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Health, Wellbeing, and Academic Achievement among Urban College Students

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Health, Wellbeing, and Academic Achievement among Urban College Students

Submitted to the Department of Psychology of the City College of New York
in partial fulfillment of the requirements
for the degree of master of arts in general psychology

By
Elise Tanzini
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Abstract

The post-secondary educational environment is full of demands—both academically and outside of the direct college setting—and as a result, stress is a prevailing concern for college students. Chronic, high levels of stress have been linked to a number of negative health outcomes, such as anxiety and depression, and academic outcomes, such as lower academic achievement. Using a diverse sample of undergraduate and masters students \( n=84; \) mean (SD) age = 22.89 (5.99) years] from an urban, public college, the current study measured students’ experiences of stress (Perceived Stress Scale) and the adaptive and maladaptive strategies they utilized to cope with stress, including mindfulness (Mindful Attention Awareness Scale), physical activity (International Physical Activity Questionnaire – Short Form), and substance use (Rutgers Collegiate Substance Abuse Screening Test). This study then assessed whether these experiences differed for students who were achieving highly (as measured by semester-end GPA) and whether stress predicted anxiety (Beck Anxiety Inventory) and depression (Beck Depression Inventory-II). Participants completed three surveys at the beginning, middle, and end of the academic semester. Participants experienced chronic, high levels of stress and a substantial minority experienced moderate to severe levels of anxiety and depression. Experiences of stress did not differ as a function of academic achievement. Few students expressed problem substance use and most engaged in moderate to high levels of physical activity. There is preliminary evidence to suggest that changes in stress and mindfulness were predictive of changes in anxiety and depression. These results suggest that promoting mindfulness and physical activity as interventions in college settings may be beneficial to buffer the effects of stress on anxiety and depression. Future studies delineating the sources of stress and their relation to coping strategies may help to better identify those most likely to benefit from these strategies. Furthermore,
assessing concurrent coping strategies specifically associated with academics would help to further clarify the role of mindfulness and physical activity as adaptive coping mechanisms.

*Keywords*: stress, coping, anxiety, depression, academic achievement
Health, Wellbeing, and Academic Achievement among Urban College Students

Higher educational attainment is important for both individuals and society. Higher income, improved quality of life, and decreased utilization of government financial support are among the many economic and social benefits associated with the achievement of a post-secondary degree (Bloom, Hartley, & Rosovsky, 2007). The process of earning a degree—from the transition to postsecondary education through to degree completion—is challenging academically (with curricular and time demands), socially (with forging new relationships), and financially (Aselton, 2012). These challenges may become magnified if students are the first in their families to attend college (i.e., first-generation) or are members of lower-income households (Engle & Tinto, 2008). If these challenges are perceived as exceeding an individual’s ability to cope with them, or if these challenges persist, stress may be experienced. Moreover, if prolonged, stress may have detrimental effects on students’ health and functioning.

Conceptualizing stress

Stress may be defined as “the nonspecific response of the body to any demand made upon it” (Selye, 1973, p. 692). The body, under the exposure of different demands or “stressors” reacts adaptively; that is, by maintaining homeostasis (i.e., the stability of its environment). This adaptive response occurs once an individual perceives the demands of a situation as potentially threatening, and exceeding his or her current resources (Lazarus & Folkman, 1984). Accordingly, stressors and subsequent experiences of stress vary greatly within and between individuals. Stressors may be predictable or unpredictable, short or long in duration, may occur repeatedly, and may result in positive (i.e., eustress) or negative (i.e., distress) experiences (Ursin & Eriksen, 2004).
This nonspecific response of the body includes “a general increase in wakefulness and brain arousal, and specific responses to deal with the reasons for the alarm” (Ursin & Eriksen, 2004, p. 571). These responses involve activation of the hypothalamic-pituitary-adrenal axis (HPA), which results in the production and release of glucocorticoids (e.g., cortisol) by the adrenal cortex, and activation of the sympathetic-adrenal-medullary (SAM) system, which results in the production and release of catecholamines from the sympathetic nerves and adrenal medulla (Lupien, McEwen, Gunnar, & Heim, 2009). These changes function to signal the body to adapt to experiences of acute stress, enabling its fight-or-flight response (Cannon, 1929). Changes occur in neural circuitry and increase or decrease expression of cognition, decision-making, anxiety, and mood (McEwen, Eiland, Hunter, & Miller, 2012).

Once a situation is no longer perceived as stressful, this system also functions as a negative feedback loop in which cortisol signals to the hypothalamus and anterior pituitary gland to suppress further production of corticotropic releasing hormone and adrenocorticotropic releasing hormone, respectively, ultimately resulting in cortisol concentration returning to baseline (Lupien et al., 2009). However, if stress is chronic, or experienced intensely for long duration, these systems are unable to recover between acute episodes and remain activated (Fuchs & Flügge, 2011). Exposure to chronic stress may result in maladaptive changes in brain structure and function, particularly of the hypothalamus, prefrontal cortex, and amygdala (McEwen et al., 2012) and consequently, in modified physiological (e.g., activity of HPA axis) and behavioral responses to stress (e.g., impairments in learning and symptoms of anxiety and depression; Heim & Binder, 2012; Lupien et al., 2009).
Stress and college students

Stress is ubiquitous. Everyone experiences events in daily life that are unexpected and perceived as dangerous—a car swerving in traffic or a dog suddenly barking behind a fence—which are accompanied by typical bodily responses, such as increases in heart rate, rapid breathing, and tightening of the stomach muscles (McEwen, 2008). Modern day stressors, however, are not only acute dangers to physical health, but are also characterized by psychosocial demands: a looming deadline or a series of bills to be paid when the capacity to finance them is uncertain (Danielsson et al., 2012). Often, these psychosocial stressors are chronic.

Although everyone has had the experience of stress, it appears that college students are particularly at risk for high levels of stress. A recent survey by the American College Health Association (2014) indicated that a majority of post-secondary students (53.8% of undergraduates and 61.2% of graduates sampled) experienced “more than average stress” or “tremendous stress” in the last 12 months. In the same survey, 32% of undergraduate students and 19.2% graduate students indicated that stress had influenced their academic performance (e.g., lower grades or dropped courses). Of note, in this survey stress was reported with higher frequency above all other factors reported to affect academic performance (e.g., participation in extracurricular activities). Money, work, family responsibilities, and health concerns are prevalent stressors reported by Americans, and experienced at higher levels by individuals who are members of lower-income households (American Psychological Association, 2015). For post-secondary students, stress may be initiated by similar events outside of the direct college setting (e.g., relationship difficulties, financial and health problems), or may be the result of specific, school-based factors (e.g., an upcoming test, an assignment deadline). These reports of
high levels of stress are not only of concern in themselves, but are problematic clinically, as high
levels of stress have been associated with greater prevalence of mental health difficulties, such as
anxiety and depression (Lupien et al., 2009), and academically, as they are associated with
poorer academic outcomes (Richardson, Abraham, & Bond, 2012).

Consequently, the health and wellbeing of college students is a persistent concern for
institutions of higher education. Whether this includes promotion of positive mental health or
illness prevention, students’ wellbeing has an impact on their learning, academic success, and
outcomes outside of the educational setting (American Council on Education, 2014). In addition,
colleges and universities are not only mandated to provide appropriate academic
accommodations to students who present with clinical mental health diagnoses (and who request
services; Americans With Disabilities Act, 1990), but they are also responsible for ensuring that
students who present with symptoms of anxiety and depression, even if these do not meet full
criteria for a diagnosis, are offered interventions to help combat these symptoms (American
Council on Education, 2014). In light of these responsibilities, identifying patterns of stress and
its impact on students’ functioning is essential.

Stress, wellbeing, and achievement

Many studies have investigated the impact of stress on health, cognition, and behavior.
Physical health is negatively affected by chronic stress; studies show that immune system
functioning is compromised (Sergerstrom & Miller, 2004) and risk for developing cardiovascular
disease is increased (Rozanski, Blumenthal, & Kaplan, 1999) subsequent to chronic stress. In
their 10-year longitudinal study of predominantly European-American adults (ages 34 to 84),
Piazza et al. (2013) found that individuals’ reports of emotional responses to daily stress at
baseline significantly predicted reports of the development of a chronic physical health condition ten years later.

Beyond effects on health, stress also impacts cognitive function, such as memory. Although few studies have been conducted with human populations, there is evidence to suggest that if the magnitude of stress is high or if it is experienced chronically, memory is impaired (Sandi, 2013). In their five-year longitudinal study of healthy elderly subjects (ages 60 to 80), Lupien et al. (1994) found that explicit memory and selective attention were impaired in subjects whose stress levels (as measured by plasma cortisol) increased over time and were high in magnitude, compared to subjects whose stress levels were not high in magnitude. Other research suggests mixed effects of stress on memory in healthy college males, such that implicit memory for negative emotional material may be facilitated and working memory impaired (Luethi, Meier, & Sandi, 2009).

It is also important to consider the impact of stress on mental health and emotional functioning. Much of the stress literature has focused on “stressful” life events, such as divorce or being fired at work, and their role in the development of depression (Hammen, 2005; Mazure, 1998; Kessler, 1997). Hammen (2005) expanded this discussion by indicating that not only does stress influence onset of depressive symptoms, but that depression influences experiences of stressful life events, suggesting a bidirectional relationship. For example, a longitudinal study that assessed stressful life events and symptoms of depression among a community sample of adults, found that stressful life events at the first time point was a significant predictor of symptoms of depression reported five years later (Phillips, Carroll, & Der, 2015). There was also emerging evidence that depression experienced at the first time point marginally predicted stressful life events five years later. Similarly, evidence suggests that stress experienced during
key times of development (i.e., prenatal and adolescence) are related to subsequent diagnoses of mood and anxiety disorders in adulthood (Lupien et al., 2009). Furthermore, it was reported that the number of stressful life events might influence onset of generalized anxiety disorder (Blazer, Hughes, & George, 1987).

Associations between stress and anxiety and depression are also evident in college student populations. In a cross-sectional evaluation using self-report measures, Dyson and Renk (2006) investigated stress among 74 freshman students, a population they hypothesized would be particularly vulnerable to effects of stress as they adapt to university life. The authors found that stress (related to family and college changes) was correlated with symptoms of depression ($r = 0.27$). In a cross-sectional evaluation of 1124 predominantly white college students, perceived stress was positively associated with negative affect (e.g., symptoms of depression, anxiety, irritability) and adaptive (i.e., problem-focused) coping strategies (Eisenbarth, Champeau, & Donatelle, 2013). Most studies investigating associations between college student health and wellbeing have used cross-sectional evaluations; however, in order to provide appropriate interventions for students, it is important to examine changes in health throughout the academic year (Ruthig, Marrone, Hladkyjm & Robinson-Epp, 2011). In one study, levels of perceived stress, test anxiety, and personal burnout of 581 undergraduate students enrolled in courses that included either stress management, physical activity, or cardiovascular fitness components were assessed at the beginning and end of a semester (Baghurst & Kelley, 2014). This study found that there was a reduction in perceived stress, test anxiety, and personal burnout scores at the completion of the semester for students in the stress management and physical activity classes. Mokrue and Acri (2015) indicated that despite past research connecting the health status of college students with symptoms of anxiety and depression, more research is necessary to
investigate these relationships in ethnically diverse samples of college students. In their study of 567 undergraduate students at an ethnically diverse public university, students’ ratings of symptoms of anxiety and depression were higher than ratings of students in a national survey (22.3% and 26.8% in this sample versus 14.5% and 17.8% in a national survey fell into moderate to severe categories of depression and anxiety, respectively). In addition, students’ ratings of health as “poor” (versus ratings of “excellent,” “good,” or “average”) were associated with increased symptoms of depression and anxiety (Mokrue & Acri, 2015).

Furthermore, beyond investigations of past achievement and cognitive capacity, stress has been explored as a correlate of academic achievement in college settings. In their meta-analysis, Richardson, Abraham, and Bond (2012) reviewed psychological correlates of academic performance among undergraduate students, as measured by cumulative or course grade point average (GPA) in college. Factors were categorized using five domains: personality, motivation, self-regulation, approach to learning, and psychosocial contextual influences, such as general and academic stress. This review included 217 different studies and found small and non-significant negative correlation effects for the relations between both general and academic stress and GPA ($r^{+1} = -0.13$ and $r^+ = -0.12$, respectively). In contrast, others have shown that high levels of stress have detrimental effects on academic performance. Andrews and Wilding (2004) investigated contributions of life stress to anxiety, depression, and exam performance in 351 undergraduate students and found that financial difficulties predicted a decrease in final exam performance from first to second year. Experiencing academic stress in particular, has been found to be negatively associated with academic performance in both predominantly white ($n = 218$; Pritchard & Wilson, 2003) and Jamaican immigrant ($n = 150$; Buddington, 2002) private college

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1 Indicates weighted correlation.
student populations. However, other analyses did not determine any effects on GPA of change in perceived stress from the beginning to the end of an academic semester (Ruthig, Marrone, Hladkyj, & Robinson-Epp, 2011), or alternatively, of stress related to minority status (Greer & Brown, 2011). These differing results suggest that further investigation of the relation between academic achievement and stress is required.

It is important to note, however, that although high levels of stress may be debilitating and lead to poor academic performance, low levels of stress may produce similar outcomes, whereas moderate levels may be necessary to initiate and maintain performance in difficult tasks, such as assignment completion or studying for examinations. This formulation—the Yerkes-Dodson law—may be applied to any measure of performance and is depicted by an inverted U shape, which implies that performance increases as stress increases, but then decreases after a certain point (Teigen, 1994). That is, a certain level of stress is necessary for an individual to perform at his or her optimum capacity—if a person experiences stress below or above this level, his or her performance is compromised. What is considered optimal differs based on the individual, however; that is, a number of genetic, developmental, and contextual factors may influence an individual’s susceptibility to stress, its effects, and an individual’s ability to cope with stress (McEwen, 2008).

