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Examining the Bidirectional Relations between Psychological Functioning and Academic Outcomes Among College Students

Maya Hareli

LOYOLA UNIVERSITY CHICAGO

EXAMINING THE BIDIRECTIONAL RELATIONS BETWEEN PSYCHOLOGICAL

FUNCTIONING AND ACADEMIC OUTCOMES AMONG COLLEGE STUDENTS

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MAYA HARELI

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ABSTRACT

Emerging adulthood is a developmental period associated with a variety of transitions and changes, including rising rates of mental health concerns (Arnett, 2004, 2006; Center for Collegiate Mental Health, 2020). The literature has established that both psychological and academic functioning are critical components of students' lives, as mental health has been shown to interfere with students' grades, graduation rates, and postgraduate employment (Hartley, 2010; Mojtabai et al., 2015), while poor achievement is associated with mental health challenges in college and beyond (Bruffaerts et al., 2018; Respondek et al., 2017). Additionally, women and men have been shown to experience these areas of functioning differently. However, less is known about how psychological functioning and academic outcomes impact one another throughout college as well as how gender is implicated in these relations. Using random-intercept cross-lagged panel modeling (RI-CLPM), the present study investigated the interrelations between mental health and academics at five time points throughout college among two cohorts of students. Analyses identified three distinct critical periods such that (1) greater distress at the start of college was predictive of higher grades at the end of the first year, (2) higher grades between the first and third years were predictive of higher well-being between the second and fourth years, and (3) greater distress in the third year was predictive of poorer grades by the fourth year. Additionally, women were consistently shown to experience worse outcomes with respect to the latter two patterns. Surprisingly, academic performance was overall a stronger and more important predictor in the model than psychological functioning in both autoregressive

and cross-lagged paths. The findings have important implications for future directions for research to further identify vulnerable students as well as for campuses to implement screening and targeted prevention programs to support students' functioning.

CHAPTER ONE

INTRODUCTION

Emerging adulthood is a developmental period associated with changes and transitions in a variety of domains (Arnett, 2004, 2006). Most notably, the majority of emerging adults in the United States enroll in postsecondary education after high school (National Center for Education Statistics, 2020), marking the continuation of their educational careers. This transition period into college is characterized by environmental changes such as shifts in living arrangements and social relationships, as well as more personal changes such as shifts in self-identity and independence. These transitions have been associated with alterations in mental health and psychological functioning, specifically increasing rates of depression, anxiety, stress, and relationship problems (Auerbach et al., 2018). In addition to the first year of college being associated with a rise in rates of mental illness, the course of college also has been associated with fluctuations in the prevalence and intensity of various mental health challenges (Center for Collegiate Mental Health, 2020; Mistler et al., 2012).

A key component of students' lives is academics, and college students consistently self-report that mental health challenges interfere with school (e.g., Arria et al., 2013). Mental illness is linked to lower grades, delayed graduation, higher risk for dropping out, and low occupational achievement (Ettner et al., 1997; Hartley, 2010; Mojtabai et al., 2015), which are all exacerbated during academic transition periods such as that between high school and college. For example,

high school grades have consistently been linked to performance in college (van der Zanden et al., 2019), highlighting the importance of this transition in setting students up for success.

In addition to mental health affecting academics, the reverse is also true such that poor academic achievement is associated with a variety of challenges in psychological functioning in college and beyond (Bruffaerts et al., 2018; Fleming et al., 2004; Respondek et al., 2017), including increased rates and severity of these difficulties. The bidirectionality of these constructs is complex in that students experience difficulties at varying points and to differing degrees, which are often driven by a plethora of factors. To complicate even further, the literature suggests that men and women are at higher risk for experiencing different challenges at different points in time. Overall, the existing literature has illuminated gender differences in mental health and academic functioning as well as trajectories of change in both domains among adolescents and emerging adults. However, less is known about how mental health and academics interact with one another throughout the course of college and how gender impacts experiences of adverse outcomes in the interactions between these domains.

Using random-intercept cross-lagged panel modeling (RI-CLPM), the present study will investigate the interrelations between academics and mental health at five time points throughout college, among two consecutive cohorts of students. Specifically, the current study will examine (1) how psychological functioning and academic achievement influence one another longitudinally over the course of college, and (2) whether gender differences exist within this model to suggest whether subsets of students are at increased risk for poor psychological and academic outcomes. This research has the potential to inform interventions geared toward

improving college students' academics and well-being, either through campus mental health

clinics or through broader prevention and promotion programs.

CHAPTER TWO

REVIEW OF THE RELATED LITERATURE

Theoretical Frameworks: Emerging Adulthood

Emerging adulthood, the formative developmental period between late adolescence and early adulthood, is characterized by a variety of changes and transitions (Arnett, 2015, 2016). Specifically, around 70% of emerging adults who complete high school enroll in a 2- or 4-year postsecondary educational institution immediately after graduating (National Center for Education Statistics, 2020). The transition into college, as well as the period of college attendance, is associated with changes in social supports, emotional functioning, cognitive development, academics, employment, and identity exploration (Arnett, 2000; Wood et al., 2018). This period is also associated with increased independence and decision-making about students' educational, financial, and social trajectories (Arnett, 2004, 2006).

Schulenberg and colleagues (Schulenberg et al., 2004; Schulenberg & Zarrett, 2006) thus suggest that it is normative for the emerging adult period to be characterized by some level of uncertainty and instability amid the various contextual and social role changes. However, there is heterogeneity in trajectories of health and well-being, and various conceptual models explain the emergence of mental health problems during this period. For example, the *Matthew effect* posits that those who are doing well have the "psychological and social resources to rise to the occasion and successfully negotiate the various transitions," while those experiencing difficulties tend to fall further behind as they navigate this period (Dannefer, 1987; Schulenberg & Schoon, 2012, p.

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167). Additionally, the *overload model* suggests that psychopathology may develop during this period when the challenges of this transition become so stressful that they overwhelm one's resources to effectively cope (Schulenberg & Zarrett, 2006). Moreover, the *carry-over* perspective proposes that stressors may spill from one life domain to another, from person to person, or across life stages (Thoits, 1995). Pederson (2012) thus suggests that college students may be particularly vulnerable to these carry-over effects, particularly with stress from home impacting school stress, stress experienced by a roommate or peer spilling over to one's own stress, and stress during high school or college impacting health in college or postgraduate life, respectively.

College Student Mental Health

As such, mental illness has been on the rise, with rates of depression, anxiety, and substance use, as well as disordered eating and sleeping, steadily increasing over the past decade (SAMHSA, 2020). According to various population-based studies, the age of onset of these high-prevalence disorders, including mood, anxiety, and substance use, is around the adolescent and emerging adult period (de Girolamo et al., 2012; Kessler & Bromet, 2013). Specifically, according to the World Health Organization (WHO) World Mental Health Survey, the average age of onset of depression is in the mid-20s, with the peak risk period extending to as early as mid- to late-adolescence (Kessler & Bromet, 2013). Anxiety disorders are also highly prevalent and co-morbid with other psychiatric disorders, with the mean age of onset at approximately 21 years of age (Legerstee et al., 2019). Legerstee and colleagues further found in their meta-analysis on the age of onset of anxiety disorders that the 95% confidence interval of mean anxiety disorder onset is between 17.46 and 25.07 years, thus suggesting that most people begin

to experience anxiety symptoms in late adolescence and early adulthood (although there is some variability between anxiety disorder subtypes). The onset of substance use disorders is also around the period of late adolescence and early adulthood (Kessler et al., 2007), with the most common age of drug initiation between 14-21 years (Kelly et al., 2019). The onset and prevalence of these diagnoses in late adolescence and early adulthood suggests that this developmental period is a particularly vulnerable time.

