p < .001$.

Table 3

Bivariate Correlations between Study Variables at Time 2

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. Need satisfaction	(.61**)																				
2. Need frustration	-.74**	(.79**)																			
3. Harmonious passion	.51**	-.32**	(.58**)																		
4. Obsessive passion	-.18	.41**	.08	(.57**)																	
5. Intrinsic aspiration	.02	.14	.14	.17	(.59**)																
6. Extrinsic aspiration	-.08	.20	.03	.13	.02	(.75**)															
7. Academic time	-.04	.20	.01	.19	.14	-.12	(.41**)														
8. METs – min/wk	.06	-.14	.10	-.15	.18	-.05	-.17	(.73**)													
9. Sedentary time	-.11	.23*	-.14	.24*	-.16	.14	.12	-.20	(.37**)												
10. Diet quality	.10	-.31**	.07	-.25*	.02	-.24*	.14	.53**	-.32*	(.82**)											
11. Physical symptoms	-.26*	.42**	-.22	.36**	.25*	-.02	.10	-.13	.13	-.34**	(.80**)										
12. Positive affect	.50**	-.42**	.37**	-.24*	.13	.00	-.13	.33**	-.15	.17	-.27*	(.47**)									
13. Negative affect	-.45**	.53**	-.20	.43**	.16	.14	.09	-.13	.14	-.24*	.61**	-.37**	(.54**)								
14. MQLI	.67**	-.70**	.34**	-.43**	-.12	-.13	-.07	.20	-.14	.32**	-.42**	.52**	-.58**	(.71**)							
15. PHQ-4	-.44**	.52**	-.13	.45**	.21	.11	.05	-.09	.09	-.27*	.50**	-.31**	.72**	-.64**	(.55**)						
16. Burnout: exhaustion	-.34**	.39**	-.40**	.32**	.16	-.11	.26*	-.02	.03	-.01	.43**	-.27*	.49**	-.39**	.49**	--					
17. Burnout: cynicism	-.43**	.30*	-.54**	.08	-.11	.01	-.08	-.03	.04	-.10	.17	-.30**	.28*	-.26*	.20	.50**	--				
18. Burnout: efficacy	.32**	-.27*	.36**	.01	.17	.03	.05	.14	-.04	.04	-.05	.32**	-.19	.21	-.02	-.22	-.44**	--			
19. Self-neglect behaviors	-.22	.41**	-.29*	.52**	.16	.06	.30*	-.10	.26*	-.31**	.49**	-.26*	.32**	-.46**	.36**	.55**	.32**	-.03	--		
20. Sleep	.13	-.35**	.22	-.23*	-.21	.04	.02	-.14	-.07	.18	-.46**	.11	-.27**	.28*	-.35**	-.25*	-.23*	.08	-.46**	--	
21. Advisor socioemotional support	.06	.04	-.03	.07	.08	-.23*	.01	.14	-.20	-.04	.21	-.06	.16	.05	.22	.02	.07	-.12	-.05	-.30*	--

Note. The correlations along the diagonal represent the associations between the measures from Time 1 to Time 2. METs = metabolic equivalency, minutes of physical activity per week; MQLI = Multicultural Quality of Life Inventory; PHQ-4 = Patient Health Questionnaire 4-item.
* $p < .05$, ** $p < .001$

Table 4

Hierarchical Regression Results for Need Frustration, Obsessive Passion, and Extrinsic Aspiration Predicting Weekly Physical Activity

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	53.53	16.50		0.00	[20.61, 86.46]	55.74	19.79		0.01	[16.21, 95.27]
Gender	-2.96	5.96	-0.06	0.62	[0.62, 14.85]	-2.08	6.27	-0.04	0.74	[-14.60, 10.43]
BMI	-0.38	0.50	-0.09	0.45	[-1.39, 0.62]	-0.38	0.53	-0.09	0.47	[-1.44, .672]
Need frustration						-1.00	3.35	-0.04	0.77	[-7.70, 5.70]
Obsessive passion						-1.43	3.01	-0.06	0.64	[-7.44, 4.58]
Extrinsic aspiration						0.60	2.63	0.03	0.82	[-4.66, 5.86]
F	0.42			0.66		0.24			0.94	
R^2	0.01					0.02				
Adjusted R^2	-0.02					-0.06				
ΔR^2	0.01					0.01				