**Stress and Coping**

In light of the myriad effects of stress on the brain and adaptive functioning, it is essential that individuals learn to manage stress or adopt measures to offset its negative effects. In fact, Lazarus and Folkman’s (1984) definition of stress centers around individuals’ perceptions of their capacity to manage demands on them. That is, they consider that stress is experienced when the demands of a situation outweigh an individual’s perception of his or her ability to cope with
them. An individual’s response to stress will not only depend on physiological activation in response to stressors, but also on an individual’s appraisal of the situation as stressful and on their appraisal of resources available to cope with the stressful situation. Therefore, coping is an individual’s process of managing his or her environment, which has been appraised as significantly stressful, and exceeding his or her limited resources (Folkman & Moskowitz, 2004). The ways in which individuals manage the stress that they experience may alter different pathways of short- and/or long-term effects of stress (Skinner, Edge, Altman, & Sherwood, 2003).

There is vast variability in the way individuals cope with stress, and this is reflected in the many ways of coping (Skinner et al., 2003). Skinner et al. (2003) suggest that coping may be viewed as a hierarchy, with individual coping behaviors at the lowest level and as adaptive processes that mediate the relationship between stress and various outcomes at the highest level. Variation in coping strategies is not simply across individuals, but also within individuals; type of stressor, situation, age, and time all influence the coping strategy that is utilized (Lazarus, 2000). As such, research that examines the temporal patterns of coping strategies is necessary. Folkman and Lazarus (1985) suggest that during any stress-inducing situation, the emotions experienced are constantly changing, and in turn, so are coping changes. For example, in their study of 108 college students, Folkman and Lazarus (1985) found that a range of different coping strategies—to regulate emotions and change the problem causing the distress—were deployed before and immediately following a midterm exam, and before receiving grades for this exam.

Although researchers suggest that the adaptive nature of a particular coping strategy may be dependent on the individual, the stressor, and its accompanying situation, it is nonetheless important to distinguish between adaptive and maladaptive coping strategies (Skinner et al.,
2003). That is, some coping strategies buffer effects of a stressor by changing levels of physical arousal, behavior, or cognitive appraisal of the situation. Mindfulness and physical activity are two examples of adaptive coping strategies. In contrast, some strategies, particularly after repeated use, may cause harm or involve attempts to escape or avoid a stressor. Substance use is an example of one such strategy.

**Mindfulness.** Mindfulness may be defined as “the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment” (Kabat-Zinn, 2003, p.145). If we break this down, mindfulness is a concept that involves: (1) directing attention to one stimulus at a time, (2) the intention to experience with interest and with purpose, and (3) employing an attitude of acceptance and non-judgment to the experience regardless of its affective connotation (Burke, 2010).

Mindfulness is an “inherent human capacity” which may be refined through practice (Kabat-Zinn, 2003, p. 146). That is, although mindfulness may be viewed as a disposition, mindfulness skills may vary based on the situation (Bishop et al., 2004) and may be fostered through a variety of different methods: practices, such as mindfulness meditation, or training interventions that incorporate mindfulness meditation, such as Mindfulness-Based Stress Reduction (MBSR). Changes in brain structure (Hölzel et al., 2011; Taren, Creswell, & Gianaros, 2013) and function, particularly in areas involved in attention, concentration, and emotion regulation (Greenberg & Harris, 2012; Marchand, 2014) have been noted in the mindfulness literature.

As mindfulness practice focuses on intention, attention, and attitude, it has most notably been linked to buffering the effects of stress on various stress-related illnesses (Hoffman, Sawyer, Witt, & Oh, 2010). Benefits of formal training through mindfulness-based interventions
also include improvements in symptoms of anxiety and depression (Strauss, Cavanagh, Oliver, & Pettman, 2014). More recently, research on mindfulness as practiced by non-clinical populations of college students show similar stress-buffering effects and suggests that mindfulness may serve as a key adaptive coping strategy in this population. However, investigations in this area are still in its infancy. In one study, researchers found that college students enrolled in a modified MBSR program administered on campus (1.5 hours per week for 8 weeks) reported a decrease in symptoms of stress, anxiety, and depression and an increase in mindfulness after completion of the program compared to no changes reported by students in a wait-list control group (Lynch, Gander, Kohls, Kudielka, & Walach, 2011). Of note, this was a pilot study in which participants were not randomly assigned to either the mindfulness or control conditions, so generalizability of these findings is limited.

Unfortunately, much less research has investigated levels of mindfulness irrespective of formal training. Emerging data shows that even in the absence of formal training, mindfulness is negatively associated with psychological distress (including somatization, anxiety, and depression) among college students (Masuda & Tully, 2011). Hou, Ng, and Wan (2015) examined changes in mindfulness, positive affect, stress (as measured by cortisol secretion), and symptoms of anxiety and depression among college students before, during, and after an exam period. In this study, increases in mindfulness before, during, and after exams were associated with decreases in stress and symptoms of anxiety; however, impact on exam performance was not investigated. Murphy, Mermelstein, Edwards, and Gidycz (2012) found that greater levels of mindfulness were associated with better self-reported “health” (i.e., sleep, eating, and exercise behaviors, and physical health) in a sample of 441 female Caucasian students. These authors also found that mindfulness reported at the beginning of an academic semester predicted physical
health reported at the end of the semester, although effects were small and results are difficult to generalize given lack of diversity in the sample.

It is suggested that mindfulness may serve to both modify the cognitive appraisal of a situation, so as to consider it to be less stressful, and to allow for adaptive coping in the face of a potentially stressful situation (Weinstein, Brown, & Ryan, 2009). That is, focusing on the present moment-by-moment in a nonjudgmental and open way, instead of on the past or future with negativity, may reduce stress and improve wellbeing (Hofmann, Sawyer, Witt, & Oh, 2010).

**Physical activity.** Physical activity involves the expenditure of energy through bodily movements created by skeletal muscles (Casperson, Powell, & Christenson, 1985). Physical activities may involve engagement in sports or exercise, or in activities in leisure or occupational settings. Much research has focused on the benefits of physical activity, which range from reducing the risk of coronary heart disease (Biddle & Mutrie, 2007) to improving cognition of elderly who reported issues with memory (Lautenschlager et al., 2008). Additionally, physical activity may serve as a buffer against the effects of stress on various health outcomes (Edenfield & Blumenthal, 2011; Gerber & Pühse, 2009).

A number of cross-sectional studies have noted that college students who report low levels of physical activity also report high levels of stress (Hudd et al., 2000). It is important to note, however, that the relationship between stress and physical activity is likely bidirectional; that is, not only does physical activity affect stress, but also, experienced stress affects physical activity. In one study, college students’ engagement in physical activity during an exam-period decreased compared to frequency and duration of engagement at the beginning of the semester (Oaten & Cheng, 2005). In another study, male students who reported high levels of stress at baseline were more physically active after participation in a 3-month course that promoted
physical activity, compared to those who did not report high levels of stress or those assigned to a course on general health (Johnson-Kozlow, Sallis, & Calfas, 2007).

These results suggest that the likelihood of individuals engaging in physical activity may be reduced if they are experiencing high levels of stress. But, also, that students who are not motivated to engage in physical activity; that is, students who do not view physical activity as a strategy that may help them cope with stress, may be particularly affected. Even for students who, under less stressful conditions, are motivated to engage in physical activity, increasing demands and energy expenditure in other areas, such as preparing for final exams, might result in a decrease of adaptive coping. Not only does not being physically active have consequences for experiences of stress, but it also increases physical health risks, such as obesity (Huang et al., 2003).

Furthermore, engaging in physical activity is associated with fewer symptoms of depression (Dunn, Trivedi, & O’Neal, 2001; Mammen & Faulkner, 2013) and anxiety (Herring, O’Connor, & Dishman, 2010). In an eight-year longitudinal study of a large sample of adults (ages 35 to 55), researchers found that individuals who reported regular physical activity displayed fewer symptoms of depression at follow-up (Da Silva et al., 2012). Regular physical activity was defined as participants who reported engagement in at least 2.5 hours of moderate physical activity per week at two or three time points. However, it is important to note that participants who began the study with greater symptoms of depression and anxiety were less likely to engage in physical activity throughout the course of the study (Da Silva et al., 2012).

The literature suggests that physical activity is associated with a number of positive health outcomes. Despite its documented benefits, and the negative consequences of inactivity,
further research is necessary to ascertain experiences of physical activity among college student populations as a strategy to cope with stress.

**Substance use.** In contrast to the above adaptive strategies, consumption of alcohol, tobacco, and/or illicit drugs, as well as misuse of prescription drugs (such as Adderall or Xanax for example) may be viewed as a maladaptive coping strategy. That is, substance use may provide a means of escaping from stressful situations if more adaptive strategies are perceived to be impossible, too time-consuming or unpleasant to an individual (Cooper, Frone, Russell, & Mudar, 1995). In the long term, however, substance use may be associated with other negative outcomes, such as substance abuse or dependence (Arria, Vincent, & Caldeira, 2009). In a sample of 535 Hispanic college students, Cabriales, Cooper, & Taylor (2013) determined that higher levels of anxiety and lower levels of depression predicted whether students had ever (in their lifetime) misused prescription drugs. Positive relationships between generalized anxiety disorder and both binge drinking and cigarette use and negative relationships between major depression and binge drinking have been determined (Cranford, Eisenberg, & Serras, 2008). However, in another study, binge drinking alone was associated with higher symptoms of depression versus binge drinking in social contexts or not at all (Christiansen, Vik, & Jarchow, 2002).

In 2013, the National Survey on Drug Use and Health reported that 22.3% of full-time college students (ages 18 to 22) reported engagement in illicit drug use, 39% reported binge drinking compared to 33.4% not enrolled in college or enrolled part-time (Substance Abuse and Mental Health Services Administration, 2014). Despite these high levels, few studies have directly examined the motivations behind substance use in non-clinical college samples. However, studies have determined that experiences of stress may influence subsequent substance
use. Rutledge and Sher (2001) determined that in first-year college students, experiences of negative life events were associated with alcohol use. Similarly, Broman (2005) found that undergraduate students’ experiences of stressful life events and traumatic life events were associated with increases in substance use; however, these relationships varied due to race and gender suggesting that investigations of more diverse samples of college students are necessary.

**The current study**

The literature presented suggests that stress is a prevailing concern for college students. Moreover, as stress has been linked to a number of health outcomes, such as anxiety and depression, and to a lesser extent, academic outcomes, such as achievement, it is imperative that ways in which college students may buffer the effects of stress are determined. Individuals’ experiences of stress, and its potential consequences, may be altered depending on the strategies employed to cope with stress. The use of adaptive strategies, such as mindfulness and physical activity, may provide a buffer against detrimental effects of stress compared to the use of maladaptive strategies, such as substance use, which may exacerbate potential issues. Based on the demands of a situation, stress levels may change over time, and coping strategies utilized may be altered as a result. It is important to foster coping strategies, particularly when they are at risk of not being utilized, as these are the situations in which they are most required.

The current study assessed perceived stress, and symptoms of anxiety and depression throughout the course of an academic semester longitudinally. Specifically, this study attempted to ascertain whether stress increased throughout the course of a semester and if stress predicted anxiety and depression severity scores among a college student population underrepresented in the stress and health literature.
Furthermore, this study investigated levels of mindfulness, physical activity, and substance use as strategies that this sample of college students may employ to cope with stress. Changes in the use of these strategies throughout the semester and their relationships with health and wellbeing were determined. This study also examined whether experiences of stress differed as a function of participants’ level of academic achievement, as measured by their current semester GPA (A, B or ≤C range). It was hypothesized that: (1) stress would increase throughout the course of the semester, as academic demands increased over time (the normal academic cycle); (2) stress would be positively associated with anxiety and depression; (3) coping strategies would be associated with levels of stress, anxiety, and depression, such that use of adaptive strategies would be associated with lower levels of stress, anxiety, and depression and use of maladaptive strategy would be associated with higher levels of stress, anxiety, and depression; (4) change in stress would predict change in levels of anxiety and depression over time; and (5) stress would be experienced differently for students with different levels of academic achievement.

Method

Subjects

Undergraduate and masters level students attending The City College of New York (CCNY) were recruited as participants via flyers (see Appendix A) posted in highly visible areas (e.g., outside libraries, elevators, and cafeteria) on the CCNY campus. In addition, the Principal Investigator (PI) directly contacted instructors of jumbo science (i.e., astronomy, physics, chemistry, biology, calculus) and social science (i.e., psychology and economics) courses via email and asked if they would offer extra credit in their respective courses for participation in this study, and either distribute the flyer to their students via email or post to their course page...
online (via Blackboard). The PI also contacted all CCNY department heads and asked if they would send email announcements to students enrolled in their respective programs (see Appendix B); department heads of Psychology and Economics and Business programs granted approval. Finally, students enrolled in specific Psychology courses (i.e., that offer extra credit, or require participation in research) were able to sign up for participation via CCNY’s Psychology Department Subject Pool (SONA System) (see Appendix C).

There were several inclusion criteria for students to be eligible to participate in this study. Students had to be: at least 18.0 years of age; conversant in English; enrolled full-time at the undergraduate or masters level; and willing to allow the PI to access their academic transcripts through CUNYFirst (an online tool which allows students and faculty to manage academic and financial accounts), and for the researchers to contact individual instructors to acquire attendance and mid-term grades.