Research focusing specifically on college students further corroborates these findings. Specifically, the literature suggests that students are entering college with increasing rates of mental illness. The WHO World Mental Health International College Student project found that among almost 14,000 incoming first-year students who started college between 2014 and 2017 and who were surveyed across 19 colleges and universities in eight countries, 35% and 31% reported a lifetime and past 12-month prevalence, respectively, of at least one of the six common DSM-IV mood, anxiety, or substance use disorders (Auerbach et al., 2018). In addition, the median age of onset of any disorder among this sample of first-year students was 14.2 years of age, with the U.S. having the youngest age of onset at 13.6 years of age (Auerbach et al., 2018). Beyond rates of psychopathology, the Freshman Survey (TFS) administered by the Cooperative Institutional Research Program (CIRP) shows that first-year students' self-reported physical and emotional health have steadily declined between 2015 and 2019, among both men and women (Stolzenberg et al., 2020). Moreover, the transition into the first year of college has generally been associated with increased levels of stress (Garett et al., 2017; Howard et al., 2006) and declines in psychological well-being (Conley et al., 2014).

The college period itself is also associated with Increased rates of mental health challenges. Between 2009 and 2015, there was a 30-40% increase in college students' utilization of counseling center services, while only a 5% increase in enrollment (Center for Collegiate Mental Health, 2016), with this change in demand attributable to increased nonsuicidal self-injury and suicidal ideation. Of college students seeking mental health services at their counseling centers, over 40-60% report concerns with depression, anxiety, and stress, with the former two being identified as top problems among 16-23% of students (Center for Collegiate Mental Health, 2020). More specifically, the Association for University and College Counseling Center Directors (AUCCCD) reports that anxiety continues to rank as the top mental health concern among college students, with approximately 41.6% of students who seek counseling services on campus identifying anxiety issues, followed by concerns of depression (36.4%) and relationship problems (35.8%; Mistler et al., 2012). Conversely, one study reports that less than half of students who experienced mental health problems persisting for more than two years received psychological treatment in that time period (Zivin et al., 2009). Well-being and mental health concerns are also highly prevalent among non-treatment seeking students (Blanco et al., 2008). For example, among non-treatment seeking students, 41.1% self-reported experiencing moderate to serious levels of psychological distress, while 50.3% reported feelings of loneliness (American College Health Association [ACHA], 2020). Additionally, a systematic review revealed that higher levels of perceived stress among undergraduate students have been associated with lower quality of life, particularly in the domains of physical and mental health (Ribeiro et al., 2018).

Moreover, mental health issues are often persistent among college students. Longitudinal research suggests that students follow varying patterns and trajectories of mental health throughout the course of college. For example, Conley and colleagues (2014) demonstrated that students transitioning into their first year of university experienced declines in psychological well-being and increases in psychological distress. Of note, women experienced persistent elevations in psychological distress through the end of the first year (Conley et al., 2014). Conley and colleagues (2020) found that among a similar sample of students, levels of depression, anxiety, and stress worsened into the second year of college but improved within the latter two years. Additional evidence from a longitudinal study of undergraduate Chinese students supports this trajectory in that symptoms of depression, anxiety, and stress were highest in the first two years of college, with some improvements in the latter two years (Liu et al., 2019). In addition, longitudinal cross-lagged analyses show a reciprocal relationship between mental health status and resilience such that higher levels of depression, anxiety, and stress during the first year predicted poorer resilience in junior year, which in turn predicted higher levels of mental health problems in senior year (Wu et al., 2020).

Population-based longitudinal studies show evidence for the long-term mental health consequences of the onset of these disorders in the adolescent and early adulthood period. For example, the onset of depression in childhood and adolescence (<18 years of age) is associated with a higher likelihood of developing social phobia and alcohol dependence (Alpert et al., 1999) and attempting suicide (Fernando et al., 2011) into adulthood, in addition to experiencing a longer duration of illness (Korczak, 2012). Additionally, increased numbers of adolescent-onset anxiety disorders have been associated with higher risk for developing anxiety, major depression,

substance dependence, and suicidal behavior in early adulthood (Woodward & Fergusson, 2001). Given that the literature suggests that these mental health challenges and consequences may have significant impacts during the emerging adult period, it is critical to more closely study this transition period into and throughout college.

College Student Academic Achievement

In addition to the development of independence, identity, and social supports throughout the college period, students also report academics as an important part of this formative period. Many educational institutions assign students credit points or a grade point average (GPA) to represent their achievement in courses (Richardson et al., 2012), and oftentimes students must obtain a predefined GPA at various benchmarks in their undergraduate career to continue their studies (Moss & Yeaton, 2015). Research shows that high school GPA is the strongest predictor of college cumulative GPA (Dennis et al., 2005; van der Zanden et al., 2019) and graduation rates (Allensworth & Clark, 2020). As such, it is not surprising that academic achievement is highly valued in society by employers, post-graduate institutions, and the like, and thus is also important to students themselves.

The transition period into college is thus highly important in setting students up for success academically. While academics are highly valued, academic performance is rated among the top five most commonly endorsed concerns among treatment-seeking college students, after depression, anxiety, stress, and relationship problems (Center for Collegiate Mental Health, 2020). Studies of non-treatment-seeking students also reveal high rates of endorsement of academic concerns (e.g., Robinson et al., 2016). Crede and Niehorster (2012) assessed the relationship between first-year GPA and college adjustment in a meta-analysis of 237

independent samples and found that first-year students' cumulative GPA was positively correlated to academic adjustment, and to a much stronger degree than to personal-emotional adjustment, suggesting that students' achievement may be more predictive of their adjustment to academics in their first year of college. Various patterns of academic performance are observable from college entrance through the remainder of the college period and are often linked to changes in mental health or general psychological functioning (see next section for further details).

Students' academic performance throughout college is predictive of distal outcomes including final cumulative GPA and dropout and graduation rates, which impact postgraduate employment opportunities and income potential. For example, the Bureau of Labor Statistics (2019) found that over the past decade and a half, the employment-population ratio of those who obtained at least a bachelor's degree was 71.5-77.2%, while the ratio was 62.6-70.6% for those with some college or an associate degree and 53.6-61.0% for those with a high school diploma. These statistics highlight the importance of studying changes in college academic performance to better understand how to support students and reduce negative outcomes beyond college.

Mental Health Impacts on Academic Outcomes

Research has shown that academic achievement in high school is one of the strongest predictors of achievement in higher education (Allensworth & Clark, 2020), however there are other strong non-academic predictors, such as mental health. The mental health challenges that college students typically experience, including depression, anxiety, and stress, are defined by emotional, behavioral, physical, and cognitive symptoms (American Psychiatric Association, 2013). There is a plethora of research supporting the notion that these symptoms impede

students' ability to perform academically. Research examining the transition from high school to college suggests that mental health predicts academic achievement. For example, Rothon and colleagues (2009) examined the associations between psychological distress and educational achievement between the beginning and end of secondary school, respectively, among British students and found that early psychological distress was a strong predictor of later achievement among both adolescent boys and girls. In a college sample, Arria and colleagues (2013) assessed the11hinese11nship between mental health and discontinuous enrollment throughout college and found that as self-reported depression increased, the risk for discontinuous enrollment (a gap in enrollment in one or more semesters) during the first two years of college increased as well. Interestingly, the authors found that being diagnosed with depression prior to starting college was not associated with an increased risk for discontinuous enrollment, however receiving a depression diagnosis while in college was associated with more than a two-fold increase in risk for discontinuous enrollment during both the former and latter two years of college. These findings suggest that depressive symptoms experienced throughout this period are a particular risk factor for interruptions in college enrollment, and that broadly, difficulties with adjusting to college contribute to discontinuous enrollment.