Table 5

Hierarchical Regression Results for Need Frustration, Obsessive Passion, and Extrinsic Aspiration Predicting Weekly Sedentary Time

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	57.42	5.57		<.001	[46.29, 68.54]	51.27	6.30		<.001	[38.69, 63.86]
Gender	-0.40	2.01	-0.02	0.84	[-4.42, 3.62]	-1.83	1.99	-0.11	0.36	[-5.81, 2.16]
BMI	0.12	0.17	0.09	0.48	[-0.22, 0.46]	0.11	0.17	0.08	0.53	[-0.23, 0.44]
Need frustration						1.06	1.07	0.12	0.33	[-1.07, 3.19]
Obsessive passion						2.33	0.96	0.31	0.02	[0.42, 4.24]
Extrinsic aspiration						0.05	0.84	0.01	0.95	[-1.62, 1.73]
F	0.27			0.77		1.85			0.12	
R^2	0.01					0.12				
Adjusted R^2	-0.02					0.06				
ΔR^2	0.01					0.12				

Table 6

Hierarchical Regression Results for Need Frustration, Obsessive Passion, and Extrinsic Aspiration Predicting Physical Symptoms

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	0.88	0.37		0.02	[0.14, 1.61]	0.59	0.42		0.17	[-0.25, 1.43]
Gender	0.28	0.13	0.24	0.04	[0.01, 0.54]	0.23	0.13	0.20	0.09	[-0.04, 0.50]
BMI	0.02	0.01	0.21	0.07	[-0.00, 0.04]	0.02	0.01	0.17	0.14	[-0.01, 0.04]
Need frustration						0.19	0.07	0.30	0.01	[0.04, 0.33]
Obsessive passion						0.02	0.06	0.04	0.71	[-0.10, 0.15]
Extrinsic aspiration						-0.02	0.06	-0.05	0.69	[-0.13, 0.09]
F	3.98			0.02		3.23			0.01	
R^2	0.11					0.20				
Adjusted R^2	0.08					0.14				
ΔR^2	0.11					0.09				

Table 7

Hierarchical Regression Results for Need Frustration, Obsessive Passion, and Extrinsic Aspiration Predicting Self-Neglect Behaviors

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*P*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	1.29	0.95		0.18	[-0.60, 3.17]	0.82	1.13		0.47	[-1.43, 3.08]
Gender	0.61	0.34	0.21	0.08	[-0.07, 1.29]	0.54	0.36	0.19	0.13	[-0.17, 1.26]
BMI	0.05	0.03	0.19	0.11	[-0.01, 0.11]	0.04	0.03	0.17	0.17	[-0.02, 0.10]
Need frustration						0.17	0.19	0.11	0.38	[-0.21, 0.55]
Obsessive passion						0.05	0.17	0.04	0.77	[-0.29, 0.39]
Extrinsic aspiration						0.02	0.15	0.02	0.88	[-0.28, 0.32]
F	2.98			0.06		1.38			0.24	
R^2	0.08					0.10				
Adjusted R^2	0.05					0.03				
ΔR^2	0.08					0.02				

Table 8

Hierarchical Regression Results for Need Frustration, Obsessive Passion, and Extrinsic Aspiration Predicting Sleep

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*P*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	2.96	0.38		<.001	[2.21, 3.71]	3.14	0.44		<.001	[2.26, 4.02]
Gender	-0.15	0.14	-0.13	0.29	[-0.42, 0.13]	-0.11	0.14	-0.10	0.42	[-0.39, 0.17]
BMI	-0.02	0.01	-0.19	0.12	[-0.04, 0.01]	-0.02	0.01	-0.16	0.19	[-0.04, 0.01]
Need frustration						-0.12	0.08	-0.20	0.11	[-0.27, 0.03]
Obsessive passion						-0.02	0.07	-0.04	0.76	[-0.16, 0.11]
Extrinsic aspiration						0.02	0.06	0.04	0.74	[-0.10, 0.14]
F	1.87			0.16		1.36			0.25	
R^2	0.05					0.10				
Adjusted R^2	0.02					0.03				
ΔR^2	0.05					0.04				