The final sample comprised 84 participants—undergraduate (n=73) and masters level students (n=11) aged 18-46 years (mean=22.89; SD=5.99)—who completed the online study at Time 1. Gender distribution was reported as 71.4% female and 28.6% male. The sample was racially and ethnically diverse. Racial distribution was reported as 1.2% Native American Indian/Native Alaskan, 29.8% Asian, 17.8% Black/African American, 34.5% White, and 16.7% Other. Across the whole sample, 26.2% identified as Hispanic/Latino. The demographics of the participants recruited into this study are fairly representative of the CCNY population from which it is drawn: 25.0% Asian, 20.7% Black, 31.3% Hispanic, 0.1% Native American, and 22.8% White; 52.9 % female and 47.1% male; and 73.4% of undergraduate students and 15.7% of graduate students are enrolled full-time. The most recent six-year graduation rate available was for the 2007 cohort, which consisted of 42.0% of first-time full-time students.
Of the 84 participants who completed the survey at Time 1, 70 participants completed the survey at Time 2 (attrition rate = 16.67%) and 68 participants completed the survey at Time 3 (attrition rate = 19.05%). In order to check for sample bias, responses to measures at Time 1 were compared for participants who only completed the survey at Time 1 and for those who completed surveys at two or three time points. Participants did not differ in anxiety \((t(82)=-0.94, p=.35)\), mindfulness \((t(80)=-0.95, p=.34)\), depression \((t(80)=0.27, p=.79)\), physical activity \((t(78)=-0.22, p=.83)\), stress \((t(80)=-1.23, p=.22)\), and substance use \((t(80)=0.52, p=.60)\) scores at Time 1. Nor did these participants differ with respect to previous semester GPA \((t(71)=-0.28, p=.78)\), age \((t(74)=0.81, p=.42)\), racial distribution \((\chi^2(4)=4.62, p=.33)\), ethnic distribution \((\chi^2(1)=0.79, p=0.38)\), and socioeconomic status (as determined by household income; \(\chi^2(5)=0.21, p=.10)\). Of note, 10 individuals accessed the survey, but either closed it immediately after providing consent \((n=6)\) or did not meet inclusion criteria (i.e., not allowing for the PI to access grades, \(n=3\); not full-time study, \(n=1\)). Group differences between these 10 individuals and the 84 individuals who completed at least one survey are not possible, as declining to consent to one of the inclusion criteria resulted in the individual exiting the survey before providing any demographic data.

Students were compensated for their participation in this study, but the method depended on how participants were recruited. Students who signed up for participation through the SONA System \((n=67)\) received participation credits for their involvement in the study \((1 \text{ credit for each completed survey}; \text{total} = 3 \text{ credits})\). Students who signed up for participation by responding to flyers or email announcements \((n=17)\) received a single entry into a draw for a $50 Amazon gift.

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2 Although multiple independent samples t-tests increase the likelihood of obtaining a significant finding, we did this to be conservative in our estimates of group differences in outcomes as a function of attrition. Furthermore, it should be noted that parametric tests are not suitable when assumptions of normality are not met.
voucher for their involvement in the study (1 draw entry for each completed survey; total = 3 draws).

This study was reviewed and approved by the Institutional Review Board (IRB) of CCNY. All participants completed a web-based consenting procedure at Time 1 only, as this provided consent for all aspects of the study (see Appendix D). As noted above, if students decided not to continue participation in the study at Time 2 or Time 3, they simply exited the online survey or did not respond to email notifications at follow-up.

Materials/Equipment

After consenting to take part in the study at Time 1, participants provided demographics and contact information. At each time point—Time 1 (i.e., first six weeks of the semester), Time 2 (i.e., period surrounding midterms, approximately 1.5 months after Time 1), and Time 3 (i.e., period immediately preceding final examinations, approximately 1.5 months after Time 2)—anxiety, mindfulness, depression, physical activity, stress, and substance use were assessed using a battery of self-report questionnaires: Beck Anxiety Inventory (BAI), Mindful Attention Awareness Scale (MAAS), Beck Depression Inventory, Second Edition (BDI-II), International Physical Activity Questionnaire, Short Form (IPAQ-SF), Perceived Stress Scale (PSS-14), and Rutgers Collegiate Substance Abuse Screening Test (RCSAST), respectively. Finally, at Time 3, students’ attendance and assessment grades were obtained from course instructors, and final GPA for previous and current semesters were obtained from student records.

Demographics Questionnaire (see Appendix E). Participants completed a demographics questionnaire asking for information about their background (i.e., age, date of birth, gender, handedness, ethnicity, and race), occupation/education (i.e., self, maternal, and paternal), and household (i.e., number of individuals, number of bedrooms, total income).
Contact Information Sheet (see Appendix F). Participants completed a questionnaire asking for their contact information (i.e., name, CCNY email, CUNYFirst ID), the names of the courses in which they were currently enrolled, and their associated instructors.

Beck Anxiety Inventory (BAI; Beck, Brown, Epstein, & Steer, 1988). This 21-item self-report questionnaire is an instrument to screen for anxiety. Participants are asked to rate how much they have been bothered by an item in the last months on a 4-point Likert scale (0 = “Not At All” to 3 = “Severely – It Bothered Me a Lot”). Items refer to symptoms of anxiety, such as “numbness or tingling” or “dizzy or lightheaded.” Individual items scores are summed to yield a total severity score, where higher scores indicate more severe anxiety (maximum 63). Total scores may also be categorized as Minimal (total severity = 0 to 7), Mild (total severity = 8 to 15), Moderate (total severity = 16 to 25), and Severe (total severity = 26 to 63). Cronbach’s alpha internal reliability estimates for Time 1, Time 2, and Time 3 were .91, .92, and .93, respectively; consistent with Creamer, Foran, and Bell (1995) where internal consistency was found to be 0.91.

Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003; see Appendix G). MAAS is a 15-item self-report questionnaire developed by Brown and Ryan (2003) that assesses mindfulness by asking respondents to rate how often an item occurs based on a six-point Likert scale (1 = “Almost Always” to 6 = “Almost Never”). Items refer to the absence of mindfulness, such as “I could be experiencing some emotion and not be conscious of it until some time later” or “I tend to walk quickly to get where I’m going without paying attention to what I experience along the way.” Scores for the MAAS are determined computing the mean score obtained for each item (15 items total). A higher score (maximum 6) indicates a greater level of mindfulness. Cronbach’s alpha estimates for Time 1, Time 2, and Time 3 were .90, .91, and .94, respectively;
consistent with Brown and Ryan (2003) where internal consistency was found to range from 0.80 to 0.90.

**Beck Depression Inventory, Second Edition** (BDI-II; Beck, Steer, & Brown, 1996). The BDI-II comprises 21 groups of statements to assess the severity of depression experienced by participants during the past two weeks. Each group (e.g., sadness or loss of pleasure) includes four statements of increasing severity, labeled 0 to 3. Individual items scores are summed to yield a total severity score, where higher scores indicate more severe depression (maximum 63). Total scores may also be categorized as Minimal (total severity = 0 to 13), Mild (total severity = 14 to 19), Moderate (total severity = 20 to 28), and Severe (total severity = 28 to 63). Cronbach’s alpha for Time 1, Time 2, and Time 3 were .89, .92, and .94, respectively; consistent with Storch, Roberti, and Roth (2004) where internal consistency was found to be 0.90.

**International Physical Activity Questionnaire – Short Form** (IPAQ-SF; Craig et al., 2003; see Appendix H). IPAQ-SF is part of a collection of empirically based instruments that assess physical activity among individuals aged 15 to 69 years (Craig et al., 2003). This 4-item self-report questionnaire asks participants to provide the amount of time (days, hours, and minutes) during the last 7-days they engaged in “vigorous” physical activities (such as heavy lifting or aerobics), “moderate” physical activities (such as carrying light loads or bicycling at a regular pace), walking, and sitting for at least 10 minutes at a time. All responses for vigorous, moderate, or walking activity variables that exceeded three hours are truncated to three hours, or if it is determined that participants consistently indicated total activity per week instead of per day (i.e., for vigorous, moderate, and walking variables) responses are calculated per day by dividing number of hours provided with number of days provided for the appropriate variable. Scores are determined by multiplying this amount of time per week by the amount of energy
consumed, i.e., metabolic equivalent (MET), for vigorous (8.0 METs), moderate (4.0 METs), and walking (3.3 METs) physical activity. Total scores are obtained by summing the MET-minutes per week of vigorous, moderate, and walking physical activity, as well as categorical scores created based on total scores: low (total MET-minutes per week < 600), medium (600 ≤ total MET-minutes per week < 3000), and high (total MET-minutes per week ≥ 3000) physical activity. The short form of the IPAQ shows adequate test-retest reliability over a 3- to 7-day period (Spearman’s rho = .75). Validity, when assessed against CSA accelerometers, was Spearman’s rho = .30 (Craig et al., 2003).

**Perceived Stress Scale** (PSS-14; Cohen, Kamarck, & Mermelstein, 1983; see Appendix I). PSS is a 14-item self-report questionnaire developed by Cohen et al. (1983) that assesses perceived stress. Participants are asked to rate how often an item occurred in the last month on a five-point Likert scale (0 = “Never” to 4 = “Very Often”). Items are classified as either positive (e.g., “In the last month, how often have you felt that you were on top of things?”) or negative (e.g., “In the last month, how often have you felt that you were unable to control the important things in your life?”). Scores for the PSS are determined by summing the scores obtained for each “negative” item and the reverse scores (e.g., 0=4, 1=3, 2=2) for each “positive” item (i.e., 4, 5, 6, 7, 9, 10, and 13). A higher score (maximum 56) indicates a greater level of stress. Cronbach’s alpha estimates for Time 1, Time 2, and Time 3 were .79, .83, and .83, respectively; consistent with Cohen, Kamarck, and Mermelstein (1983) where internal consistency was found to range from 0.84 to 0.86.

**Rutgers Collegiate Substance Abuse Screening Test** (RCSAST; Bennett, McCrady, Frankenstein, Laitman, Van Horn, & Keller, 1992; see Appendix J). The RCSAST is a 25-item self-report questionnaire that assesses substance use among young adults. Participants are asked
to rate items, such as “Has drinking alcohol or using other drugs ever interfered with your preparations for exams?” as true or false. Scores for the RCSAST are determined by summing the number of true responses for each item. Categorical scores are created based on the number of “True” responses, with 5 or more “True” responses indicating problems users. Cronbach’s alpha estimates for Time 1, Time 2, and Time 3 were .90, .87, and .94, respectively; consistent with Crawford, Moore, and Ahl (2004) where internal consistency was found to be 0.88.

**Midterm exam grades.** Attempts were made to obtain participants’ midterm exam grades directly from course instructors (via email communication) at Time 3.

**Course attendance.** Attempts were made to obtain participants’ class attendance records from throughout the semester directly from course instructors (via email communication) at Time 3.

**Previous semester and current semester GPA.** Overall GPA was obtained for most recent previous semester and for current semester by PI through CUNYFirst. GPA is measured on a scale from 0 to 4 in which “A range” = 3.70 to 4.00, “B range” = 2.70 to 3.69, “C range or below” = 0.00 to 2.69.

**Procedure**

This online study was completed at three time points throughout the academic semester. At Time 1 (mean [SD] = 3.74 [1.29] weeks from semester start date), participants provided their informed consent to take part in the study and then completed a demographics questionnaire and provided contact information. Immediately after this, they completed the following questionnaires in the order listed: The Beck Anxiety Inventory (BAI), Mindful Attention Awareness Scale (MAAS), Beck Depression Inventory, Second Edition (BDI-II), International Physical Activity Questionnaire – Short Form (IPAQ-SF), Perceived Stress Scale (PSS-14), and
Rutgers Collegiate Substance Abuse Screening Test (RCSAST). As some of the questionnaires asked about sensitive information including severity of internalizing symptomatology (i.e., depression) and also substance use, at the completion of the survey, participants were provided with contact information for the Counseling Center at CCNY (see Appendix K).

At Time 2, a mean 5.34 (SD = 1.21) weeks from Time 1, and coinciding with the midterm examination period, participants were sent a link to survey 2 (see Appendix L). This was identical in all ways to the survey completed at Time 1, with the exceptions that consent was not obtained (consent at Time 1 covered the entire study) and demographics information was not recollected. Participants were asked to provide their name and CCNY email address in order to match their responses to the previous survey.

If a participant did not complete the survey within 72 hours of receiving the first email, he or she would receive an email reminder. If there was no response to the second email within 72 hours, a third and final email containing the link was sent. If there was no response to the third email, the participant was not re-contacted at that time point; however, he or she was sent an email containing the link to the third online survey.

The third and final survey was sent to participants in the week preceding final examinations (mean = 4.99, SD = 0.48 weeks after Survey 2). This was identical in all ways to Survey 2. The same procedure to contact non-responding participants was used as for Survey 2.

After completing each survey (i.e., at Time 1, Time 2 and Time 3), participants who signed-up for the study through CCNY subject pool received a single participation credit for completing the survey via the online SONA system. Each participant could receive a maximum of three credits if they completed all three surveys. Participants who responded to email
broadcasts, or flyers posted on campus, received a single entry into a draw for a $50 Amazon gift voucher. As draws were held after each survey, a total of three draws were made.

At Time 3, after the completion of final examinations, investigators contacted participants’ instructors (provided by participants at Time 1) via email, indicating the names of students who had provided their informed consent and asking instructors to provide the participants’ midterm grades and attendance records (see Appendix M). Following final examinations, the PI obtained participants’ current and previous semester GPA and individual course grades through CUNYFirst.

**Statistical analyses**

All analyses were conducted using SPSS version 22. Descriptive analyses were conducted for health (perceived stress), wellbeing (anxiety and depression), coping (mindfulness, physical activity, and substance use), and academic achievement variables. Within subjects analysis of variance (ANOVA) tests with repeated measures were conducted to determine any differences in health (perceived stress), wellbeing (anxiety and depression), and coping strategies (mindfulness, physical activity, and substance use) over time. Pearson correlations were used to assess associations between stress, anxiety, and coping strategies. Mixed analysis of variance (ANOVA) tests were also conducted to determine any differences in stress, anxiety, and depression over time as a function of academic achievement categories. All assumptions (no significant outliers, normality of residuals, sphericity) were verified prior to these analyses. Growth curve analyses (i.e., linear mixed-effects models) were used to examine individual trajectories anxiety and depression over time, and their association with stress, coping, and academic achievement.
Results

Descriptive statistics were obtained for key demographic and study variables (see Table 1). As can be seen, on average, participants were enrolled in 4.35 courses (SD = .80), which was to be expected given that full time study was an inclusion criterion. Modal range of household income was $10,000-24,999, although 19% of the sample reported that household income was equal to or greater than $100,000. Just over half of participants lived in a residence with two or fewer bedrooms. Across the whole sample, the mean (SD) number of residents in the household was 4.13 (1.7).