Further research supports the notion that the early college years are a particularly vulnerable time period for students. Various studies have demonstrated the link between internalizing mental health problems and academic functioning among first- and second-year students (Andrews & Wilding, 2004; Bruffaerts et al., 2018; Respondek et al., 2017). For example, van der Zanden and colleagues (2019) found three distinct patterns of success relating to academic achievement and social-emotional adjustment to college life among first-year

students: (1) average-achieving well-adjusted students, (2) high-achieving average-adjusted students, and (3) low-achieving low-adjusted students. The latter group was represented by 22% of students in the study, suggesting that a considerable proportion of individuals struggle to spend time on their studies and develop social relationships. This pattern of functioning is not novel, however, as prior literature shows similar levels and trajectories of academic and mental health functioning among first-year students (Postareff et al., 2017). Additionally, Beattie and colleagues (2019) assessed first-year college students at the beginning of their first and second semesters and found that "divers," compared to "thrivers" (students in the bottom or top decile of the distribution of grades, respectively), had lower life satisfaction and were more likely to feel depressed and stressed in their first semester. Additionally, "divers" expected to obtain lower grades by the end of the first semester, and this negative expectation further increased by the end of the second semester, whereas "thrivers" remained optimistic, suggesting poorer optimism and hope among students struggling academically. This finding is in line with prior research suggesting an association between hope and academic endpoints, such that students endorsing higher levels of hope in their first semester of college were more likely to remain enrolled in their second semester and generally enrolled for more semesters of college, as well as graduate in four years (Gallagher et al., 2017). It has also been shown that hope from the first semester strongly predicts yearly cumulative GPA across the four years of college after controlling for prior academic performance (Gallagher et al., 2017). Moreover, a meta-analysis of the adjustment to college found that this period in the first two years of college was associated with grades and retention (Crede & Niehorster, 2012).

While longitudinal research illuminates the directionality of these constructs, cross-sectional research also shows that mental health functioning throughout the college period is related to academic outcomes. For example, stress has consistently been associated with poor academic outcomes among college students (Frazier et al., 2019; Leppink et al., 2016). A survey of over 30,000 undergraduates across 58 postsecondary institutions revealed that approximately 40% of all students reported stress as negatively impacting their academic performance, with a disproportionate impact on women (44.9%) compared to men (29.9%; American College Health Association, 2020). Research also shows that students with high levels of life satisfaction have greater academic engagement and self-efficacy as well as higher GPAs compared to students with average or low life satisfaction (Antaramian, 2017), suggesting that this domain of psychological well-being may be important for understanding differences in educational outcomes. In addition, among college students categorized as having low versus high subjective well-being and psychopathological symptoms, those labeled as well-adjusted (high levels of well-being and low symptoms) had the highest GPAs, highlighting that this marriage of having positive well-being with the absence of clinical symptoms resulted in academic success (Antaramian, 2015). Moreover, authors found that having high levels of self-reported well-being, regardless of psychological symptoms, was still related to engagement in school and sense of belonging to the university community, suggesting that positive well-being may be a protective factor and critical for students' sense of connectedness and performance in college.

In addition to impacting academic outcomes during college, mental health problems also have been shown to affect longer-term outcomes such as educational attainment, employment, and income (Woodward & Fergusson, 2001). For example, students with diagnosed mental

health problems have an increased likelihood of dropping out of college (Hartley, 2010).

Additionally, Ettner and colleagues (1997) examined the impact of having a psychiatric disorder on labor market outcomes via the National Comorbidity Survey and found that among both adult men and women, having any psychiatric disorder was associated with a significantly lower probability of employment by approximately 11 percentage points, as well as a reduction in annual personal income. Moreover, the presence of three or more disorders was associated with a decline in employment status by one-third. A 10-year follow-up to the National Comorbidity Survey shows that among a subsample of students, the odds of being temporarily laid off at the follow-up increased by 85% [95% CI = 1.00-3.41, p = .049] for every additional lifetime psychiatric disorder that is present, although it is important to factor that the confidence interval includes 1, suggesting that there is insufficient evidence to conclude that the change in employment was statistically significant (Mojtabai et al., 2015). In addition, the odds of being employed at the 10-year follow-up decrease by 35% [95% CI = 0.42-1.00, p = .048) for every additional psychiatric disorder with an onset after the baseline, although assessment of the confidence interval again warrants caution in the interpretation of these results (Mojtabai et al., 2015). These findings suggest a multiplicative effect of psychiatric disorders and comorbidities on employment and extend the extant literature showing effects of comorbid psychopathology on academics (Eisenberg et al., 2009).

Given that mental health challenges impact academics, it is unsurprising that improvements in mental health symptoms also have an effect on academic outcomes. Research has shown that interventions targeting mental health have a positive impact on both short- and long-term academic outcomes. For example, among treatment-seeking students, 66% self-

reported that campus counseling services helped with their academic performance and 62%

believed that these services helped reduce mental health-related attrition (LeViness et al., 2020).

Kivlighan and colleagues (2020) further found that among students who received campus

counseling services, those who reported greater reductions in their psychological distress had

increases in their GPAs by an average of 0.02 points each semester post-counseling, whereas

those with fewer reductions in their psychological distress had decreases in their GPA by 0.02

points each semester. Additionally, the authors found that among students with clinical levels of

distress pre-counseling, reductions in psychological distress, but not in academic distress, were

associated with positive changes in their GPA. These findings provide support for the notion that

greater improvements in mental health specifically positively impact academic functioning. As

low treatment-seeking and adherence are common behaviors among college students (Pedrelli et

al., 2015), it is imperative to disseminate psychoeducation to this population about the

importance of prioritizing one's mental health and well-being in light of the consequences of not

doing so, including risk for academic impairment. Lastly, through reporting on both positive and

negative changes in symptomatology during the transition into college, and linking these to both

risk and protective factors, Andrews and Wilding (2004) highlight students' resiliency and

ability to overcome challenges when proper supports are in place.

Academic Impacts on Mental Health Outcomes

Although it is often assumed that psychological factors are antecedents of academics,

there is a substantial literature base suggesting that psychological factors may also function as

outcomes of academic achievement. Specifically, research shows that poor academic

performance contributes to worsening mental health (Fleming et al., 2004; Lipson et al., 2015).

Research highlights academic transition periods as a time of heightened vulnerability.

Particularly, Evans and colleagues (2018) found that youth are vulnerable to poorer academic

achievement in the transition from primary to secondary education. Specifically, those with

lower academic achievement during this critical period are vulnerable to a variety of negative

consequences in both the immediate and long-term future, including school dropout, higher

delinquency, early pregnancy, and low occupational achievement and income in their futures

(Hartley, 2010). Among college students, the academic workload has been identified as a major

source of stress (Aselton, 2012) that can result in more severe psychopathology if left

unaddressed, including the development of anxiety (Rehman, 2016). This carryover of stress and

pressures from student life to other domains of functioning has been coined "school spillover,"

and Pederson and colleagues have found that higher levels of school spillover among

undergraduates was associated with more frequent feelings of nervousness, restlessness,

worthlessness, depression, and hopelessness (Pedersen et al., 2017). In addition, academic

control, or one's belief in their ability to influence their own achievement, has been associated

with various well-being outcomes among college students. For example, Perry and colleagues

(2005) found that students with high academic control obtained higher GPAs three years later

and withdrew from fewer courses in comparison to those with lower academic control, and

interestingly found that concern about failure further improved outcomes among students with

high academic control. Additionally, perceived academic control has been found to predict

anxiety such that greater control is associated with less anxiety (Respondek et al., 2017;

Stupnisky et al., 2013). These findings suggest that some level of concern or stress is beneficial

for students (however too little or too much can be detrimental) and that cognitions about one's

abilities also play a role in one's performance and general well-being. These results are in line with the well-established Yerkes-Dodson law suggesting a bell-shaped curve to represent the relationship between pressure/arousal and performance (Yerkes & Dodson, 1908).

Various cohort studies show that poor school performance is associated with mental illness into adulthood. For example, the British 1946 birth cohort study found that low test scores at ages 8, 11, and 15 were associated with schizophrenia and affective disorder in adulthood (Jones & Tarrant, 1999). In addition, the Northern Finland birth cohort study of 11,017 adults found that those with schizophrenia, other psychoses, or non-psychotic disorders by age 28 were two to eight times more likely to be in a lower-than-expected grade level at age 14 (Isohanni et al., 1998). This study also found that young adults hospitalized for non-psychotic disorders had significantly low school grades in adolescence. Moreover, a national sample of 907,011 Swedes found that poor school performance at age 15 to 16 was associated with an increased prevalence of a psychotic disorder between ages 17 and 31 (MacCabe et al., 2008). These studies did not adjust for prior mental health functioning, so it is unclear whether the findings simply reflect those students who struggled academically had concurrent mental health problems or prodromes of mental illness, or whether difficulty with academics in late adolescence was truly a precursor for later mental health problems.