Table 9

Hierarchical Regression Results for Need Frustration, Obsessive Passion, and Extrinsic Aspiration Predicting Diet Quality

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	4.08	0.67		<.001	[2.75, 5.41]	5.13	0.74		<.001	[3.65, 6.62]
Gender	-0.11	0.24	-0.05	0.66	[-0.59, 0.37]	0.06	0.24	0.03	0.79	[-0.41, 0.53]
BMI	-0.05	0.02	-0.26	0.03	[-0.09, -0.00)]	-0.04	0.02	-0.23	0.05	[-0.08, 0.00]
Need frustration						-0.14	0.13	-0.13	0.28	[-0.39, 0.12]
Obsessive passion						-0.25	0.11	-0.27	0.03	[-0.48, 0.03)]
Extrinsic aspiration						-0.11	0.10	-0.13	0.27	[-0.31, 0.09]
F	2.53			0.09		3.19			0.01	
R^2	0.07					0.20				
Adjusted R^2	0.04					0.14				
ΔR^2	0.07					0.13				

Table 10

Hierarchical Regression Results for Need Frustration, Obsessive Passion, and Extrinsic Aspiration Predicting Anxious and Depressive Symptoms

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*P*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	-0.06	0.48		0.90	[-1.02, 0.89]	-1.08	0.52		0.04	[-2.12, -0.04)]
Gender	0.39	0.17	0.26	0.03	[0.04, 0.73]	0.29	0.16	0.19	0.09	[-0.04, 0.62]
BMI	0.02	0.02	0.16	0.18	[-0.01, 0.05]	0.01	0.01	0.09	0.44	[-0.02, 0.04]
Need frustration						0.20	0.09	0.26	0.02	[0.03, 0.38]
Obsessive passion						0.08	0.08	0.12	0.31	[-0.08, 0.24]
Extrinsic aspiration						0.15	0.07	0.24	0.03	[0.01, 0.29]
F	3.52			0.04		4.58			<0.001	
R^2	0.09					0.26				
Adjusted R^2	0.07					0.20				
ΔR^2	0.09					0.17				

Table 11

Hierarchical Regression Results for Need Frustration, Obsessive Passion, and Extrinsic Aspiration Predicting Quality of Life

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	94.70	11.49		<.001	[71.77, 117.62]	111.66	12.48		<.001	[86.73,136.59]
Gender	-5.62	4.15	-0.16	0.18	[-13.89, 2.66]	-4.47	3.95	-0.12	0.26	[-12.36, 3.42]
BMI	-0.83	0.35	-0.27	0.02	[-1.53, 0.13)]	-0.58	0.33	-0.19	0.09	[-1.24, 0.09]
Need frustration						-7.82	2.12	-0.41	<.001	[-12.04, -3.59)]
Obsessive passion						1.09	1.90	0.07	0.57	[-2.70, 4.88]
Extrinsic aspiration						-1.56	1.66	-0.10	0.35	[-4.87, 1.76]
F	3.81			0.03		4.73			<.001	
R^2	0.10					0.27				
Adjusted R^2	0.07					0.21				
ΔR^2	0.10					0.17				

Table 12

Hierarchical Regression Results for Need Frustration, Obsessive Passion, and Extrinsic Aspiration Predicting Positive Affect

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	40.86	4.16		<.001	[32.56, 49.15]	42.60	4.83		<.001	[32.95, 52.24]
Gender	-2.90	1.50	-0.22	0.06	[-5.89, 0.10]	-3.10	1.53	-0.24	0.05	[-6.16, -0.05)]
BMI	-0.25	0.13	-0.22	0.06	[-0.50, 0.01]	-0.19	0.13	-0.17	0.15	[-0.45, 0.07]
Need frustration						-1.55	0.82	-0.22	0.06	[-3.18, 0.09]
Obsessive passion						1.03	0.73	0.17	0.16	[-0.43, 2.50]
Extrinsic aspiration						-0.26	0.64	-0.05	0.69	[-1.54, 1.02]
F	3.81			0.03		2.51			0.04	
R^2	0.10					0.16				
Adjusted R^2	0.07					0.10				
ΔR^2	0.10					0.06				