Table 1

Demographic variables of participants in A, B, and C range or below achievement groups

<table>
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<tr>
<th>Variable</th>
<th>A range (n=30)</th>
<th>B range (n=39)</th>
<th>C or below (n=15)</th>
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<td>10 (66.7)</td>
<td>60 (71.4)</td>
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</table>

3 Differences in mean perceived stress scores at Time 1 as a function of ethnicity, race, average income per household, and number of courses taken were not significant as determined by one-way ANOVAs. Also, based on chi-square tests or fisher’s exact tests (if min. expected count was less than 5), differences between these variables and academic achievement groups were not significant.
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<th>Not Hispanic or Latino</th>
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</table>

**Health across time**

Across all participants, stress levels at each time point were high. Mean (SD) perceived stress at Time 1 was 27.3 (7.2); at Time 2 it was 28.9 (8.4); and at Time 3 it was 28.3 (8.3). At each time point, the mean perceived stress score of the CCNY sample was compared to the mean perceived stress score (as measured by the PSS-14) in a large normative US sample (M = 19.62, SD = 7.49; Cohen & Williamson, 1988) using a one-sample t-test. The t-tests revealed that at each time point, CCNY students' perceived stress was significantly higher than the normative population: Time 1, t(81) = 9.63, p < 0.0001; Time 2, t(69) = 9.22, p < 0.0001; and Time 3, t(66) = 8.55, p < 0.0001 (see Figure 1). Effect sizes were large at each time point (d = 1.05, 1.17, and 1.10, respectively). Mean perceived stress appeared to be highly stable over time, with large correlations between Time 1 and Time 2, r = .60, p < 0.0001; Time 1 and Time 3, r = .55, p < 0.0001; and between Time 2 and Time 3, r = .75, p < 0.0001. Consistent with this, a repeated measures analysis of variance (ANOVA) of perceived stress over time was not significant, F(2,126) = 2.29, p = 0.11.
Figure 1. Mean perceived stress scores at Time 1 (beginning of semester), Time 2 (mid-semester) and Time 3 (end of semester) compared to a normative US sample of adults.

Wellbeing across time and academic achievement

Participants’ wellbeing—levels of anxiety and depression—were measured at each point of time. Mean (SD) anxiety levels at Time 1 were 14.29 (10.62); at Time 2 they were 14.83 (10.65); and Time 3 they were 13.85 (11.34). At each time point, mean anxiety levels fell in the Mild range (i.e., total severity = 8 to 16), however, the range of scores spanned from 0 to 47 at Time 1 and 3, and 0 to 44 at Time 2. Given that the anxiety scores covered almost the full scale, the number of participants falling into each severity classification was calculated for each time point. As can be seen in Figure 2, 38.1% of participants experienced Moderate or Severe anxiety at Time 1, 41.4% at Time 2, and 39.7% at Time 3. Considerable stability over time was seen, with $r=.52$ between Time 1 and Time 2; $r=.62$ between Time 1 and Time 3; and $r=.79$ between
Time 2 and Time 3. To determine any differences in mean anxiety severity scores over time, a within subjects analysis of variance (ANOVA) was conducted. The assumption of sphericity was violated, so the Huynh-Feldt corrections were used and a non-significant effect of time on anxiety was determined ($F(1.84,117.86) = 0.50, p = 0.59$). On average, anxiety severity scores did not differ between Time 1, Time 2, and Time 3.

![Graph showing frequency (%) of participants in each anxiety severity classification at three time points](image)

*Figure 2. Frequency (%) of participants whose anxiety scores (as measured using BAI) fall into each severity classification (Minimal, Mild, Moderate, and Severe) at Time 1 (beginning of semester), Time 2 (mid-semester) and Time 3 (end of semester).*

Exploratory analyses were conducted to determine any differences in the proportion of participants in the Moderate/Severe anxiety severity classifications at Time 1, Time 2, and Time 3. Of participants who completed the measure of anxiety at all three time points ($n = 65$), the same 17 participants fell into the Moderate/Severe anxiety severity classifications at Time 1 and
Time 3, and the same 32 fell into the Minimal/Mild classifications at Time 1 and Time 3. Of these participants, very few moved into different severity classifications at Time 2, with 3 moving from the Moderate/Severe to Minimal/Mild anxiety severity classifications and 5 moving from the Minimal/Mild to Moderate/Severe anxiety severity classifications at Time 2. The same number of participants (n = 8) moved from either low to high or high to low levels of anxiety from Time 1 to Time 3. Cochran’s Q test revealed that the proportion of participants who fell into the anxiety severity classifications did not change over time ($\chi^2(2) = 0.33, p = 0.85$), indicating that the number of participants who fell in the Moderate/Severe anxiety severity classifications did not differ at Time 1, Time 2, and Time 3.

Similar findings were observed for levels of depression over time among students. Mean (SD) depression levels at Time 1 were 13.55 (9.12); at Time 2 they were 12.99 (10.46); and Time 3 they were 14.64 (12.13). Thus, mean levels fell in the Minimal (Time 1 and Time 2) or Mild range (Time 3). However, classifying the percentage of participants’ depression severity scores as Minimal, Mild, Moderate, and Severe at each time point (see Figure 3) reveals that a substantial minority were experiencing high levels of depression. A quarter of participants fell into either the Moderate or Severe depression categories at Time 1 (25.6%) and Time 2 (25.7%), while nearly a third of participants were classified in those ranges at Time 3 (32.8%). As seen with anxiety severity scores, high correlations were observed for mean depression severity scores across the three time points ($r_s = .60 – .85, p < .0001$). Similar to above, to determine any differences in mean depression severity scores over time, a within subjects analysis of variance (ANOVA) with repeated measures over time was conducted. The assumption of sphericity was violated, so the Huynh-Feldt corrections were used and a non-significant effect of time on
depression severity scores ($F(1.74,109.53) = 0.31, p = 0.70$) was determined. On average, depression severity scores did not differ between Time 1, Time 2, and Time 3.

![Figure 3. Frequency (%) of participants whose depression scores (as measured using BDI-II) fall into each severity classification (Minimal, Mild, Moderate, and Severe) at Time 1 (beginning of semester), Time 2 (mid-semester) and Time 3 (end of semester).](image)

Like those completed for anxiety, exploratory analyses of participants who completed the measure of depression at all three time points ($n = 64$) revealed that the same 15 participants fell into the Moderate/Severe depression severity classifications, and the same 40 fell into the Minimal/Mild classifications at Time 1 and Time 3. Of note, five of these participants, who fell into the Moderate/Severe severity classifications at Time 1 and Time 3, fell into the Minimal/Mild classifications at Time 2. Only a single participant who fell into the Minimal/Mild classifications at Time 1 moved into the Moderate/Severe classifications at Time 2, and returned
to low levels of depression at Time 3. Few participants moved down and up in depression severity from Time 1 to Time 3, with 3 and 6 participants who fell into the Moderate/Severe and Minimal/Mild depression severity classifications at Time 1 moving into the Minimal/Mild and Moderate/Severe classifications at Time 3, respectively. Cochran’s Q test revealed that the proportion of participants who fell into the depression severity classifications did not change over time ($\chi^2(2) = 1.20, p = 0.55$), indicating that the number of participants who fell in the Moderate/Severe depression severity classifications did not differ at Time 1, Time 2, and Time 3.

Overall, findings suggest that a considerable minority of students experienced moderate to severe levels of internalizing problems. Despite this, students’ academic achievement, as measured by current semester GPA, was relatively high: 36% of participants achieved grades in the A range and 46% of participants achieved grades in the B range. A small proportion (18%) achieved a C or below (and only four participants failed or withdrew from their studies). The mean (SD) GPA of the CCNY sample was 3.21(0.85), which is significantly higher than the national average public post-secondary school GPA of 3.0 (Rojstaczer & Healy, 2010), $t(83) = 2.31, p < 0.05$.

The percentage of participants who achieved grades in the A, B, or C or below ranges and who were classified as Minimal or Mild, or Moderate or Severe are presented in Table 2. At Time 1, 46.7% of participants in the A range fell into either the Moderate or Severe anxiety categories, compared to 33.3% of participants in both the B and C or below ranges. However, at Time 2 and Time 3 42.9% and 44.0% of participants in the A range, 41.2% and 38.2% of participants in the B range, and 37.5% and 33.3% in the C or below range, respectively, were classified as experiencing either Moderate or Severe anxiety.
Different patterns of depression severity classification seem to be seen among achievement groups across the three time points. For participants in the A range, 30%, 17.9%, and 28.0% and for participants in the B range, 26.3%, 26.5%, and 36.4% fell into the Moderate or Severe depression categories at Time 1, Time 2, or Time 3, respectively. While 14.3% participants in the C range fell into the Moderate or Severe depression categories at Time 1, but 50% did so for Time 2 and 33.3% did so for Time 3.

Table 2

*Frequency (%) of participants in A, B, ≤C categories who fall into anxiety and depression severity classifications (Minimal and Mild or Moderate and Severe) at Time 1, 2, and 3.*

<table>
<thead>
<tr>
<th>Wellbeing Classification</th>
<th>Time</th>
<th>Academic Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A range</td>
</tr>
<tr>
<td>Anxiety Minimal/Mild</td>
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<td>53.3</td>
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<tr>
<td></td>
<td>2</td>
<td>57.1</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>56.0</td>
</tr>
<tr>
<td>Anxiety Moderate/Severe</td>
<td>1</td>
<td>46.7</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>42.9</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>44.0</td>
</tr>
<tr>
<td>Depression Minimal/Mild</td>
<td>1</td>
<td>70.0</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>82.1</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>72.0</td>
</tr>
<tr>
<td>Depression Moderate/Severe</td>
<td>1</td>
<td>30.0</td>
</tr>
</tbody>
</table>
Coping techniques

In light of the high, stable levels of stress and internalizing problems experienced by students, yet relatively high academic achievement, it is important to understand how students cope with their difficulties.

Almost all students engaged in medium-to-high levels of physical activity at each time point. Mean total physical activity (in met-mins) (SD) at Time 1, 2, and 3 was 2,516 (1,913), 3,079 (2,591) and 2,994 (2,543). As can be seen from the standard deviations, considerable variability in total physical activity was observed. At Time 1, 15% of participants were classified as exhibiting low levels of physical activity, whereas 47.5% and 37.5% engaged in medium and high levels, respectively. At mid-semester (Time 2), it appeared that a similar percentage of individuals (13.2%) engaged in low levels of physical activity compared to 45.6% being moderately active and 41.2% being highly active. Thus, more people seemed to be falling into the high activity group at Time 2. At the time of final examinations (Time 3), the percentage of people categorized as exhibiting low, medium, and high levels of physical activity at Time 3 were 6.1%, 59.1%, and 34.8% respectively. Thus, it seemed as if the number of people in the low activity group had fallen at Time 3. Moderate stability over time was seen, with \( r = .42 \) between Time 1 and Time 2; \( r = .34 \) between Time 1 and Time 3; and \( r = .56 \) between Time 2 and Time 3. A repeated measures ANOVA of total MET-minutes of physical activity per week revealed a significant difference over time on physical activity scores \( F(2,122) = 3.21, p < 0.05 \), with a
significant increase in total physical activity from Time 1 to Time 2 \( (p = .03) \), but no significant
difference in activity levels from Time 2 to Time 3 \( (p = .97) \); however, the effect size was small
\( (\eta^2_p = 0.05) \). This likely reflects the fact that more people were falling in the high activity group
at Time 2 than at Time 1, and stayed in this group at Time 3.

Mean (SD) mindfulness levels at Time 1 were 3.93 (0.96); at Time 2 they were 3.98
(0.96); and at Time 3 they were 3.82 (1.14) with a maximum score possible being 6. Moderate-
to-high correlations were observed for mean mindfulness scores across the three time points \( (r_s =
.42 \text{ to } .68, p < .0001) \). A non-significant difference over time on mean mindfulness scores
\( (F(2,126) = 1.07, p = 0.35) \) was determined using a within subjects analysis of variance
(ANOVA) with repeated measures. Cut-off scores for mindfulness are not provided in the
literature to be able to classify participants into severity-based groups.

For the sole maladaptive coping strategy studied, a small minority of students were
classified as problem substance users. At Time 1, 9.8% of participants identified as problem
substance users, compared to 8.6% at Time 2, and 11.9% at Time 3. There was a non-significant
difference in the proportion of problem substance users at Time 1 and Time 2, and Time 2 and
Time 3 \( (p = 1.00) \). A repeated measures ANOVA was carried out on the total number of “true”
responses at each time point. After correcting for violation of sphericity, a non-significant
change in time on substance use was found, \( F(1.32, 83.17) = 0.75, p = 0.42. \)

**Associations between perceived stress, coping, and wellbeing**

Pearson correlations were computed to evaluate the relationships between perceived
stress, coping strategies (i.e., mindfulness, physical activity, and substance use scores), and
wellbeing (i.e., anxiety and depression severity scores) over all time periods. Plots were created
and linear relationships between stress, coping strategies, and wellbeing were found. Significant
large positive correlations ($p < 0.01$) were revealed at Time 1, Time 2, and Time 3 between perceived stress and corresponding anxiety severity scores ($r=0.50$ at Time 1; $r=0.51$ at Time 2, $r=0.55$ at Time 3) and between perceived stress and corresponding depression severity scores ($r=0.54$, $r=0.70$, $r=0.65$).