In sum, it is evident that a bidirectional relationship exists between mental health functioning and educational outcomes. As Dalgard and colleagues (2007) suggest, there are several models that may explain this association: (1) Individuals with poor mental health, or increased vulnerability for poor mental health, may be less capable of completing higher education, (2) Individuals with low education levels may experience various psychological

stressors, such as a lack of social support or low sense of mastery, which may affect mental health, and (3) Individuals with low education levels may struggle with poor employment or income, due to labor market issues, which may influence mental health functioning. Given these varying theoretical models, the directionality of the relationship between mental health functioning and academics throughout each year of college is not well understood. In addition, as Dalgard's theories suggest, there may be additional factors or moderators influencing the relationship between these two primary constructs, which warrants further investigation.

Gender Differences in the Bidirectional Relation between Mental Health and Academics

In addition to studying the bidirectional relation between mental health and academics, it is important to acknowledge that not all students experience impairments in these domains of psychological and academic functioning and thus it is imperative to explore moderators of this relation. Specifically, gender is a key moderator to explore given known gender differences in the prevalence rates and trajectories of both mental health and academic functioning between the late adolescence and early adulthood period. Below, gender differences in prevalence rates and in the manifestation of mental health disorders and of academic outcomes will be summarized. Additionally, gender differences in the interrelations between these two constructs will be examined and gaps in the extant literature will be identified. It is important to note that to date, gender has been primarily conceptualized as a binary construct in this literature and thus presents various limitations in the interpretation and applicability of these findings to the current college student body.

Gender Differences in College Student Mental Health

There is substantial literature showing that gender is a risk factor for mental health functioning, or in other words, that gender differences exist in mental health functioning. For example, a meta-analysis of representative national samples showed that gender differences in depression emerged as early as age 12, peaked in adolescence, and narrowed into adulthood (Salk et al., 2017), with prevalence rates higher for women compared to men. In addition, the authors found that in nations with greater gender equity, larger gender differences in depression diagnoses were observed; this finding may be a result of the difference in the manifestation of depression among different cultures (which was assessed using the Western conceptualization of depression across studies, with minimal cultural adaptations to diagnostic criteria) as well as of the difference in subjective self-ratings and self-construals between genders (such that individuals in high-gender-equity countries have more opportunities for cross-gender, intergroup interactions and comparisons whereas those in low-gender-equity countries are primarily exposed to within-gender, intragroup interactions). Regarding college students, Surtees and colleagues (2002) found that among a random sample of almost 1,200 undergraduate and postgraduate students surveyed at three annual time points, the current and past-year prevalence of DSM-IV major depressive disorder was on average 3% and 13%, respectively, at each time point, with rates twice as high among women relative to men. Additionally, current and past-year prevalence of generalized anxiety disorder was on average 2% and 7%, respectively, at each time point, with rates three times as high among women compared to men. A synthesis of three national mental health surveys conducted in the United States found that despite there being no gender differences in the age of onset or duration of anxiety, there was a higher prevalence of

lifetime and 12-month anxiety in addition to higher rates of comorbidities between anxiety and other disorders in women (McLean et al., 2011). The authors also found that among women, anxiety disorders were more strongly associated with a greater illness burden, suggesting that anxiety is more disabling in women compared to men. Among college students specifically, some cross-sectional data suggests that women endorse significantly higher levels of stress compared to men (Brougham et al., 2009; Hudd et al., 2000; Pierceall & Keim, 2007). For example, one report found that among a subsample of students reporting severe stress, 76% were women (Leppink et al., 2016). Another study found that in addition to reporting higher stress levels than men, women also utilized emotion-focused coping strategies more often (Graves et al., 2021).

While it is established that gender differences in mental health functioning exist within the general population as well as in college students, it is unclear which mental health domains are impacted most and at which time points during college among various genders, as the literature shows mixed findings. Alfeld-Liro and Sigelman (1998) found that among students transitioning into college, women self-reported significantly greater levels of depression three months prior to college enrollment as well as in the winter of their first year compared to men, tapering off into their second year. Another study suggests that among students who completed their first year of university, men reported better emotional 20hinesent, including physical and psychological health, than women (van der Zanden et al., 2019), which is further confirmed by another report suggesting that women experience greater levels of psychological distress than men at the end of their first year of college (Bewick et al., 2010). During the second year of college, the same report suggests that men experience a significant decline in psychological well-

being between the first and second semesters while women do not (Bewick et al., 2010). The authors also found that men reported greater anxiety and depression than women at the end of their third (final) year of university. Longitudinally, Sher and colleagues (1996) found that among a cohort of students followed throughout their four years of college, men more frequently exhibited clinically significant scores on a brief symptom inventory compared to women, with the prevalence of these elevated scores decreasing over the four years. While this research identified men as endorsing more clinical symptoms, there is other work showing that women suffered from more chronic, mild anxiety from the first through third years of college in comparison to men (Gao et al., 2020). Overall, the literature suggests different, and at times inconsistent, patterns and trajectories of mental health functioning between men and women.

Gender Differences in College Student Academic Achievement

The extant literature also points to gender differences in academic functioning and outcomes among college students. A report from the National Center on Education Statistics has shown that since 1979, women have represented the gender majority in college enrollment and completion rates in the United States (Snyder et al., 2008), and as of spring 2021, they make up 59.5% of college students (National Student Clearinghouse Research Center, 2021). It has been widely established that high school GPA is strongly predictive of achievement in the first year of college (van der Zanden et al., 2019), however gender differences in this association are less known. A study of administrative data collected from four-year institutions across two states found that lower high school grades among men accounted for more than three-fifths of the gender difference in GPA and credits earned in the first year of college, as well as partially explained men's poorer performance in later semesters (Conger & Long, 2010). Moreover, men

were identified as taking fewer credits and earning lower grades than women throughout their college careers, as corroborated by D'Lima and colleagues (2014), in addition to graduating at lower rates than women. A report from the National Center for Education Statistics (2021) corroborates these findings, showing that the overall six-year graduation rate for first-time, full time students who began their degree in 2013 was 66% for women and 60% for men. In addition, a comprehensive meta-analysis of 214 studies revealed that women in college obtained higher GPAs, however the effects were small (Richardson et al., 2012). In sum, the literature suggests a gender gap in college academic outcomes such that women consistently outperform men in obtaining higher grades and their degrees.

Gender Differences in the Interrelations between Mental Health and Academics

The literature covered thus far has identified gender differences in the prevalence rates and trajectories of mental health functioning and academic achievement separately. Below, the interrelations between these constructs will be explored.

As noted, research sheds light on gender differences in the interrelations between mental health and academic functioning, starting as early as high school. For example, Rothon and colleagues (2009) found that secondary school girls with greater depressive symptoms had a third of the odds of achieving benchmark grades compared to non-depressed girls, suggesting an interaction between mental health and gender on academics. Among college students, Surtees and colleagues (2002) found that a larger percentage of students reported their degree courses as extremely stressful with each passing year, with twice as many women reporting courses as stressful at each of the three time points relative to men. Academic-related pathology has been extensively studied, with various reports suggesting women experience greater levels of

academic-induced stress (Arbona & Jimenez, 2014; Dusselier et al., 2005; Greer, 2008; Misra & McKean, 2000), anxiety symptoms (Gao et al., 2020), school spillover (Pedersen, 2012), and poorer self-efficacy (D'Lima et al., 2014) as a result of academic functioning (e.g., GPA), particularly at the cusp of college. However, evidence is inconclusive as some literature suggests that whereas women tend to score slightly higher on various measures of stress, these differences are not statistically significant (Calaguas, 2011), bringing into question the clinical meaningfulness of these small differences. Lastly, while some research suggests gender differences in the manifestation of mental health and academic functioning challenges, the extant literature has lacked exploration of the interrelations between these constructs in a longitudinal sense and thus there is limited understanding of how changes in each construct influence each other over time among various genders.

Overall, the literature suggests gender differences in psychological functioning and academics and alludes to the interrelation between these two constructs at various points in the college period. However, less is known about how gender affects the relations between mental health and academics longitudinally throughout college while adjusting for these constructs at earlier time points. By identifying how gender interacts with mental health and academics, it can be better understood which students are at risk for poor outcomes and thus inform prevention and intervention efforts to curb these negative outcomes.