Table 13

Hierarchical Regression Results for Need Frustration, Obsessive Passion, and Extrinsic Aspiration Predicting Negative Affect

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	11.94	4.93		0.02	[2.09, 21.78]	3.35	5.39		0.54	[-7.41, 14.12]
Gender	2.97	1.78	0.20	0.10	[-0.59, 6.52]	1.97	1.71	0.13	0.25	[-1.44, 5.37]
BMI	0.17	0.15	0.13	0.28	[-0.14, 0.47]	0.08	0.14	0.06	0.60	[-0.21, 0.36]
Need frustration						2.85	0.91	0.36	<0.001	[1.03, 4.67]
Obsessive passion						0.70	0.82	0.10	0.40	[-0.94, 2.33]
Extrinsic aspiration						0.70	0.72	0.11	0.33	[-0.73, 2.13]
F	2.04			0.14		3.72			0.01	
R^2	0.06					0.22				
Adjusted R^2	0.03					0.16				
ΔR^2	0.06					0.17				

Table 14

Hierarchical Regression Results for Need Frustration, Obsessive Passion, and Extrinsic Aspiration Predicting Burnout Exhaustion

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	3.33	1.02		0.00	[1.29, 5.37]	3.26	1.21		0.01	[0.85, 5.67]
Gender	0.74	0.37	0.24	0.05	[-0.00, 1.47]	0.77	0.38	0.25	0.05	[0.01, 1.54]
BMI	-0.01	0.04	-0.04	0.75	[-0.07, 0.05]	-0.02	0.03	-0.07	0.59	[-0.08, 0.05]
Need frustration						0.26	0.21	0.16	0.21	[-0.15, 0.67]
Obsessive passion						-0.17	0.18	-0.12	0.36	[-0.54, 0.20]
Extrinsic aspiration						-0.02	0.16	-0.02	0.88	[-0.35, 0.30]
F	2.03			0.14		1.24			0.30	
R^2	0.06					0.09				
Adjusted R^2	0.03					0.02				
ΔR^2	0.06					0.03				

Table 15

Hierarchical Regression Results for Need Frustration, Obsessive Passion, and Extrinsic Aspiration Predicting Burnout Cynicism

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	3.61	.99		<.001	[1.63, 5.58]	2.50	1.14		0.03	[0.22, 4.78]
Gender	-0.13	0.36	-0.04	0.72	[-0.84, 0.59]	-0.20	0.36	-0.07	0.58	[-0.92, 0.52]
BMI	-0.02	0.03	-0.09	0.44	[-0.08, 0.04]	-0.04	0.03	-0.16	0.20	[-0.10, 0.02]
Need frustration						0.44	0.19	0.28	0.03	[0.06, 0.83]
Obsessive passion						-0.05	0.17	-0.04	0.77	[-0.40, 0.30]
Extrinsic aspiration						0.13	0.15	0.10	0.41	[-0.18, 0.43]
F	0.38			0.69		1.37			0.25	
R^2	0.01					0.10				
Adjusted R^2	-0.02					0.03				
ΔR^2	0.01					0.09				

Table 16

Hierarchical Regression Results for Need Frustration, Obsessive Passion, and Extrinsic Aspiration Predicting Burnout Efficacy

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	5.35	0.57		<.001	[4.21, 6.49]	5.42	0.67		<.001	[4.08, 6.75]
Gender	-0.28	0.21	-0.16	0.18	[-0.69, 0.13]	-0.28	0.21	-0.16	0.20	[-0.70, 0.15]
BMI	0.03	0.02	0.21	0.08	[-0.00, 0.07]	0.04	0.02	0.24	0.05	[0.00, 0.07]
Need frustration						-0.21	0.11	-0.22	0.07	[-0.44, 0.02]
Obsessive passion						0.07	0.10	-0.08	0.51	[-0.14, 0.27]
Extrinsic aspiration						0.05	0.09	0.07	0.57	[-0.13, 0.23]
F	2.44			0.10		1.77			0.13	
R^2	0.07					0.12				
Adjusted R^2	0.04					0.05				
ΔR^2	0.07					0.05				