Similarly, significant negative correlations ($p < 0.01$) were revealed between mindfulness scores and stress ($r=-0.38$, $r=-0.60$, $r=-0.56$), anxiety ($r=-0.45$, $r=-0.66$, $r=-0.59$), and depression ($r=-0.53$, $r=-0.63$, $r=-0.62$) at Time 1, Time 2, and Time 3. Correlation effects were moderate for perceived stress score at Time 1 and mindfulness scores at Time 1, with all other effects large. These negative correlations imply that higher mindfulness scores are associated with lower perceived stress, anxiety, and depression scores, respectively. Correlation effects were not significant between physical activity and corresponding perceived stress ($r=-0.10$, $r=-0.16$, $r=-0.21$), anxiety ($r=-0.09$, $r=0.08$, $r=0.08$), and depression ($r=-0.14$, $r=-0.18$, $r=-0.07$) scores at Time 1, Time 2, and Time 3 (all $p \geq .05$). Similarly, correlation effects were not significant between substance use and corresponding perceived stress ($r=0.05$, $r=-0.06$, $r=0.05$), anxiety ($r=0.10$, $r=0.06$, $r=0.16$), and depression ($r=0.06$, $r=0.09$, $r=0.06$) at Time 1, Time 2, and Time 3. Correlations across all time points are presented in Table 3. Of note, a significant negative correlation was found between physical activity at Time 2 and anxiety at Time 3 ($r=-0.33$, $p < 0.01$), and a significant positive correlation was found between stress ($r=0.24$, $p < 0.05$) and anxiety ($r=0.27$, $p < 0.05$) at Time 1 and substance use at Time 3. These results suggest that stress, anxiety, and depression are related constructs, and that mindfulness may be used as a strategy to cope with stress in this sample of students. Although the findings are not robust, physical activity may also potentially be used as an adaptive strategy to cope with stress, and of concern, higher levels of stress and anxiety appear to be related to later substance use.
Table 3

Correlations among coping strategies, health, and wellbeing over time

<table>
<thead>
<tr>
<th>Coping Strategies</th>
<th>Health</th>
<th>Wellbeing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stress</td>
<td>Anxiety</td>
</tr>
<tr>
<td></td>
<td>Time</td>
<td>1</td>
</tr>
<tr>
<td>Mindfulness</td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>-38*</td>
<td>-46*</td>
</tr>
<tr>
<td>2</td>
<td>-37*</td>
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<td>3</td>
<td>-45*</td>
<td>-60*</td>
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<td>Physical Activity</td>
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</tr>
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<td>-.10</td>
<td>-.06</td>
</tr>
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<td>2</td>
<td>-.21</td>
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</tr>
<tr>
<td>3</td>
<td>-.13</td>
<td>-.19</td>
</tr>
<tr>
<td>Substance use</td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>.05</td>
<td>.14</td>
</tr>
<tr>
<td>2</td>
<td>-.03</td>
<td>-.06</td>
</tr>
<tr>
<td>3</td>
<td>.24**</td>
<td>-.05</td>
</tr>
</tbody>
</table>

*p < 0.01 **p < 0.05

Time 1 = beginning of the semester; Time 2 = mid-semester; Time 3 = end of the semester
Stress = Perceived Stress Scale Total Severity Score; Anxiety = Beck Depression Inventory Total Severity Score;
Depression = Beck Depression Inventory, 2nd ed. Total Severity Score; Mindfulness = Mindful Attention Awareness
Scale Score; Physical Activity = Total MET-min per week activity score; Substance use = Total number of “True”
responses

Exploratory analyses were conducted to determine if levels of coping strategies reported
differed for participants whose levels of anxiety and depression remained stable, increased in
severity, or decreased in severity, as determined by movement between low (i.e., Minimal/Mild)
and high (i.e., Moderate/Severe) severity classifications over time. Multiple mixed ANOVA tests
were used to ascertain effects of movement in anxiety and depression severity classifications and
time (separately) on mean total physical activity (in met mins), mindfulness, and substance use levels (as determined by the total number of “true” responses).

Non-significant main effects were obtained for anxiety severity movement and time on physical activity \( (F(3,58) = 0.39, p = 0.76; F(2,116) = 2.10, p = 0.13) \) and substance use \( (F(3,60) = 0.72, p = 0.55; F(1.30,78.19) = 0.40, p = 0.59) \), and for time on mindfulness \( (F(2,120) = 1.47, p = 0.23) \). Similarly, non-significant interactions between anxiety severity movement and time on physical activity \( (F(6,116) = 1.03, p = 0.41) \) and substance use \( (F(3.91,78.19) = 1.24, p = 0.30) \) were found. For mindfulness, however, a significant main effect for anxiety severity movement \( (F(3,60) = 5.59, p = 0.002) \) and a significant interaction between anxiety severity movement and time \( (F(6,120) = 3.65, p = 0.002) \) were determined. As such, participants whose levels of anxiety remained stable, increased in severity, or decreased in severity on average report the same mean levels of physical activity and substance use over time. There is evidence, however, to suggest that mean levels of mindfulness differ over time based on anxiety severity movement, with participants who remained low in anxiety severity reporting, on average, significantly higher levels of mindfulness compared to participants who remained high in anxiety severity \( (p = 0.002) \).

Similar results were obtained for models that included depression severity movement as a between-subjects factor. Non-significant main effects were determined for depression severity movement and time on physical activity \( (F(3,58) = 0.02, p = 1.00; F(2,116) = 0.25, p = 0.78) \) and substance use \( (F(3,60) = 1.59, p = 0.20; F(1.31,78.39) = 2.04, p = 0.15) \), and for time on mindfulness \( (F(2,120) = 3.01, p = 0.05) \). Similarly, non-significant interactions between depression severity movement and time on physical activity \( (F(6,166) = 0.84, p = 0.54) \), substance use \( (F(3.92,78.39) = 2.03, p = 0.10) \), and mindfulness \( (F(6,120) = 1.74, p = 0.12) \) were
found. Conversely, a significant main effect was found for depression severity movement on mindfulness \( (F(3,60) = 7.69, p < 0.001) \), with participants who remained low in depression severity reporting, on average, significantly higher mean levels of mindfulness compared to participants who remained high in depression severity \( (p < 0.001) \). It is important to note that the small number of participants in each severity movement group limits the power of these analyses.

**Differences in health and wellbeing across academic achievement groups over time**

Based on observed differences in the frequency of participants who fell into the Minimal/Mild or Moderate/Severe ranges of anxiety and depression, Mixed ANOVA tests were conducted to evaluate differences in perceived stress, anxiety, and depression severity scores among the three academic achievement groups at Time 1, Time 2, and Time 3. The mixed ANOVA only includes participants with complete data sets; as such, the sample size was reduced for these analyses as only participants who completed measures of perceived stress \( (n=64) \), anxiety \( (n=65) \), and depression \( (n=64) \) at all three time points were included.

Three separate analyses were conducted for each dependent variable: mean perceived stress score, mean anxiety severity score, and mean depression severity score, and the results appear in Table 4. All assumptions of the mixed ANOVA model (no significant outliers, normality of errors, and sphericity) were met for perceived stress scores, and anxiety severity scores. The assumption of sphericity was not met for depression severity scores; however, results of the mixed ANOVA did not differ after meeting this assumption by performing a natural log transformation of depression severity scores. Non-significant main effects were obtained for academic achievement and time on each outcome, respectively: perceived stress \( (F(2,61) = 0.74, p = 0.48; F(2,122) = 1.90, p = 0.15) \), anxiety \( (F(2,62) = 0.52, p = 0.60; F(2,124) = 0.85, p = \)
0.43), and depression \( (F(2,61) = 0.52, p = 0.60; F(2,122) = 0.34, p = 0.71) \). Similarly, non-significant effects for the interaction between time and academic achievement were determined for perceived stress \( (F(4,122) = 1.27, p = 0.29) \) and depression \( (F(4,122) = 0.33, p = 0.86) \). As such, participants in each academic achievement group, on average experience the same amount of stress and depression over time, although small sample size limits power. However, a significant interaction between time and academic achievement was determined for anxiety \( (F(4,124) = 2.91, p = 0.02) \). With this, there is evidence that changes in mean anxiety scores over time differ depending on academic achievement group. That is, on average, participants in the B range reported lower levels of anxiety compared to participants in the A or C or below ranges over time.

Table 4

*Mixed ANOVA of Stress, Anxiety, and Depression by Academic Achievement and Time*

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>Df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td><strong>Perceived stress</strong></td>
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<td></td>
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</tr>
<tr>
<td>Academic achievement</td>
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<td>115.81</td>
<td>0.74</td>
<td>0.48</td>
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<td>61</td>
<td>155.72</td>
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<td></td>
</tr>
<tr>
<td>Time</td>
<td>92.02</td>
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<td>46.01</td>
<td>1.90</td>
<td>0.15</td>
</tr>
<tr>
<td>Time*Academic achievement</td>
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<td>30.65</td>
<td>1.27</td>
<td>0.29</td>
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<tr>
<td>Error within</td>
<td>2948.53</td>
<td>122</td>
<td>24.17</td>
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<td><strong>Anxiety</strong></td>
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<td>62</td>
<td>268.06</td>
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</table>
**Growth Curve Analyses**

Preliminary analyses using mixed ANOVAs provide evidence that any changes in mean anxiety scores over time may differ depending on academic achievement group classification. However, although the assumption of independence of observations for the mixed ANOVAs is technically met, analyses revealed that mindfulness, stress, anxiety, and depression are correlated at each time point. This suggests that observations are not truly independent (Shek & Ma, 2011), and that a model that controls for this non-independence may be required. In addition, intra-class correlation coefficients (i.e., ratio of inter-individual variance to total variance) for stress (0.63), anxiety (0.64), and depression (0.68), computed by dividing the intercept error by the total error, exceed the recommended benchmark of 0.25. This suggests that growth curve analyses may
produce results that are more accurate than those of other analyses (Heinrich & Lynn, 2001). As such, linear mixed model analyses were conducted in order to ascertain (1) whether perceived stress, anxiety, and depression severity scores change over time; (2) the effects of stress and/or coping strategies on anxiety and depression severity scores; and (3) if these effects differ for different academic achievement groups.

Figures 4 – 6 present plots of mean perceived stress, anxiety and depression severity scores over time for each academic achievement group. Based on these graphical representations, different effects over time for each academic achievement group seem plausible, despite results of previous analyses.

![Mean Stress](image)

**Figure 4.** Mean perceived stress (±1SE) as a function of Academic Achievement (A, B and ≤C GPA) and Time [beginning (1), mid (2) and end of semester (3)].

Figure 4 illustrates that participants in the B range experience lower mean perceived stress at Time 1 compared to participants in the A range and C or below range. From Time 1 to
Time 2, mean perceived stress increased for participants in the B range and C or below range, but then decreased for participants in the C or below range and remained relatively stable for participants in the B range from Time 2 to Time 3. Mean perceived stress remains relatively stable across time for participants in the A range.

Figure 5. Mean anxiety levels (±1SE) as a function of Academic Achievement (A, B and ≤C GPA) and Time [beginning (1), mid (2) and end of semester (3)].

Figure 5 illustrates different rates of decreasing mean anxiety levels between Time 1 and 2, and Time 2 and 3 for participants in the A range and C or below range. Participants in the B range appear to experience lower mean anxiety levels at Time 1, but reach mean anxiety levels similar to participants in the A range and C or below range at Time 2 and Time 3.
Figure 6 below illustrates that for participants in the A range and C or below range, mean depression levels decrease from Time 1 to Time 2, but return to previous levels at Time 3. Mean depression levels remain relatively stable across time for participants in the B range.

![Figure 6. Mean depression levels (±1SE) as a function of Academic Achievement (A, B and ≤C GPA) and Time [beginning (1), mid (2) and end of semester (3)].](image)

In order to ascertain whether perceived stress, anxiety and depression severity scores change over time, growth curve models were created to estimate any inter-individual differences in baseline scores (i.e., intercepts) and trajectory changes over time (i.e., slopes). Based on graphical representations, trajectories of change do not solely appear to be linear. In order to estimate any nonlinear growth in the subsequent models created, a quadratic time variable was included in all models. This variable was created by first transforming time into number of
months (Time 1 = 0 months [baseline measurement], Time 2 = 1.25 months, Time 3 = 2.50) and then squaring each value.

Three separate analyses were conducted in which perceived stress, and anxiety and depression severity scores were defined as response variables. In these models, estimates of fixed effects of the intercept, linear time variable, and quadratic time variable, as well as random effects of the intercept and linear time variable were estimated (random effects allow for linear slopes to vary across individuals).

The mean initial perceived stress score was 27.28 ($\beta = 27.28$, $SE = 0.81$, $p < 0.01$). There was a significant linear increase in perceived stress scores over time ($\beta = 2.28$, $SE = 1.10$, $p < 0.05$); however, the quadratic effect ($\beta = -0.74$, $SE = 0.42$, $p = 0.09$) and the random error for linear effects of time ($\beta = 0.51$, $SE = 2.98$, $p = 0.87$) were not significant. These results suggest that stress levels are not constant over time. On average, levels of stress increase linearly, but there is not evidence that individuals differ in the rate of increase.

The mean initial anxiety severity score was 14.29 ($\beta = 14.29$, $SE = 1.13$, $p < 0.01$) and initial depression severity score was 13.53 ($\beta = 13.53$, $SE = 0.97$, $p < 0.01$). There was not a significant linear increase ($\beta = 1.76$, $SE = 1.48$, $p = 0.24$) or quadratic effect ($\beta = -0.73$, $SE = 0.57$, $p = 0.21$) of anxiety severity scores over time. Similarly, there was not a significant mean linear decrease ($\beta = -0.81$, $SE = 1.31$, $p = 0.54$) or quadratic effect ($\beta = 0.41$, $SE = 0.50$, $p = 0.42$) of depression severity scores over time. The random error for linear effects of time was not significant for anxiety, but was significant for depression ($\beta = 1.76$, $SE = 5.92$, $p = 0.77$; $\beta = 8.69$, $SE = 4.08$, $p = 0.03$, respectively). These results indicate that on average, levels of anxiety and depression do not change over time; however, there is evidence that individuals may vary in rates of change, which suggests that adding predictors may provide further explanation.
To test any effects of stress on anxiety and depression severity scores over time, a new model was created with stress as a time-varying predictor. Due to the robust significant correlations between mindfulness, perceived stress, and anxiety and depression severity scores, mindfulness was also added as a time-varying predictor in this model, while the other coping strategies assessed (physical activity and substance use) were not included. In addition, in order to ascertain whether different effects of stress and/or mindfulness differ based on academic achievement group, academic achievement was included as a grouping variable.