The Current Study

Existing literature discusses the bidirectional effects of mental health and academic achievement, with research highlighting both predictors of functioning as well as trajectories of change separately in both constructs among the adolescent and emerging adult populations. Prior

literature published from the current dataset has focused primarily on examining trajectories of psychological functioning and well-being and has not yet explored the interplay of academic achievement with these mental health outcomes. Additionally, there is limited research discussing how mental health and academic achievement interact with one another throughout the course of college and which factors predict adverse outcomes in the interaction between these domains at different points throughout the college period. Moreover, less research has examined the continuity of functioning from high school through college. Thus, the current study examines the longitudinal associations between psychological functioning and academic outcomes at each year of college using a cross-lagged panel design, with an exploratory focus on identifying gender differences in these associations. The specific study aims are:

Aim 1: Establish autoregressive effects among psychological functioning and academic outcomes, separately, over the college period. The extant literature supports the capacity for psychological functioning, as well as academic performance, to predict itself from year to year during the college period. Thus, the preliminary research aim is to establish these autoregressive effects via a cross-lagged panel design such that psychological functioning, separated into psychological well-being and psychological distress, and academic outcomes are each regressed on themselves over time. This portion of the model will show how much each construct at one time point predicts itself at the subsequent time point while controlling for its prior levels.

Hypothesis 1: Does psychological dysfunction predict greater future psychological dysfunction throughout the college years? Given longitudinal research showing that psychological problems persist throughout various periods in college (Conley et al., 2014; Liu et al., 2019; Wu et al., 2020), it is hypothesized that psychological dysfunction (lower

psychological well-being and higher psychological distress) at one time point will predict more negative psychological dysfunction at the following time point, controlling for current psychological functioning.

Hypothesis 2: Does academic dysfunction predict greater future academic dysfunction throughout the college years? The literature, though limited, shows that academic performance in high school predicts college achievement (Allensworth & Clark, 2020; Dennis et al., 2005; van der Zanden et al., 2019), thus it is predicted that academic dysfunction (lower GPA) at one time point will predict more negative academic outcomes at the following time point, controlling for current academic achievement.

Aim 2: Establish causal pathways between psychological functioning and academic outcomes throughout the college period. The extant literature supports the bidirectional relation between psychological functioning and academic outcomes at various time points in the emerging adult period, however limited research shows how these constructs are associated with and impact one another throughout each year of college. Thus, the primary research aim is to establish these relations via a cross-lagged panel design such that psychological functioning, separated into psychological well-being and psychological distress, and academic outcomes are each regressed on themselves over time, and simultaneously regressed on each other. Through these two models, it will be possible to determine the relative strength of association between these constructs while controlling for prior levels of these outcomes, as well as to compare the relative strength of various associations to one another to compare the relative importance of each predictor and pathway in the overall model. Understanding these interrelations and

influences over time will contribute to a more comprehensive understanding of college student functioning.

Hypothesis 3: Does psychological dysfunction predict greater academic dysfunction across the college years? Given the body of cross-sectional and longitudinal research showing the negative impacts of poor mental health on academic achievement (American College Health Association, 2020; Arria et al., 2013; Beattie et al., 2019), it is predicted that psychological dysfunction (lower psychological well-being and higher psychological distress) at one time point will predict more negative academic outcomes (lower GPA) at the following time point, controlling for current academic achievement.

Hypothesis 4: Does academic dysfunction predict greater psychological dysfunction across the college years? The extant literature demonstrates that worse academic achievement affects psychological functioning (Jones & Tarrant, 1999; MacCabe et al., 2008), thus it is predicted that academic dysfunction (lower GPA) at one time point will predict more negative psychological dysfunction (lower psychological well-being and higher distress) at the following time point, controlling for current psychological functioning.

Hypothesis 5: Does psychological dysfunction more strongly predict academic dysfunction across the college years than does academic dysfunction predict psychological dysfunction? The longitudinal and treatment outcomes research supports that mental health is strongly predictive of academic outcomes (e.g., Beattie et al., 2019; Postareff et al., 2017; van der Zanden et al., 2019), however little research has compared the relative strength of these associations in either direction and at different time points during college. Thus, this exploratory hypothesis examines whether psychological dysfunction has relatively greater importance in the

overall model in predicting academic outcomes, or vice versa, as well as at which time points in college these associations are strongest.

   Aim 3: Explore gender differences among the causal pathways. This research is critical for understanding the specific periods of psychological and academic vulnerability for college students as well as highlighting which students are at greatest risk for poor outcomes in these two domains. Thus, the secondary exploratory research aim is to identify whether women and men broadly differ in the ways in which their mental health and academics correlate longitudinally over the college period. Due to the lack of specificity in the extant literature around the distinction between psychological well-being and psychological distress as they relate to interactions with academic outcomes and gender, separate models will be run with each of these psychological functioning constructs regressed on the academic outcomes variable. This analysis will offer some clarity into whether men and/or women are at risk for poor outcomes at various points throughout college and will inform prevention and intervention efforts for bolstering supports for students.

CHAPTER THREE

METHODS

Participants

Participants were undergraduate students who matriculated into an urban, mid-sized Midwestern university in five consecutive cohorts between Fall 2009 and Fall 2013. Participants were recruited via email to participate in online assessments of psychological functioning for an IRB-approved study. Students signed an online informed consent during the two weeks leading into their first academic year, in which they also provided researchers permission to access their academic records for the duration of their studies. Due to researchers' current access to academic records data in only the first two cohorts (recruited between Fall 2009 and Fall 2010), all information and analyses hereafter pertain to the first two cohorts. 3,680 students were eligible and invited to complete the first baseline survey in the week prior to the start of their first academic year (Time 0, T0), of which 2,689 (73.07%) participated. Of those invited at the end of their first academic year (Time 1, T1; $n = 2,584$), 1,560 (60.37%) participated. Of those invited at the end of their second year (Time 2; T2; $n = 2,616$), 980 (37.46%) participated. Of those invited at the end of their third year (Time 3; T3; $n = 2,721$), 673 (24.73%) participated. Lastly, of those invited at the end of their fourth year (Time 4; T4; $n = 2,721$), 682 (25.06%) participated. The final sample consists of 1,636 students who had data available on at least two time points.

Information about gender and sexual orientation was self-reported through surveys, while race and ethnicity were collected from students' academic records. In the final sample of 1,636 students (M_{age} = 18.49, SD = 0.46), 69.25% (n = 1,133) self-identified[1] as females, 30.75% % (n = 503) as males, and 0% (n = 0) as transgender.[2] Additionally, 94.93% (n = 1,553) identified as heterosexual, 3.79% (n = 62) as non-heterosexual,[3] and 1.28% (n = 21) did not provide a response. In terms of racial and ethnic identity, 0.06% (n = 1) as American Indian or Alaskan Native, 11.12% (n = 182) as Asian, 2.02% (n = 33) as Black or African American, 9.23% (n = 151) as Hispanic or Latino, 0.37% (n = 6) as international,[4] 2.26% (n = 37) as multi-racial, 0.24% (n = 4) as Native Hawaiian or Pacific Islander, 72.49% (n = 1186) identified as White, and 2.20% (n = 36) as "other.".

Regarding the covariates, the most common highest level of parental education responses was "college degree (30.56%, n = 500) and graduate degree (29.95%, n = 490). At baseline, 37.22% (n = 609) and 37.16% (n = 608) reported having a lifetime history of a psychological disorder or mental health treatment, respectively, with only 2.32% (n = 38) endorsing both.

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[1] Students were only presented with two categories (male and female) due to study decisions made to conceptualize gender in this manner at the onset of the project.

[2] This gender category was added to the survey in 2013 and as the present study uses T0 report of gender, this category was not represented in the first two cohorts, and only seven participants in the full dataset self-identified as transgender. Specifically, one participant in the first cohort who self-identified as male at T0 later self-identified as transgender at T4.

[3] This sexual orientation category is comprised of "Gay/Lesbian," "Bisexual," and "Other." Due to the small number of participants in each of these subcategories, they are grouped together for analyses.