Table 17

Hierarchical Regression Results for Need Satisfaction, Harmonious Passion, and Intrinsic Aspiration Predicting Weekly Physical Activity

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	53.53	16.50		0.00	[20.61, 86.46]	13.21	37.80		0.73	[-62.28, 88.70]
Gender	-2.96	5.96	-0.06	0.62	[-14.85, 8.93]	-4.65	5.99	-0.09	0.44	[-16.62, 7.32]
BMI	-0.38	0.50	-0.09	0.45	[-1.39, 0.62]	-0.33	0.52	-0.08	0.52	[-1.37, 0.70]
Need satisfaction						9.26	5.29	0.27	0.08	[-1.29, 19.82]
Harmonious passion						-5.69	3.34	-0.25	0.09	[-12.36, 0.98]
Intrinsic aspiration						2.63	4.64	0.07	0.57	[-6.63, 11.89]
F	0.42			0.66		1.09			0.38	
R^2	0.01					0.08				
Adjusted R^2	-0.02					0.01				
ΔR^2	0.01					0.07				

Table 18

Hierarchical Regression Results for Need Satisfaction, Harmonious Passion, and Intrinsic Aspiration Predicting Weekly Sedentary Time

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	57.42	5.57		<.001	[46.29, 68.54]	84.87	12.37		<.001	[60.16, 109.58]
Gender	-0.40	2.01	-0.02	0.84	[-4.42, 3.62]	0.61	1.96	0.04	0.76	[-3.31, 4.53]
BMI	0.12	0.17	0.09	0.48	[-0.22, 0.46]	0.06	0.17	0.04	0.72	[-0.28, 0.40]
Need satisfaction						-4.08	1.73	-0.35	0.02	[-7.53, -0.62)]
Harmonious passion						1.69	1.09	0.22	0.13	[-0.49, 3.87]
Intrinsic aspiration						-1.99	1.52	-0.16	0.20	[-5.02, 1.05]
F	0.27			0.77		1.94			0.10	
R^2	0.01					0.13				
Adjusted R^2	-0.02					0.06				
ΔR^2	0.01					0.12				

Table 19

Hierarchical Regression Results for Need Satisfaction, Harmonious Passion, and Intrinsic Aspiration Predicting Physical Symptoms

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	0.88	0.37		0.02	[0.14, 1.61]	1.01	0.84		0.24	[-0.67, 2.69]
Gender	0.28	0.13	0.24	0.04	[0.01, 0.54]	0.29	0.13	0.25	0.03	[0.03, 0.56]
BMI	0.02	0.01	0.21	0.07	[-0.00, 0.04]	0.02	0.01	0.25	0.04	[0.00, 0.05]
Need satisfaction						-0.24	0.12	-0.29	0.05	[-0.47, 0.00]
Harmonious passion						0.04	0.07	0.07	0.60	[-0.11, 0.19]
Intrinsic aspiration						0.14	0.10	0.17	0.18	[-0.07, 0.35]
F	3.98			0.02		2.69			0.03	
R^2	0.11					0.17				
Adjusted R^2	0.08					0.11				
ΔR^2	0.11					0.07				

Table 20

Hierarchical Regression Results for Need Satisfaction, Harmonious Passion, and Intrinsic Aspiration Predicting Self-Neglect Behaviors