Fixed effects of stress, mindfulness, academic achievement, and linear and quadratic time, and random effects of intercept and time were assessed. Results of fixed effects appear in Tables 5 (anxiety severity score as outcome variable) and 6 (depression severity score as outcome variable).

Table 5

*Estimates of fixed effects – anxiety severity score as response variable*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Std. Error</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>13.50</td>
<td>4.45</td>
<td>149.10</td>
<td>3.04</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Time</td>
<td>1.49</td>
<td>1.24</td>
<td>103.60</td>
<td>1.21</td>
<td>0.23</td>
</tr>
<tr>
<td>Time$^2$</td>
<td>-0.72</td>
<td>0.45</td>
<td>98.44</td>
<td>-1.61</td>
<td>0.11</td>
</tr>
<tr>
<td>Academic achievement</td>
<td>1.55</td>
<td>1.18</td>
<td>64.59</td>
<td>1.32</td>
<td>0.19</td>
</tr>
<tr>
<td>Stress</td>
<td>0.42</td>
<td>0.08</td>
<td>159.54</td>
<td>5.34</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Mindfulness</td>
<td>-0.24</td>
<td>0.04</td>
<td>153.70</td>
<td>-6.24</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

*Time = beginning of semester [0 months], mid-semester [1.25 months], and end of semester [2.50 months];
Academic Achievement = Final semester GPA classification (A, B, ≤C); Stress = Perceived Stress Scale Total Severity Score; Mindfulness = Mindful Attention Awareness Scale Score; Anxiety = Beck Anxiety Inventory Total Severity Score
Table 6

Estimates of fixed effects – depression severity score as response variable

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Std. Error</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>15.29</td>
<td>3.78</td>
<td>213.77</td>
<td>4.04</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Time</td>
<td>-1.22</td>
<td>1.17</td>
<td>77.40</td>
<td>-1.05</td>
<td>0.30</td>
</tr>
<tr>
<td>Time²</td>
<td>0.47</td>
<td>0.42</td>
<td>74.34</td>
<td>1.12</td>
<td>0.27</td>
</tr>
<tr>
<td>Academic achievement</td>
<td>-0.70</td>
<td>0.94</td>
<td>100.67</td>
<td>-0.75</td>
<td>0.46</td>
</tr>
<tr>
<td>Stress</td>
<td>0.46</td>
<td>0.07</td>
<td>219.48</td>
<td>6.82</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Mindfulness</td>
<td>-0.22</td>
<td>0.03</td>
<td>205.38</td>
<td>-6.34</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

Time = beginning of semester [0 months], mid-semester [1.25 months], and end of semester [2.50 months]; Academic Achievement = Final semester GPA classification (A, B, ≤C); Stress = Perceived Stress Scale Total Severity Score; Mindfulness = Mindful Attention Awareness Scale Score; Depression = Beck Depression Inventory-II Total Severity Score

Fixed effects of academic achievement were not significant for anxiety ($\beta = 1.55, SE = 1.18, p = 0.19$) or depression ($\beta = -0.70, SE = 0.94, p = 0.46$) severity scores. However, stress and mindfulness were significant predictors of anxiety ($\beta = 0.42, SE = 0.08, p < 0.01; \beta = -0.24, SE = 0.04, p < 0.01$, respectively) and depression severity scores ($\beta = 0.46, SE = 0.07, p < 0.01; \beta = -0.22, SE = 0.03, p < 0.01$, respectively). The variance estimate of the intercept was not significant for anxiety severity scores ($\beta = 25.35, SE = 49.66, p = 0.61$) and could not be computed for depression severity scores. These results suggest no differences over time across the different academic achievement groups. They also suggest that stress and mindfulness are predictors of change in anxiety and depression severity scores over time. It should be noted that these results should be interpreted with caution because the parameter values could not be estimated, possibly because of the small sample size and/or the number of variables included in the model.
Of note, restricted maximum likelihood (REML) estimation and unstructured (UN) covariance structure were assumed in all models. REML was used due to the small sample size (n = 84); however, linear mixed models allow for the full sample to be used, despite missing data due to attrition and incomplete surveys. Unstructured covariance structure was used as it does not assume any structure of the error terms and is most commonly used in longitudinal studies.

Based on these results, on average, levels of stress increased linearly over time; however, this change over time does not seem to vary depending on the individual. Alternatively, levels of anxiety and depression do not seem to change over time. With the creation of a more complex model, there is evidence to suggest that changes in stress and mindfulness over time may predict changes in anxiety and depression. However, estimates of change and baseline scores could not reliably be computed, so results cannot reliably be interpreted.

**Discussion**

The purpose of this study was to assess perceived stress, strategies utilized to cope with stress (mindfulness, physical activity, and substance use), and symptoms of anxiety and depression throughout the course of an academic semester in an ethnically diverse sample of college students. Specifically, this study attempted to ascertain levels of and relations between perceived stress, anxiety, depression, and coping strategies, whether these variables changed over time, and whether changes in stress were predictive of changes in levels of anxiety and depression. Furthermore, this study wished to determine if experiences of perceived stress differed as a function of participants’ academic achievement, as measured by their current semester GPA (A, B or ≤C range).

It was predicted that levels of stress would increase throughout the course of the semester, as academic demands increased over time. Levels of stress among participants were
high in comparison to a normative general population sample, and participants’ levels of stress were stable from the beginning of the semester through to midterms and finals. This is consistent with previous research, which suggests that post-secondary students are at heightened risk of experiencing high levels of stress (American College Health Association, 2014) due to the unique pressures associated with completion of a post-secondary degree (Aselton, 2012). However, this study did not investigate sources of stress; that is, high levels of stress reported at the beginning of the semester, which might be a time of year when we would think students would be most relaxed. There may be several reasons for this, particularly in light of the CCNY population; stress may be anticipatory because students are first-generation in their family to attend college, first-year college students, or transfer students and so expectations and processes of the 4-year college are unfamiliar; and/or students may have so much on their plate outside of the academic setting that the beginning of the semester signals the addition of yet another stressor that has to be managed. These are empirical questions that remain to be answered. Although it was predicted that stress levels would change as a function of increased academic commitments, evaluations, and pressures that are typically associated with midterm and final exam periods, preliminary analyses revealed that levels of stress began and remained high in this college student sample over the course of the academic term. That is, despite the academic demands (i.e., examination periods), which may promote stress responses, this sample of students may be experiencing stress from other sources (e.g., financial, relationships), and the academic pressure did not add measurably to that. It is possible that high levels of stress reported by college students is not necessarily due to demands of the college environment, but is simply due to stress associated with this stage of development (i.e., mean age of participants in this sample = 22.89). Alternatively, based on the range of courses in which these students are
enrolled, the three periods of survey administration may not have been significantly different from other periods of assessment during these courses, and as such may have not allowed for variations in stress to be detected.

In addition to high levels of stress, approximately 40% of participants experienced Moderate to Severe levels of anxiety, and one quarter to one third of participants experienced Moderate to Severe levels of depression at each time point. Based on a national survey, 54% “felt overwhelming anxiety” and 32.6% of college students “felt so depressed that it was difficult to function” at any time within the last 12 months (American College Health Association, 2014). It is interesting to note that the sample of participants in this study consistently experienced similar levels of anxiety and depression throughout the course of the semester compared to this national sample. Furthermore, the proportion of participants in the Moderate/Severe anxiety and depression classifications did not differ at Time 1, Time 2, and Time 3; indicating the number of participants experiencing Moderate/Severe levels of anxiety and depression remained stable across time.

Despite these troubling indicators of students’ emotional functioning, most participants exhibited moderate to high levels of academic achievement, as measured by current semester GPA. That is, the majority of participants had overall course grades within the A and B ranges. It may be the case that the elevated levels of stress reported may actually be optimal for these students and may serve to enhance functioning. That is, a certain level of stress is required for an individual to perform; however, if stress levels deviate from what is optimal (i.e., if stress is too low or too high) functioning may be impaired. These patterns of responses are known as the well-established Yerkes-Dodson law (Teigen, 1994). Still, experiences of stress vary greatly between individuals (Lazarus & Folkman, 1984); and as such, what may be considered too low,
too high, or optimal may differ depending on the individual. For the majority of participants in this sample who, on average, experience high levels of stress and are achieving academically, these levels may be highly motivating, whereas for others, these levels may be impairing. Distinguishing what constitutes optimal, low, or high levels of stress for any given individual is important, but cannot be addressed based on the data collected. Still, elevated anxiety and depression are concerning, particularly as other areas of functioning, such as in employment or in relationships may adversely be affected.

It was also predicted that stress would be positively associated with anxiety and depression. Consistent with this and with the literature, relationships between stress and anxiety, and depression were observed such that higher levels of stress were associated with higher levels of anxiety and depression at all time points. Conversely, it was predicted that stress would be experienced differently for students in the different academic achievement groups; however, no differences in stress or depression scores over time were determined for the different academic achievement groups. Yet, anxiety scores at the beginning of the semester seem to be higher for students who fall in the A or C ranges compared to students who fall in the B range. The relationships between stress and wellbeing suggest that high levels of stress may have an effect on students’ emotional functioning; however, this sample of college students is succeeding academically. As such, there seem to be disconnects between stress and wellbeing, and achievement. These results suggest that other factors may account for students’ ability to manage stress and achieve academically. Although speculative, students may be actively seeking resources offered by the college in order to assist with coursework or instructors may be sympathetic to students’ needs and as such provide support and accommodations in order to promote academic success (e.g., extra time to complete term papers; offer extra credit). It would
be important to note if school-based factors are contributing to the academic success of this population of students, who seem to exhibit mental health concerns. With what is understood about long-term effects of stress and subsequent symptoms of anxiety and depression (Lupien et al., 2009), the number of students falling in moderate to high severity ranges paints a poor picture of overall health and wellbeing of this college sample.

Coping strategies were evaluated in order to determine any relationships with stress, anxiety, and depression. It was predicted that coping strategies would be associated with levels of stress, anxiety, and depression, such that adaptive strategies would be associated with lower levels of stress, anxiety, and depression. Across time points, few participants were considered problem substance users and the majority of participants exhibited medium to high levels of physical activity; unfortunately established cut-off scores for mindfulness are not provided in the literature. This may indicate that few participants use (or admit to using) substances excessively to cope with stress, but rather, engage in adaptive coping behaviors, such as physical activity. Both substance use and mindfulness scores were stable over time. For physical activity, more people fell in the High activity level at Time 2, and there was a significant increase in mean total activity level from the beginning of the semester (Time 1) to mid-term examinations (Time 2). Furthermore, physical activity levels at Time 2 were negatively associated with anxiety at Time 3. Although preliminary, it may suggest that physical activity could be useful for reducing later anxiety. This is certainly consistent with the literature showing that physical exercise is associated with lower anxiety and that clinicians recommend that their patients engage in physical activity as an anxiety management strategy (Herring, O’Connor, & Dishman, 2010).

Conversely, stress and anxiety at Time 1 were positively associated with substance use levels at Time 3. This suggests that higher levels of stress and anxiety may be associated with later
substance use, a maladaptive coping strategy. Of note, levels of mindfulness were related to stress, anxiety, and depression, such that increases in mindfulness were associated with decreases in stress, anxiety, and depression. These relationships are consistent with findings in the literature and suggest that mindfulness may be an effective strategy for coping with stress (Strauss, Cavanagh, Oliver, & Pettman, 2014). Furthermore, mean levels of mindfulness differed as a function of changes in anxiety and depression severity classification, such that for participants whose anxiety and depression severity levels remained low over time exhibited, on average, higher mean levels of mindfulness. This suggests that by focusing on the present moment without judgment, instead of negatively focusing on the past or future, individuals who exhibit greater levels of mindfulness may be able to better regulate emotional state.

Finally, it was predicted that change in stress would predict change in levels of anxiety and depression over time. Individual trajectories of stress, anxiety, and depression over time were estimated, which showed that on average, stress appeared to increase linearly over time. No changes in anxiety and depression were observed, consistent with earlier analyses. These findings indicate that there is evidence to suggest that stress changes over time over the course of a semester. In addition, plots of mean stress, anxiety, and depression scores over time for the different achievement groups suggested that differences in levels of health and wellbeing seemed plausible for the different achievement groups, despite results of earlier analyses. As such, and because mindfulness was significantly negatively related to anxiety and depression, individual trajectories of anxiety and depression as a function of stress, mindfulness, and academic achievement were estimated. It appears that both stress and mindfulness are predictive of anxiety and depression; however, growth trajectories do not differ based on academic achievement group. Due to the small sample size and the number of variables included, however, this model
could not reliably be computed, and as such, results should be interpreted with caution. The interaction between stress and mindfulness is important to consider, but cannot reliably be determined based on small sample size. Nevertheless, this preliminary analysis suggests that stress coupled with mindfulness could produce some positive effect on anxiety and depression over time.

The findings of this pilot study provide preliminary evidence that an ethnically diverse sample of college students experience high levels of stress, anxiety, and depression. Yet, despite concerning levels of health and wellbeing, academically, students appear to be achieving relatively highly. Furthermore, evidence suggests that students may be able to use mindfulness and physical activity as an adaptive coping mechanism to buffer effects of continued high levels of stress on symptoms of anxiety and depression.