[4] Nationality was grouped into the race and ethnicity variable in the dataset provided by OIE, thus the "international" category is a complex mix of racial and ethnic groups.

Upon receipt of students' demographic information and academic records from the Office of Institutional Effectiveness (OIE), differences between the final sample of students and those who did not complete at least two of the survey time points were calculated.

Procedure

Recruitment

All incoming, first-year students who matriculated into the university between Fall 2009 and Fall 2010 were invited to participate in the study. Students' contact information was provided to the research team by the university's OIE. Additional recruitment occurred through first-year living-learning communities in residence halls and via flyers and announcements posted throughout campus to advertise the study. Students whose information was provided by OIE were sent email invitations to participate. Participants who were college students and at least 18 years of age met the eligibility requirements for participation in the baseline survey (T0).

Consent and Compensation

Prior to completing the first, baseline survey, students were emailed a digital IRB-approved consent form in the week prior to the start of their first academic year. Students who provided consent agreed to (a) complete the baseline survey (T0), (b) to potentially receive invitations to complete follow-up surveys (T1-T4), and (c) to allow the research team to access their demographic information and academic enrollment data via the OIE. At baseline, students had the opportunity to opt-out of part "c" without affecting their ability to participate in the baseline or follow-up surveys, however participants who opted-out of part "c" were not included in the present study.

Students who completed the baseline survey (T0) were subsequently invited via email to participate in the four follow-up surveys conducted at the end of each academic year (T1-T4). Students were entered into a drawing to win a gift card of up to $200 in value (or other prizes such as an iPad, mini laptop, or university gear) at each time point in which they completed surveys. Students in learning communities, as well as those specifically enrolled in select university courses associated with learning communities, were individually compensated $5 at each time point of survey completion (up to $25 for all time points) due to their additional layer of participation in the study (i.e., allowing their course materials to be included in the research if they so choose).

Measures

Demographic and Background Information

Information about age, race, ethnicity, highest level of parental education, first-generation college attendance status, citizenship, and residential/commuter status were provided by the university's OIE. Information regarding gender, sexual orientation, and presence/history of a diagnosis of and treatment for a psychological problem were collected in the survey assessments.

Psychological Functioning

At each time point, students completed measures assessing various components of psychological well-being and distress. The reliability and/or validity reported for the seven measurements below were established using college student samples unless otherwise noted.

Psychological well-being. Self-efficacy was assessed using the General Self-Efficacy Scale (GSES; Sherer et al., 1982; see Appendix A), a 17-item measure demonstrating good reliability ($\alpha = .86$) in the college student population. Participants rate their agreement with each

item on a 14-point Likert scale ranging from 1 (strongly disagree) to 14 (strongly agree), with higher scores suggesting higher self-efficacy expectations. Sample items include "If I can't do a job the first time, I keep trying until I can" and "Failure just makes me try harder."

Self-esteem was assessed using the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965; see Appendix B), a 10-item measure originally developed using a sample of high school juniors and seniors, and demonstrating high reliability (αs = .77-.88) across various samples of adolescents (Rosenberg, 1965) and adults (Blascovich & Tomaka, 1993). Items appear on a 4-point Likert scale and are scored from 1 (strongly disagree) to 4 (strongly agree), including both positively and negatively worded items respectively, for example: "I take a positive attitude toward myself" and "All in all, I am inclined to think that I am a failure." Higher scores are indicative of higher levels of self-esteem.

Resilience, or the ability to cope with adversity, was assessed using the 10-item Connor Davidson Resilience Scale (CD-RISC; Campbell-Sills & Stein, 2007; see Appendix C), which demonstrates good internal consistency (α = .85) and construct validity in the undergraduate student population. Participants rate items on a 5-point Likert scale ranging from 0 (not true at all) to 4 (true nearly all the time), with higher scores suggestive of greater resilience in the face of adversity. Sample items include "I am able to adapt when changes occur" and "I am not easily discouraged by failure."

Hope was assessed using the Adult Dispositional Hope Scale (ADHS; C. R. Snyder et al., 1991; see Appendix D), an 8-item measure demonstrating fair internal consistency in college student samples (α = .74-.78) and good internal consistency among adults in psychological treatment (α = .77-.84). The measure also demonstrates good test-retest reliability among college

students over 10-week intervals (α = .76-.82), and thus good temporal stability. Participants rate

the extent to which each item applies to them using a 4-point Likert scale ranging from 1

(definitely false) to 4 (definitely true), with higher scores suggesting higher levels of hope.

Sample items include "I can think of many ways to get out of a jam" and "I energetically pursue

my goals."

Life satisfaction was assessed using the Satisfaction with Life Scale (SWLS; Diener et

al., 1985; see Appendix E). This 5-item measure demonstrates strong internal reliability (α = .87)

and moderate temporal stability, or test-retest reliability, over a two-month period (α = .82)

among undergraduate students. Participants rate their agreement with each item on a 7-point

Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree), with higher scores

indicative of greater global satisfaction with life. Sample items include "In most ways my life is

close to ideal" and "I am satisfied with life."

Psychological distress. Depression, anxiety, and stress symptoms were assessed using

the 21-item Depression, Anxiety, and Stress Scale (DASS-21; Lovibond & Lovibond, 1995; see

Appendix F), which consists of three 7-item scales assessing each construct. The Depression,

Anxiety, and Stress subscales each demonstrate good internal consistency in various samples,

including a sample of first-year university students (αs = .91, .81, .89, respectively; Lovibond &

Lovibond, 1995), undergraduate students spanning all four years of college (αs = .83, .78, .87,

respectively; Norton, 2007), as well as in a sample of adult outpatients (αs = .94, .87, .91,

respectively; Antony et al., 1998). In the adult sample, the Depression subscale was also strongly

correlated with the Beck Depression Inventory (r = .79), the Anxiety subscale was strongly

correlated with the Beck Anxiety Inventory (r = .85), and the Stress subscale was moderately to

highly correlated with various measures of depression and anxiety (rs = .68-.70; Antony et al., 1998). Participants rate the extent to which they have experienced each symptom item over the past week, using a 4-point Likert scale ranging from 0 (did not apply to me at all) to 3 (applied to me very much, or most of the time), with higher scores indicative of higher frequency or severity of symptoms. Sample items for the depression, anxiety, and stress scales, respectively, include "I couldn't seem to experience any positive feeling at all," "I found it hard to wind down," and "I found it difficult to relax."

Perceived stress, or the degree to which one appraises life situations as stressful, was assessed using the Perceived Stress Scale (PSS; Cohen & Williamson, 1988; see Appendix G). This 10-item measure has demonstrated good reliability among undergraduate students (α = .89; Roberti et al., 2006) as well as good internal reliability in the general adult population (α = .78; Cohen & Williamson, 1988). The PSS has also demonstrated good convergent validity, correlating highly with the Strait-Trait Anxiety Inventory – Trait version total score (r = .73) and anxiety (r = .59) and depression (r = .72) factors. Participants rate the frequency at which they experienced each symptom item over the past month on a scale from 0 (never) to 4 (very often), with higher scores suggesting greater perceived stress. Sample items include "In the last month, how often have you felt that you were unable to control the important things in your life?" and "In the last month, how often have you felt that you were on top of things?"

Academic Outcomes

High school outcomes. Information about students' high school grade point average (GPA; mean of all grades obtained in high school that weighs credit hours) and rank were provided by the university's OIE. Given recent literature showing strong associations between

high school GPA and college graduation, yet weak associations between test scores (e.g.,

American College Testing [ACT] scores) and college graduation (Allensworth & Clark, 2020),

students' high school GPA (cumulative assessment of GPA obtained through all four years of

high school) was used as the sole measurement of high school academic achievement in the

current study (at T0). Moreover, GPA demonstrates high overall reliability ($\alpha = .94$) and

generally good predictive validity (Bacon & Bean, 2006).