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	1.29	0.95		0.18	[-0.60, 3.17]	-0.01	2.15		0.99	[-4.30, 4.27]
Gender	0.61	0.34	0.21	0.08	[-0.07, 1.29]	0.59	0.34	0.20	0.09	[-0.09, 1.27]
BMI	0.05	0.03	0.19	0.11	[-0.01, 0.11]	0.06	0.03	0.24	0.05	[0.00, 0.12]
Need satisfaction						-0.42	0.30	-0.20	0.17	[-1.02, 0.18]
Harmonious passion						-0.03	0.19	-0.02	0.89	[-0.41, 0.35]
Intrinsic aspiration						0.55	0.26	0.26	0.04	[0.02, 1.07]
F	2.98			0.06		2.42			0.05	
R^2	0.08					0.16				
Adjusted R^2	0.05					0.09				
ΔR^2	0.08					0.08				

Table 21

Hierarchical Regression Results for Need Satisfaction, Harmonious Passion, and Intrinsic Aspiration Predicting Sleep

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	2.96	0.38		<.001	[2.21, 3.71]	2.55	0.88		0.01	[0.79, 4.30]
Gender	-0.15	0.14	-0.13	0.29	[-0.42, 0.13]	-0.16	0.14	-0.14	0.25	[-0.44, 0.12]
BMI	-0.02	0.01	-0.19	0.12	[-0.04, 0.01]	-0.02	0.01	-0.19	0.14	[-0.04, 0.01]
Need satisfaction						0.08	0.12	0.10	0.51	[-0.17, 0.33]
Harmonious passion						0.03	0.08	0.06	0.68	[-0.12, 0.19]
Intrinsic aspiration						-0.03	0.11	-0.03	0.80	[-0.24, 0.19]
F	1.87			0.16		1.00			0.43	
R^2	0.05					0.07				
Adjusted R^2	0.02					0.00				
ΔR^2	0.05					0.02				

Table 22

Hierarchical Regression Results for Need Satisfaction, Harmonious Passion, and Intrinsic Aspiration Predicting Diet Quality

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	4.08	0.67		<.001	[2.75, 5.41]	3.49	1.54		0.03	[0.41, 6.57]
Gender	-0.11	0.24	-0.05	0.66	[-0.59, 0.37]	-0.14	0.24	-0.07	0.57	[-0.63, 0.35]
BMI	-0.05	0.02	-0.26	0.03	[-0.09, -0.00)]	-0.05	0.02	-0.27	0.03	[-0.09, -0.02)]
Need satisfaction						0.34	0.22	0.24	0.12	[-0.09, 0.77]
Harmonious passion						-0.07	0.14	-0.07	0.64	[-0.34, 0.21]
Intrinsic aspiration						-0.14	0.19	-0.10	0.45	[-0.52, 0.24]
F	2.53			0.09		1.59			0.18	
R^2	0.07					0.11				
Adjusted R^2	0.04					0.04				
ΔR^2	0.07					0.04				

Table 23

Hierarchical Regression Results for Need Satisfaction, Harmonious Passion, and Intrinsic Aspiration Predicting Anxious and Depressive Symptoms

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	-0.06	0.48		0.90	[-1.02, 0.89]	-0.65	1.07		0.54	[-2.78, 1.48]
Gender	0.39	0.17	0.26	0.03	[0.04, 0.73]	0.39	0.17	0.26	0.02	[0.05, 0.73]
BMI	0.02	0.02	0.16	0.18	[-0.01, 0.05]	0.03	0.02	0.22	0.07	[-0.00, 0.06]
Need satisfaction						-0.35	0.15	-0.33	0.02	[-0.65, -0.05]
Harmonious passion						0.20	0.09	0.29	0.04	[0.01, 0.39]
Intrinsic aspiration						0.22	0.13	0.20	0.10	[-0.04, 0.48]
F	3.52			0.04		3.19			0.01	
R^2	0.09					0.20				
Adjusted R^2	0.07					0.14				
ΔR^2	0.09					0.10				

Table 24

Hierarchical Regression Results for Need Satisfaction, Harmonious Passion, and Intrinsic Aspiration Predicting Quality of Life