These findings give rise to questions about how to design and implement interventions (at the institutional and individual levels) to reduce stress. Of particular interest is evidence that mindfulness, and perhaps to a lesser extent, physical activity, may be strategies that this population is currently using to deal with stress, despite its high levels. If this is the case, interventions that foster mindfulness skills and promote physical activity may prove to be beneficial. Individuals may be more likely to take part in these if they have knowledge about them and if these strategies are accessible and affordable. The popularity of mindfulness in recent years has seen a proliferation in training courses, retreats, books, podcasts, and apps available to the public. Mindfulness groups could be established on campus; student counseling services could keep a list of useful books and apps for students; faculty and course instructors may incorporate meditation exercises during class time. Skill in mindfulness does take considerable time and practice, however, and can be frustrating (Kabat-Zinn, 2003). Ensuring
students are aware of benefits and have support from peers and/or counselors so they stick with a program will be essential.

One thing that remains unclear from this study are the sources of stress for students. The data presented suggests that students’ stress levels were high from the outset of the semester and remained so over time. There was equivocal evidence to suggest that stress increased over time. Although the timing of follow-up assessments was such that they occurred at the time of mid-term and final examinations, we still cannot determine whether the examinations themselves were sources of stress. The Perceived Stress Scale (PSS-14) does not define the source of stress; it really asks about cumulative life stress and individuals perception of their capacity to manage that. It may be the case that employment, financial, or relationship difficulties, and/or academic stress may account for the high levels of stress experienced by these students. Or, individual differences among this sample of students, such as first-year or first-generation college students. Further investigations of sources of stress may prove helpful in determining how institutions may intervene, particularly as in this sample stress does seem to be related to internalizing problems.

Another issue to consider is the generalizability of the findings to the greater CCNY college student population may be questionable. Although the demographics of the recruited sample were similar to that of the overall CCNY student population, there are several ways in which the study sample may not be representative of the CCNY population. First, the sample of participants predominantly comprised undergraduate students (87%), despite recruitment measures targeting graduate students. In addition, only two department heads (Psychology and Economics and Business) responded to requests to distribute information about this study to students enrolled in their respective programs. Most notably, the study design required students to sign up for participation at the beginning of the academic semester, and as such a self-selected
sample of particularly driven and/or organized students may have resulted. Furthermore, students who decide to seek extra credit, before any threats to course grades are apparent (e.g., poor performance on a midterm exam) may be fundamentally different from students who do not elect to sign-up for participation (or who sign-up at the end of an academic semester) insofar as they experience higher levels of stress and/or anxiety, or may be more able to cope with demands of full-time college enrollment. The fact that students were being monitored throughout the course of the semester and had to agree to provide investigators with access to their grades, may have also presented a couple of sources of bias: students may have been motivated to work harder to do well in their courses because they knew their grades were going to be retrieved, or those not pleased with their academic history may have chosen not to take part in the study.

Another limitation of this study is the nature of the design: the entire study was completed online and thus all measures were collected by means of self-report. Because researchers did not have the opportunity to clarify participants’ responses immediately following the completion of each measure, results from the physical activity questionnaire should be viewed with caution. Upon review of the data, it was evident that a number of participants likely misread instructions and reported what should have been the daily amount of time spent engaged in different types of physical activity as total time per week. If this was consistently done, data were truncated based on established guidelines; however, as a substantial number of participants seemed to respond “incorrectly,” it is unclear whether researchers were able to correctly ascertain the meaning of participants’ responses. Similarly, types of physical activity, which exemplify vigorous, moderate, or walking physical activity, are left up to the interpretation of the participant. Perhaps a more reliable way to gather exercise data would be to have participants directly state the specific activity they carried out (e.g., cycling), for how far and for how long,
which can then be coded by researchers. Furthermore, the substance use questionnaire used asked participants to provide true or false responses to a number of statements evaluating the repercussions of drinking and/or drug use. Comprehensive, non-diagnostic measures of substance use are sparse; although this questionnaire was created for use within college samples, dichotomous response variables may not provide sufficient variability in the results. Furthermore, although it is important to ascertain whether substance use interferes with daily functioning, it is difficult to understand motivations behind substance use (e.g., are individuals self-medicating?) through responses to this questionnaire. Another consequence of having the whole study online was that it necessitated most constructs being evaluated by self-report, which introduces a method bias, such that participants may have completed questionnaires more positively, based on their perceptions of ideal self and/or to ensure positive impressions of investigators.

In looking at participants’ academic achievement, there was lack of variability in current semester GPA. Overall, this sample of college students is high achieving. This could be due to some self-selection bias (as described above). In addition, or alternatively, it may reflect accommodations made by faculty. Anecdotally, instructors of this student population appear to be aware of the high levels of stress they experience and utilize different strategies to promote success (e.g., by providing extra feedback, flexible deadlines, alternative assignments, or extra credit). Due to the lack of variability in current semester grades, students with GPAs in the C, D, or F range were combined to create one (albeit small) category. This categorization may be problematic as students who achieve average grades of C, D, and F are likely qualitatively different from each other. Furthermore, the majority of instructors did not respond to requests for midterm course grades and midterm and final attendance records of participants in this study, so
only one measure of academic achievement for the current semester was obtained and change in academic performance over time could not be modeled.

Finally, readers must be cautious of interpreting results given the small sample size, particularly for growth curve analyses, which require larger samples. This study in turn may be viewed as a pilot for future investigations that incorporate larger samples and as such, may be able to more accurately estimate individual trajectory differences. Expanding on this study, future studies may include other measures of academic achievement, or investigate graduation rates after tracking stress and wellbeing throughout the course of a student’s academic career. In addition, the use of physiological measures in addition to self-report questionnaires could provide a clearer picture of stress experienced, and increase concurrent validity. Similarly, requiring participation to take place in a lab setting may ensure that any confusion regarding questionnaire instructions is dealt with accordingly (although may increase attrition if students have to schedule a follow-up visit on multiple occasions over time). Introducing methods that aim to assess sources of perceived stress may be more indicative of what areas are providing strain for this particular population. Likewise, assessing other methods of coping more directly related to academic situations, such as organization, time management, and study habits, may provide a clearer picture of how this population is responds to sources of stress that may be more helpful for planning interventions specific to the academic context. Finally, introducing comparisons of level of study (i.e., undergraduate vs. master’s) or major (e.g., psychology vs. chemistry) may be interesting, but are beyond the scope of this study.

Despite these limitations, findings of this study are important as they provide some understanding of the health and wellbeing status of a diverse college sample. Post-secondary institutions are obligated to provide appropriate services for students who are experiencing high
levels of stress. Particularly as stress, as evidenced by this study, is associated with mental health—anxiety and depression. Mindfulness as utilized by this sample is also associated with lower levels of stress, anxiety, and depression, so this may be an important strategy for students to use to buffer effects of stress. Moreover, completion of a college degree is essential; ways in which institutions can assist students achieve academically is important not only during their academic careers, but beyond the educational setting. Ensuring that students remain healthy—physically and mentally—during their pursuit of higher education is of utmost importance.
References


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Appendix A – Flyer

CITY UNIVERSITY OF NEW YORK
The City College of New York
Department of Psychology, NAC 7/233; 7/114C
160 Convent Avenue
New York, NY 10031

PARTICIPANTS NEEDED FOR A RESEARCH STUDY

We are seeking City College undergraduate and masters students to take part in a study looking at health, well-being, and academic achievement.

What Does the Study Involve?

• You will participate in three 45-minute testing sessions online that involve completing a battery of questionnaires.
• PSY students who sign up through SONA will receive 3 participation credits (one for each session).
• All other participants will enter a draw for a chance to win a $50 Amazon.com gift card after each session.

Requirements for Participation

To be eligible to participate you must be:
• At least 18.0 years of age
• Enrolled full-time as an undergraduate or masters student at CCNY
• Fluent in English
• willing to allow the researchers to access to your academic transcript through CUNYFirst

For more information, please contact Elise Tanzini

wellbeing.ccny@gmail.com

CUNY UI IRB APPROVED 1/8/2015 THROUGH 1/7/2016
Appendix B – Email to Psychology and Economics students

Hello!

We are looking for City College undergraduate and masters students to take part in a study called, Health, Wellbeing, And Academic Achievement Among Urban College Students.

This study is being conducted in the Psychology Department by Sarah O’Neill (PI) and Elise Tanzini. The goal of the study is to explore the relations among stress, coping, and academic achievement.

The study involves three, 45-minute online evaluations, each held approximately 6 weeks apart. During these sessions you will complete questionnaires that measure several aspects of behavioral and emotional functioning.

As a thank you for participation you will be entered into a draw for a chance to win a $50 Amazon.com gift card after completion of each online evaluation. (If you are a PSY student you can also participate via the subject pool and receive 3 participation credits (one for each session) instead of being entered into the draw; go to ccny.sona-systems.com).

In order to be eligible for participation you must be:

- at least 18.0 years of age
- a full-time undergraduate or masters student at The City College of New York from any department
- fluent in English
- willing to allow the PI access to your academic transcript through CUNYFirst.

This study has been reviewed and approved by the City College (CUNY) IRB [696523-1, expires 01-07-2016].

If you are interested in participating please contact Elise Tanzini at wellbeing.ccny@gmail.com for more information.

Thank you!

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4 This email was sent to both psychology and economics students from respective department heads.
### Study Information

<table>
<thead>
<tr>
<th>Study Name</th>
<th>Health, wellbeing, and academic achievement among urban college students</th>
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<tbody>
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<td><strong>Study Type</strong></td>
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</tr>
<tr>
<td><strong>Description</strong></td>
<td>This is an online study. To participate, sign up, then go to the website listed below to participate.</td>
</tr>
<tr>
<td><strong>Credits</strong></td>
<td>3 Credits</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>135 minutes</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>Stress is experienced among college students and may impact levels of anxiety and depression, as well as academic achievement. Different strategies, such as mindfulness, exercise, and substance use may be used to cope with stress. The present study investigates how stress levels change over a semester, and whether students change the strategies they use to deal with stress over the same time period. We will then investigate whether changes in stress levels and in use of different coping strategies affects academic achievement, anxiety, and depression. You will complete three 45-minute sessions online, each help approximately 6 weeks apart. During these sessions you will complete questionnaires that measure several aspects of behavioral and emotional functioning. You will receive 1 credit for each completed evaluation period.</td>
</tr>
<tr>
<td><strong>Eligibility Requirements</strong></td>
<td>1. At least 18.0 years of age 2. Currently enrolled full-time as an undergraduate or masters student at CCNY 3. Fluent in English 4. Willing to allow the PI access to your academic transcript through CUNYFirst.</td>
</tr>
<tr>
<td><strong>Website</strong></td>
<td>You may not view the website until you sign up for this study.</td>
</tr>
<tr>
<td><strong>Researcher</strong></td>
<td>Sarah O'Neill</td>
</tr>
</tbody>
</table>
Appendix D – Consent form

THE CITY UNIVERSITY OF NEW YORK
City College of New York
Psychology Department

ONLINE QUESTIONNAIRE CONSENT FORM

Welcome to “Health, Wellbeing, and Academic Achievement among Urban College Students.”

Principal Investigator: Sarah O’Neill, PhD
Assistant Professor
The City College of the City University of New York
160 Convent Avenue, NAC 7/114B
New York, NY 10031
212.650.5701

This online study is being conducted within the Psychology Department, North Academic Center, Rooms 7/233 and 7/114C, The City College of New York.

Please check the box to indicate that you have read and understood this information.

Procedures:
If you volunteer to participate in this research study, we will ask you to do the following:

• Complete three (3) online evaluations, which include a battery of questionnaires:
  1. During the first month of the semester;
  2. During a 6-week period around midterms; and
  3. During the month leading up to and around finals.
Each evaluation should take approximately 45 minutes, although individual times may vary. Questionnaires will include demographic questions and questions regarding your thoughts, feelings, and behavior.

You will be asked to provide your email address so that we may send you a reminder email with a link to the next questionnaire when it is time for you to complete the evaluation around midterms and the evaluation leading up to finals.

If you do not complete the survey within 72 hours of receiving a reminder email, a second email with a link to the survey will be sent. If there is no response to the second email, a third and final email containing the link will be sent. If there is no response to the third email, we will take that to mean you do not wish to complete the survey for this time point. No more than six emails will be sent to you over the course of this study (3 emails [max] per follow up).

As the main outcome of this study is to assess academic achievement, you will be asked to provide the names of courses in which you are currently enrolled and their associated instructors, so that we may contact your instructors directly in order to access your midterm grades and course attendance information.

I give consent for Elise Tanzini to contact my instructors directly to access my midterm grades and course attendance information.

Yes [initial] No [initial]

[If students check NO, they will be exited from the survey, told they do not meet inclusion criteria and thanked for their interest in the study]

• Similarly, you will be asked to provide your CUNYFirst ID so that we may access your academic transcript through CUNYFirst.

I give consent for Dr. Sarah O’Neill (Assistant Professor) to access my complete academic transcript through CUNYFirst for the purposes of this study.

Yes [initial] No [initial]

[If students check NO, they will be exited from the survey, told they do not meet inclusion criteria and thanked for their interest in the study]

[Screen 4]

Time Commitment:
Your participation in this research study is expected to last for a total of 135 minutes (45 minutes for each of the three evaluations).

Potential Risks or Discomforts:
The risks of this study are not greater than those you experience in everyday life. It is possible that because of the longitudinal nature of this study, you may feel frustrated by contact by us; however, you have the option to simply not respond to the 3 emails sent at each follow-up period. Also, you may become upset after completing measures about depression and anxiety; if so, we will provide information about whom to contact if you feel distressed.
There is a small possible risk of breach of confidentiality, but this risk is mitigated by the security features of Qualtrics, the platform used to distribute the surveys. They have Transport Layer Security (TLS) encryption for all transmitted data and it protects surveys with passwords and HTTP referrer checking, as well as does not track IP addresses. Furthermore, only trained research personnel will have access to your responses. Your name, email address, and names of courses that you are currently enrolled in will be kept separate from your questionnaire responses, and after the completion of all phases of the study will be deleted from our files.