University outcomes. Academic data from students' enrollment at the university was

collected from the OIE. Specifically, for each academic semester in which the student was

enrolled, information regarding students' school/college, major department, major of study,

course hours and units, and semester and cumulative GPA was obtained. GPA was measured on

a 4.0 scale (i.e., a 4.0 GPA is associated with an A average, 3.7 GPA is associated with an A-

average, 3.3 GPA is associated with a B+ average, 3.0 GPA is associated with a B average, etc.),

and yearly GPAs (for each year of college enrollment) were calculated by dividing the total

number of course hours enrolled for that given academic year (Fall and Spring semesters

combined) by the number of grade/credit points earned in the given academic year (across the

Fall and Spring semesters), for each of the four years. In addition, information about enrolled,

earned, dropped, incomplete, withdrawn, and failed course credits were collected for the

purposes of calculating GPA as well as to better assess the nature of missing data (e.g., to

understand whether missing data aligns with unenrollment from the university, etc.). Students'

college GPAs represent T1-T4 in the model.

Data Analysis Plan

Descriptive statistics (mean, standard deviation) were calculated using IBM Statistics

SPSS 27 (IBM Corp, 2020) for all psychological and academic outcomes, as well as results from

chi-square and *t*-test analyses showing group differences by demographic variables. Differences

in demographic features and psychological and academic outcomes were also reported between

students who completed at least two assessment time points and those who did not to better

understand differences in rates of attrition.

Bivariate Pearson correlations were also calculated using IBM Statistics SPSS 27 (IBM

Corp, 2020) to assess the degree of shared variance between all variable pairs of interest.

Multicollinearity, the extent to which variables share variance with each other, was also

examined given that the greater this shared variance, the greater the difficulty to tease apart the

effect of any one variable from another (Tabachnick & Fidell, 2014). Multicollinearity can also

bias path estimates in the Random Intercept Cross-Lagged Panel Model (RI-CLPM), thus

multicollinearity diagnostics (i.e., variance inflation factor [VIF] and tolerance) were calculated

by regressing all variables of interest on the T4 outcomes separately (psychological well-being,

psychological distress, and academic functioning).

Aims 1 and 2: Establish autoregressive and causal pathways between psychological

functioning and academic outcomes throughout the college period. To examine how

psychological functioning and academic achievement longitudinally predict each other across the

college years (Hypotheses 1 and 2), Random Intercept Cross-Lagged Panel Models (RI-CLPM;

Hamaker et al., 2015) were estimated using M*plus* Version 8 (Muthén & Muthén, 1998). The

benefit of the panel model over other SEM models, such as structural or growth curve models, is

that it allows for examination of reciprocal (or cross-lagged) effects between two variables in both directions, as well as for assessment of the relative strength of each effect (Selig & Little, 2011). In contrast to the standard Cross-Lagged Panel Model, the RI-CLPM separates within-person from between-person level effects; this allows the model to account for trait-like, time-invariant stability in addition to the time varying component through the use of a random intercept. Specifically, unlike the standard CLPM where a mean score of as given measure is used, which compares an individual's score to the population average, the RI-CLPM teases out the within-person effects for each variable / construct (the exogenous [x] and endogenous [y] variables). That is, the variance of each observed variable / construct is split into the 1) grand means, 2) the stable time-invariant trait-like between-person variability across all measures (the random intercept), and 3) the within-person fluctuations between measurements around the individual's own expected score (novel latent factor per time point). As seen in Figure 1, P_{it} and G_{it} represent the observed scores on psychological well-being / distress and GPA for individual i at time point t, respectively. The grand means are the means for all individuals per time point, which may be time-varying or fixed to be time-invariant and are represented by μ_t and π_t for psychological well-being / psychological distress and GPA, respectively. The between-person effects, or the random intercepts, capture an individual's time-invariant deviation from the grand means and are represented by BP_i and BG_i for psychological well-being / distress and GPA, respectively. The factor loadings of the random intercepts (latent variables) are fixed to 1, and therefore the between-person effects represent the stable differences between individuals across all time points. Lastly, the within-person effects capture the differences between an individual's observed measurements and their expected score (based on the grand means and random

intercepts) at each time point and are represented by WP_{it} and WG_{it} for psychological well-being / distress and GPA, respectively. A latent variable is created for each construct at each time point and the measurement error variances are constrained to 0. Separating out the individual differences thus allows one to examine how each construct changes over time while controlling for the effect of the previous time points (to establish causal pathways), and to assess how each construct relates to the other in the model, thus evaluating the relative contribution of mental health and academics to students' functioning. Therefore, the observed score for psychological well-being / distress can be summarized by the equation $P_{it} = \mu_t + BP_i + WP_{it}$ and for GPA by the equation $G_{it} = \pi_t + BG_i + WG_{it}$ (Hamaker et al., 2015; Mulder & Hamaker, 2021).
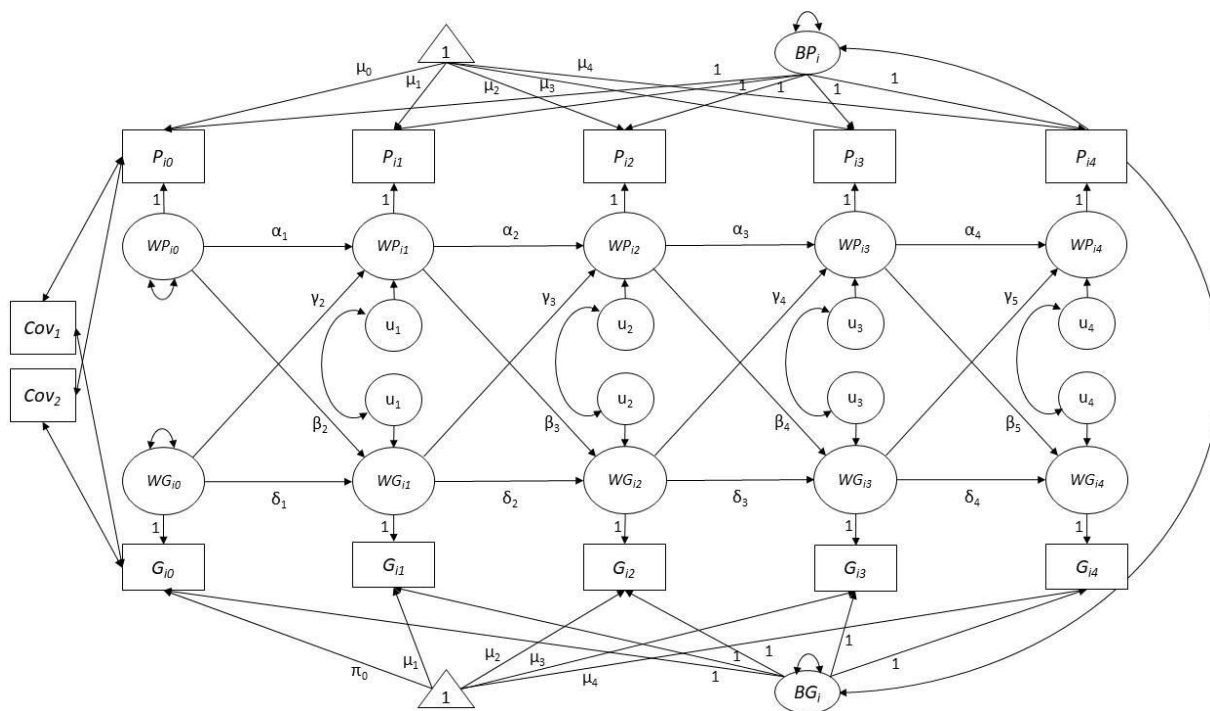
Note. Squares represent observed variables, circles represent latent variables, and triangles represent constants.