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	9.50	1.16		<.001	[7.19, 11.82]	7.45	2.48		0.00	[2.49, 12.40]
Gender	-0.53	0.42	-0.15	0.21	[-1.36, 0.31]	-0.65	0.39	-0.18	0.10	[-1.43, 0.14]
BMI	-0.09	0.04	-0.28	0.02	[-0.16, -0.02]	-0.10	0.03	-0.31	0.01	[-0.16, -0.03]
Need satisfaction						1.19	0.35	0.46	0.00	[0.49, 1.88]
Harmonious passion						-0.14	0.22	-0.08	0.53	[-0.58, 0.30]
Intrinsic aspiration						-0.55	0.30	-0.21	0.07	[-1.16, 0.06]
F	3.81			0.03		4.75			<.001	
R^2	0.27					0.27				
Adjusted R^2	0.07					0.21				
ΔR^2	0.10					0.17				

Table 25

Hierarchical Regression Results for Need Satisfaction, Harmonious Passion, and Intrinsic Aspiration Predicting Positive Affect

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	40.86	4.16		<.001	[32.56, 49.15]	25.72	9.46		0.01	[6.82, 44.62]
Gender	-2.90	1.50	-0.22	0.06	[-5.89, 0.10]	-3.39	1.50	-0.26	0.03	[-6.39, -3.93]
BMI	-0.25	0.13	0.22	0.06	[-0.50, 0.08]	-0.21	0.13	-0.19	0.12	[-0.46, 0.05]
Need satisfaction						1.29	1.32	0.14	0.33	[-1.36, 3.93]
Harmonious passion						0.83	0.84	0.14	0.32	[-0.84, 2.50]
Intrinsic aspiration						0.57	1.16	0.06	0.62	[-1.74, 2.89]
F	3.81			0.03		2.68			0.03	
R^2	0.10					0.17				
Adjusted R^2	0.07					0.11				
ΔR^2	0.10					0.07				

Table 26

Hierarchical Regression Results for Need Satisfaction, Harmonious Passion, and Intrinsic Aspiration Predicting Negative Affect

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	11.94	4.93		0.02	[2.09, 21.78]	22.11	10.96		0.05	[0.23, 43.99]
Gender	2.97	1.78	0.20	0.10	[-0.59, 6.52]	3.51	1.74	0.23	0.05	[0.04, 6.98]
BMI	0.17	0.15	0.13	0.28	[-0.14, 0.47]	0.19	0.15	0.15	0.22	[-0.11, 0.49]
Need satisfaction						-4.52	1.53	-0.42	0.00	[-7.58, -1.46]
Harmonious passion						2.03	0.97	0.29	0.04	[0.11, 3.98]
Intrinsic aspiration						0.65	1.34	0.06	0.63	[-2.03, 3.34]
F	2.04			0.14		2.69			0.03	
R^2	0.06					0.17				
Adjusted R^2	0.03					0.11				
ΔR^2	0.06					0.12				

Table 27

Hierarchical Regression Results for Need Satisfaction, Harmonious Passion, and Intrinsic Aspiration Predicting Burnout Exhaustion

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	3.33	1.02		0.00	[1.29, 5.37]	3.17	2.39		0.19	[-1.61, 7.95]
Gender	0.74	0.37	0.24	0.05	[-0.00, 1.47]	0.73	0.38	0.23	0.06	[-0.03, 1.49]
BMI	-0.01	0.03	-0.04	0.75	[-0.07, 0.05]	-0.01	0.03	-0.03	0.80	[-0.07, 0.06]
Need satisfaction						0.00	0.34	0.00	0.99	[-0.67, 0.67]
Harmonious passion						-0.20	0.21	-0.14	0.35	[-0.62, 0.22]
Intrinsic aspiration						0.17	0.29	0.08	0.57	[-0.42, 0.76]
F	2.03			0.14		1.09			0.38	
R^2	0.06					0.08				
Adjusted R^2	0.03					0.01				
ΔR^2	0.06					0.02				

Table 28

Hierarchical Regression Results for Need Satisfaction, Harmonious Passion, and Intrinsic Aspiration Predicting Burnout Cynicism