Please check the box to indicate that you have read and understood this information.

**Potential Benefits:**
You will not directly benefit from your participation in this research study. This study may benefit the CCNY college population, and other populations by providing information on different strategies used to cope with stress, and if these factors moderate the relationship between stress and academic achievement and emotional functioning. In order to improve health and wellbeing, as well as overall academic success, colleges may implement interventions and/or procedures to improve coping strategies identified as beneficial through this study.

**Alternatives to Participation:**
Participation in this study is completely voluntary. If you are accessing this study via the Psychology Department CCNY Subject Pool in order to receive course credit, you may participate in another research study or you may complete an equivalent assignment (as determined by your course instructor) in order to receive course credit.

Please check the box to indicate that you have read and understood this information.

**Payment for Participation:**
If you signed up for this study by responding to a flyer or email from your department administrator, for your participation in this study you will be entered into a draw to receive a $50 amazon.com gift card after completion of the online evaluation. You will be entered into a second and third draw after completion of the online evaluation around midterms and leading up to finals.

**OR**

If you sign up for this study through the Psychology Department subject pool, for your participation in this study you will receive 1 credit through SONA for each survey you complete, up to a maximum of three (3) participation credits.

Please check the box to indicate that you have read and understood this information.

**Confidentiality:**
We will make our best efforts to maintain confidentiality of any information that is collected during this research study. We will disclose this information only with your permission or as required by law.
We will protect your confidentiality by assigning you a unique alphanumeric ID. Links to these codes will be saved along with any identifiable data (e.g., CUNYFirst ID) and stored in a separate location from where all data collected from the questionnaires will be stored. Immediately after accessing your midterm grades, course attendance, and past and current GPA, we will remove your name and record using the alphanumeric ID. All research records will be stored securely (encrypted and on password-protected computer systems). Only trained researchers will have access to the records. Once the study has been completed, the data collected will be destroyed.

The research team, authorized CUNY staff, and government agencies that oversee this type of research may have access to research data and records in order to monitor the research. Research records provided to authorized, non-CUNY individuals will not contain identifiable information about you. Publications and/or presentations that result from this study will not identify you by name.

Please check the box to indicate that you have read and understood this information.

[Screen 8]

Participants’ Rights:

Your participation in this research study is entirely voluntary. If you decide not to participate, there will be no penalty to you, and you will not lose any benefits to which you are otherwise entitled.

You can decide to withdraw your consent and stop participating in the research at any time, without any penalty.

Questions, Comments or Concerns:
If you have any questions, comments or concerns about the research, you can talk to one of the following researchers: Sarah O’Neill, PhD or Elise Tanzini, Graduate Student by contacting wellbeing.ccny@gmail.com.

If you have questions about your rights as a research participant, or you have comments or concerns that you would like to discuss with someone other than the researchers, you are encouraged to contact Tricia Mayhew-Noel, IRB Administrator, at 212-650-7902.

Signature of Participant:
I have read the information presented in this consent form and understand my rights as a participant in this study.

Yes   No

[If students check NO, they will be exited from the survey and thanked for their interest in the study]

I agree to participate in this research study

By typing your name here you have authorized participation in this study:

[If students check YES and type their name, they will proceed to screening questions].

I do not agree to participate in this research study

[If students check NO, they will be exited from the survey and thanked for their interest in the study]
Appendix E – Demographics questionnaire

I. BACKGROUND INFORMATION:

Age: __________________________

Date of birth: __________________


Race (please check box):
[1] American Indian or Alaskan Native
[2] Asian
[3] Black or African American
[4] Native Hawaiian or Other Pacific Islander
[6] Other: Please specify: ___________________________

II. OCCUPATION/EDUCATION INFORMATION:

[Note: for years of education, consider a high school diploma 12 years]

Your current occupation: ___________________________ Years of Education: _____

Maternal occupation: ___________________________ Years of Education: _____

Paternal occupation: ___________________________ Years of Education: _____

III. HOUSEHOLD INFORMATION

How many individuals live in your household? __________

[Note: if living in a dormitory or other temporary residence, this question pertains to your permanent residence only]

How many bedrooms are in your household (please circle)?
[5] Four or more bedrooms.

Total income of household is approximately (exclude roommates) (please circle):
Appendix F – Contact information sheet

ID: ________________________________

HEALTH, WELLBEING, AND ACADEMIC ACHIEVEMENT AMONG URBAN COLLEGE STUDENTS.

CONTACT INFORMATION

Please provide the following information, so that Dr. O’Neill can access your transcript via CUNYFirst:

Name: ________________________________________________________________
  (First) ____________________________________________________________
  (Last) ____________________________________________________________

CCNY Email: __________________________________________________________

CUNYFirst ID: __________________________________________________________

Please provide the names of the courses that you are currently enrolled in and their associated instructors, so that we may obtain your midterm exam grades and current semester course attendance:

_______________________________________ Instructor: ______________________

_______________________________________ Instructor: ______________________

_______________________________________ Instructor: ______________________

_______________________________________ Instructor: ______________________

_______________________________________ Instructor: ______________________

_______________________________________ Instructor: ______________________
Appendix G – Mindfulness Attention Awareness Scale

Day-to-Day Experiences

Instructions: Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what really reflects your experience rather than what you think your experience should be. Please treat each item separately from every other item.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Almost Always</td>
<td>Very Frequently</td>
<td>Somewhat Frequently</td>
<td>Somewhat Infrequently</td>
<td>Very Infrequently</td>
<td>Almost Never</td>
</tr>
</tbody>
</table>

1. I could be experiencing some emotion and not be conscious of it until some time later. 1 2 3 4 5 6
2. I break or spill things because of carelessness, not paying attention, or thinking of something else. 1 2 3 4 5 6
3. I find it difficult to stay focused on what's happening in the present. 1 2 3 4 5 6
4. I tend to walk quickly to get where I'm going without paying attention to what I experience along the way. 1 2 3 4 5 6
5. I tend not to notice feelings of physical tension or discomfort until they really grab my attention. 1 2 3 4 5 6
6. I forget a person's name almost as soon as I've been told it for the first time. 1 2 3 4 5 6
7. It seems I am “running on automatic,” without much awareness of what I'm doing. 1 2 3 4 5 6
8. I rush through activities without being really attentive to them. 1 2 3 4 5 6
9. I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there. 1 2 3 4 5 6
10. I do jobs or tasks automatically, without being aware of what I'm doing. 1 2 3 4 5 6
11. I find myself listening to someone with one ear, doing something else at the same time. 1 2 3 4 5 6
Appendix H – International Physical Activity Questionnaire

In answering the following questions,

♦ **vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder that normal.

♦ **moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder that normal.

1a. During the last 7 days, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

Think about only those physical activities that you did for at least 10 minutes at a time.

________ days per week ⇒ 1b. How much time in total did you usually spend on one of those days doing vigorous physical activities?

or

________ hours _______ minutes

or

none

2a. Again, think only about those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

________ days per week ⇒ 2b. How much time in total did you usually spend on one of those days doing moderate physical activities?

or

________ hours _______ minutes

or

none

3a. During the last 7 days, on how many days did you **walk** for at least 10 minutes at a time? This includes walking at work and at home, walking to travel from place to place, and any other walking that you did solely for recreation, sport, exercise or leisure.

________ days per week ⇒ 3b. How much time in total did you usually spend walking on one of those days?

or

________ hours _______ minutes

or

none

The last question is about the time you spent **sitting** on weekdays while at work, at home, while doing course work and during leisure time. This includes time spent sitting at a desk, visiting friends, reading traveling on a bus or sitting or lying down to watch television.

4. During the last 7 days, how much time in total did you usually spend sitting on a week day?

______ hours _______ minutes

This is the end of questionnaire, thank you for participating.
Appendix I – Perceived Stress Scale

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer each question fairly quickly. That is, don’t try to count up the number of times you felt a particular way, but rather indicate the alternative that seems like a reasonable estimate. For each question choose from the following alternatives:

0. Never
1. Almost Never
2. Sometimes
3. Fairly Often
4. Very Often

<table>
<thead>
<tr>
<th>Question</th>
<th>Never</th>
<th>Almost Never</th>
<th>Sometimes</th>
<th>Fairly Often</th>
<th>Very Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. In the last month, how often have you been upset because of something that happened unexpectedly?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. In the last month, how often have you felt that you were unable to control the important things in your life?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. In the last month, how often have you felt nervous and &quot;stressed&quot;?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. In the last month, how often have you dealt successfully with irritating life hassles?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. In the last month, how often have you felt that you were effectively coping with important changes that were occurring in your life?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6. In the last month, how often have you felt confident about your ability to handle your personal problems?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7. In the last month, how often have you felt that things were going your way?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8. In the last month, how often have you found that you could not cope with all the things that you had to do?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9. In the last month, how often have you been able to control irritations in your life?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10. In the last month, how often have you felt that you were on top of things?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11. In the last month, how often have you been angered because of things that happened that were outside of your control?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>12. In the last month, how often have you found yourself thinking about things that you have to accomplish?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>13. In the last month, how often have you been able to control the way you spend your time?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>14. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Appendix J – Rutgers Collegiate Substance Abuse Screening Test

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Have you gotten into financial trouble as a result of drinking or other drug use?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>2. Is alcohol or other drug use making your college life unhappy?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>3. Do you use alcohol or other drugs because you are shy with other people?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>4. Has drinking alcohol or using other drugs ever caused conflict with close friends of the opposite sex?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>5. Has drinking alcohol or using other drugs ever caused conflicts with close friends of the same sex?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>6. Has drinking alcohol or using other drugs ever damaged other friendships?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>7. Has drinking alcohol or using other drugs ever been behind your losing a job (or the direct reason for it)?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>8. Do you lose time from school due to drinking and/or other drug use?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>9. Has drinking alcohol or using other drugs ever interfered with your preparations for exams?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>10. Has your efficiency decreased since drinking and/or using other drugs?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>11. Do you drink alcohol or use other drugs to escape from worries or troubles?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>12. Is your drinking and/or using other drugs jeopardizing your academic performance?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>13. Do you drink or use other drugs to build up your self-confidence?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>14. Has your ambition decreased since drinking and/or drug using?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>15. Does drinking or using other drugs cause you to have difficulty sleeping?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>16. Have you ever felt remorse after drinking and/or using other drugs?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>17. Do you drink or use drugs alone?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>18. Do you crave a drink or other drug at a definite time daily?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>19. Do you want a drink or other drug the next morning?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>20. Have you ever had a complete or partial loss of memory as a result of drinking or using other drugs?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>21. Is drinking or using other drugs affecting your reputation?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>22. Does your drinking and/or using other drugs make you careless of your family’s welfare?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>23. Do you seek out drinking/drugging companions and drinking/drugging environments?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>24. Has your physician ever treated you for drinking and/or other drug use?</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>25. Have you ever been to a hospital or institution on account of drinking or other drug use?</td>
<td>T</td>
<td>F</td>
</tr>
</tbody>
</table>
Appendix K – Counseling center contact information

**FINAL STATEMENT**

*To be presented after completion of questionnaires at Time 1, Time 2, and Time 3:*

As researchers we are not qualified to provide counseling services and we will not be following up with you about your responses to this survey. If you feel upset after completing the study, or find that some questions or aspects of the study triggered distress, talking with a qualified clinician may help.

If you feel you would like assistance please contact **The Counseling Center** at 212-650-8222 (Monday-Friday 9am-5pm) or counseling@ccny.cuny.edu.
Appendix L – Email regarding survey 2

Subject: Survey 2: Health, Wellbeing, and Academic Achievement among Urban College Students

Hello [insert student’s name],

Thank you again for your participation in this study!

It is now time for the second survey. Please find a link to the survey below: https://ccnypsych.az1.qualtrics.com/SE/?SID=SV_cU7QLFJlOoD5yBF.

We would appreciate it if you could please complete this survey by Friday, April 3.

Thank you.

Elise

---

5 This email was also sent to distribute survey 3: “Survey 3” and “the third survey” and completion date of Monday, May 11 replaced referrals to survey 2, and a new link to survey 3 was added.
Appendix M – Email to instructors regarding grades and attendance information

Subject: Health, Wellbeing, and Academic Achievement among Urban College Students

Hello,

We are conducting a study in the Department of Psychology entitled Health, Wellbeing, and Academic Achievement among Urban College Students. This study has been reviewed and approved by the City College (CUNY) IRB [696523-1, expires 01-07-2016].

As part of this study, we have received informed consent from participants to obtain their midterm grades, as well as midterm and final course attendance record from their Spring 2015 course instructors.

- Midterm grades may constitute any graded assessments that took place prior to the spring recess (i.e., April 3rd), or that took place after this date and which you have deemed to be midterm assessments.
- Attendance may constitute the number of times the student attended and missed lecture and/or lab/recitation components of your class recorded (1) prior to the spring recess (i.e., April 3rd) and (2) at the completion of the semester.

Option 1 (if 1-4 students):
The following students from your [insert course code] class have participated in this study:

<table>
<thead>
<tr>
<th>Name</th>
<th>Midterm grade</th>
<th>Midterm attendance</th>
<th>Final attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Attended</td>
<td>Absent</td>
</tr>
</tbody>
</table>

We would truly appreciate it if you could provide us with the midterm grade(s), as well as midterm and final course attendance record of [this student /these students] at your earliest convenience.

OR

Option 2 (if more than 4 students):
We have attached a spreadsheet with the names of students in your [insert course code] class who have participated in this study. We would truly appreciate it if you (or your teaching assistants) could provide us with the midterm grades, as well as midterm and final course attendance record of these students at your earliest convenience.

If you have any questions at all about this study, please do not hesitate to contact Sarah O’Neill at x5701 or soneill2@ccny.cuny.edu. We would also be happy to meet with you to discuss this further, if you would like that.

Sincerely,

Sarah O’Neill (PI)
Elise Tanzini