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	3.61	0.99		<.001	[1.63, 5.58]	6.97	2.13		0.00	[2.72, 11.22]
Gender	-0.13	0.36	-0.04	0.72	[-0.84, 0.59]	-0.04	0.34	-0.01	0.91	[-0.71, 0.64]
BMI	-0.02	0.03	-0.09	0.44	[-0.08, 0.04]	-0.04	0.03	-0.14	0.23	[-0.09, 0.02]
Need satisfaction						-0.02	0.30	-0.01	0.95	[-0.61, 0.58]
Harmonious passion						-0.57	0.19	-0.41	<0.001	[-0.94, -0.19]
Intrinsic aspiration						-0.07	0.26	-0.03	0.80	[-0.59, 0.46]
F	0.38			0.69		3.01			0.02	
R^2	0.01					0.19				
Adjusted R^2	-0.02					0.13				
ΔR^2	0.01					0.18				

Table 29

Hierarchical Regression Results for Need Satisfaction, Harmonious Passion, and Intrinsic Aspiration Predicting Burnout Efficacy

	Step 1					Step 2				
Variables	*B*	*SE*	*β*	*p*	*CI 95%*	*B*	*SE*	*β*	*p*	*CI 95%*
Constant	5.35	0.57		<.001	[4.21, 6.49]	1.82	1.23		0.15	[-0.64, 4.28]
Gender	-0.28	0.21	-0.16	0.18	[-0.69, 0.13]	-0.39	0.20	-0.22	0.05	[-0.78, 0.01]
BMI	0.03	0.02	0.21	0.08	[-0.00, 0.07]	0.04	0.02	0.29	0.01	[0.01, 0.08]
Need satisfaction						0.16	0.17	0.13	0.35	[-0.18, 0.51]
Harmonious passion						0.18	0.11	0.22	0.11	[-0.04, 0.40]
Intrinsic aspiration						0.26	0.15	0.20	0.09	[-0.04, 0.56]
F	2.44			0.10		3.81			<.001	
R^2	0.07					0.23				
Adjusted R^2	0.04					0.17				
ΔR^2	0.07					0.16				

Table 30

Comparison of Variables from the Beginning of the Semester (Time 1) to the End of the Semester (Time 2)

	Time 1	Time 2	*t*	*p*	*d*
	M (SD)	*M (SD)*			
Predictor Variables					
Intrinsic aspiration	6.36 (0.65)	6.28 (0.70)	1.18	.24	0.14
Extrinsic aspiration	4.32 (1.13)	4.17 (0.97)	1.64	.11	0.19
Need satisfaction	5.67 (0.66)	5.32 (0.76)	4.84	<.001	0.56
Need frustration	2.74 (0.88)	2.90 (0.91)	-2.30	.03	-0.27
Harmonious passion	4.78 (1.08)	4.32 (0.97)	4.27	<.001	0.50
Obsessive passion	2.50 (1.02)	2.50 (1.01)	0.06	.95	0.01
Outcome Variables					
Quality of life score	7.10 (1.60)	6.39 (1.68)	5.58	<.001	0.57
Positive affect	33.61 (6.56)	29.35 (6.22)	6.19	<.001	0.64
Negative affect	20.54 (6.39)	21.03 (7.11)	-0.68	.50	-0.08
PHQ-4 score	0.89 (0.78)	1.08 (0.70)	-2.35	.02	0.27
Physical symptoms	1.79 (0.50)	1.89 (0.55)	-2.99	.004	0.30
Overall diet quality	3.07 (0.90)	2.74 (0.95)	3.43	<.001	0.72
MET-min per week	3832.81 (2997.64)	2110.78 (2221.42)	7.25	<.001	0.84
Sedentary behavior (min/wk)	3190.14 (2563.39)	3846.49 (1718.64)	-1.92	.06	-0.22
Academic time (hrs/wk)	29.25 (11.50)	33.63 (15.24)	-2.45	.02	-0.30
Sleep hours per night		7.15 (1.12)			
Sleep quality		1.84 (0.64)			
Self-neglect behaviors		3.53 (1.39)			
Burnout cynicism		2.77 (1.40)			
Burnout efficacy		5.67 (0.84)			
Burnout exhaustion		4.29 (1.46)			
Graduate advisor support		5.27 (1.20)			

Note. PHQ = Patient Health Questionnaire; MET = Metabolic Equivalency of Tasks.