Figure 1. RI-CLPM Regressing Psychological Functioning and Academic Achievement on Each Other

In this study, composite scores of psychological well-being and psychological distress were calculated from the respective Likert-scale measures as outlined above. Specifically, measures of self-efficacy, self-esteem, resilience, hope, and life satisfaction comprised the psychological well-being composite score, while measures of depression, anxiety, and stress as well as perceived stress comprised the psychological distress composite score, as informed by a maximum likelihood (ML) confirmatory factor analysis (CFA) that was conducted on a subsample of participants included in these analyses who had complete data across three time points (the cusp of start of college, the end of the first semester, and the end of the first academic year). Specifically, the CFA revealed a psychological well-being dimension ($\alpha = .82$–$.84$ for the five measures) and a psychological distress dimension ($\alpha = .80$–$.87$ for the four measures; Conley et al., 2014). In order to create these composite scores, a mean imputation was initially applied (Jakobsen et al., 2017) to calculate the total scores for each measure for which at least 80% of the data was available per participant. Z-scores were then calculated for each of the seven psychological functioning measures to standardize them and to allow for comparison of their scores given their varying distributions. The z-scores for measures of self-efficacy, self-esteem, resilience, hope, and life satisfaction were averaged (i.e., summed and divided by the number of subscales available for this construct per participant) to create the psychological well-being composite score, while z-scores for measures of depression, anxiety, and stress as well as perceived stress were averaged (following the same procedures noted above) to comprise the psychological distress composite score. Additionally, to create the composite score for academic achievement, each student's yearly GPA was calculated by dividing the total number of course hours they were enrolled for in both the Fall and Spring semesters of each academic year by the

number of grade/credit points earned in both semesters of the respective academic year, which weighs the number of credits attempted in each semester. Composite scores were created using IBM SPSS Statistics 27 (IBM Corp, 2020).

Thus, in the RI-CLPM, two separate models were fitted using the psychological well-being and psychological distress composite scores and represent WP_{it} in Figure 1 after the within-person effects are separated in the analysis. Yearly GPA was regressed on the psychological well-being and distress composite scores separately in each of the two models (and vice-versa) and represents WG_{it} in Figure 1. Further in the models, the autoregressive parameters α_t and δ_t represent the within-person carry-over effects for psychological well-being / distress and GPA, respectively, across time points and thus are a measure of within-person stability within these variables over time (while teasing out the between-person rank-order stability). An autoregressive effect (e.g., α_t) with a positive valence suggests that an individual who experiences increased psychological well-being relative to their own expected score at one time point is likely to experience increased psychological well-being relative to their own expected score at the next time point. As the RI-CLPM model is assessing whether changes in psychological functioning are predictive of future changes in academic achievement, and vice-versa, the cross-lagged regression parameters β_t and γ_t evaluate the extent to which individual change in psychological well-being / distress or academic achievement, respectively, is associated with each individual's academic achievement or psychological functioning, respectively, in the prior year. Therefore, a cross-lagged effect (e.g., β_t) with a positive valence suggests that a positive deviation from an individual's expected level of psychological well-

being will likely be succeeded by a positive deviation in the individual's expected GPA at the

next time point (Hamaker et al., 2015; Mulder & Hamaker, 2021).

Lastly, covariances were included in both the between-person and within-person parts of

the models. Specifically, the between-person random intercepts (BP_i and BG_i) were correlated

and the within-person exogenous and endogenous latent variables (WP_{it} and WG_{it}, respectively)

were correlated within each time point. Potential confounding variables (Cov_1 and Cov_2),

including those that are time-invariant (stable over time) and time-varying (have a constant

influence on the variables in the model), were also statistically adjusted for in the RI-CLPM by

correlating them with the observed exogenous and endogenous variables, and thus the effects of

these covariates were controlled for. The variables entered into the models as covariates

included: (1) highest level of parental education (at baseline), assessed on a categorical scale

with response options of "grammar school," "some high school," "high school graduate,"

"postsecondary school other than college/some college," "college degree," "some graduate

school," and "graduate school"; (2) self-reported history or presence of a psychological disorder

(at baseline), presented as "Have you ever been diagnosed with a psychological disorder?"; and

(3) self-reported history or presence of treatment of a mental health condition (at baseline and at

any subsequent time points in which a student may have received treatment), presented as "Have

you ever received treatment (e.g., therapy, medication) for a mental health condition or

concern?" and "Are you currently receiving treatment (e.g., therapy, medication) for a mental

health condition or concern?"

Given the missing data across various time points, all observed data were used and full

information maximum likelihood (FIML) was applied to account for missing data by estimating

the likelihood of a parameter given the observed data and selecting the one with the maximum

likelihood (Enders & Bandalos, 2001).

To address Hypothesis 3, standardized betas were used to compare effect sizes to

understand the magnitude and importance of the effects in the models. Specifically, Kline (2005)

recommends using the standardized path coefficients I to represent effect sizes when utilizing

structural equation modeling. While Cohen (1988) suggests using values of 0.10, 0.30, and 0.50

to interpret effect sizes of "small," ''medium," and "large" magnitude, more recent

recommendations suggest using effect size magnitudes from prior relevant research examining

similar outcomes as a guide for interpreting the importance of findings (Durlak, 2009). As such,

Hedges and Hedberg (2007) note that effect sizes around 0.20 that are based on measures of

academic achievement are of interest in educational policy research, thus both conventions were

considered when interpreting effect sizes. Additionally, confidence intervals were examined to

determine whether there is more or less than a 50 percent overlap in the confidence interval

range between the beta estimates to conclude whether the estimates are or are not statistically

significantly different from one another. Beta estimates with confidence intervals that overlap

less than 50 percent were considered statistically significantly different from one another ($p <$

.05; Cumming, 2009).

Aim 3: Examine gender differences among the causal pathways. To explore whether

women or men follow different patterns of functioning in the cross-lagged model, separate

models were run for participants self-reporting each of these genders, while controlling for

baseline covariates as informed by Aim 1. The fit of the models was assessed to determine

improvement or worsening of fit, and the strength of association (standardized beta estimates)

was compared for each pathway to determine whether certain pathways hold greater importance in describing the patterns of functioning among the outcome variables in women and men.

Model Fit

The following fit indices were used to assess model fit: measures of absolute fit (which compared the proposed model to a perfect fit) including chi-square distribution (χ^2), degrees of freedom (*df*), root mean square error of approximation (RMSEA of the null model, <.05; Browne & Cudeck, 1992), and standard root mean square residual (SRMR, <.08; Hu & Bentler, 1998); measures of relative fit (which assess whether a modified model improves fit relative to the proposed model) including comparative fit index (CFI, >.90; Marsh et al., 2004) and Tucker-Lewis index (TLI, >.95; Marsh et al., 2004; Tucker & Lewis, 1973). The chi-square to degrees of freedom ratio (χ^2/df) was assessed, which provides the probability estimate (*p*-value) of the chi-squared distribution. Given the sensitivity of the chi-square test to sample size (i.e., the larger the sample size, the greater the chances are of deriving a statistically significant chi-square test), the other fit indices were examined in conjunction to determine model fit. Specifically, change in the CFI > 0.01 was used to determine significance of the model (Cheung & Rensvold, 2002).

Modification indices were also requested for the models to determine whether constraining parameters would improve model fit via examining changes in the models' chi-square distribution. As guided by Mulder and Hamaker (2021), three model constraints were also imposed to test whether model fit improves or worsens when these components are constrained or allowed to be freely estimated. These include: (1) constraining the autoregressive (α1-4 and δ1-4) and cross-lagged (β1-4 and γ1-4) regression coefficients to be the same over time to test whether model fit improves when they are time-invariant; (2) constraining the time-invariant

variances, covariances, and residual variances and covariances in the within-person part of the model to assess whether model fit improves; and (3) constraining the grand means (μt and πt) to be time-invariant to test whether model fit improves. The current model with 50 estimated parameters and a sample size of 1,636 was sufficiently powered given the guidelines to have at least five participants for each estimated parameter in the model (Bentler, 1995).

Lastly, *p*-values were corrected for multiple comparisons using Hochberg's False Discovery Rate (FDR) correction (Benjamini & Hochberg, 1995), and results are reported with and without the correction for each model that was run.

CHAPTER FOUR

RESULTS

Preliminary Analyses

Table 1 presents descriptive and inferential statistics for all study variables. At baseline, participants who completed at least two time points ("completers") did not differ from those who completed only one time point ("non-completers") along sexual orientation, $\chi^2(1) = 0.42$, $p = .518$, first-generation college attendance status, $\chi^2(1) = 3.82$, $p = .051$, citizenship status, $\chi^2(2) = 4.72$, $p = .095$, and history of a diagnosis of a psychological problem at baseline, $\chi^2(1) = 2.74$, $p = .098$. However, there were differences between completers and non-completers such that completers were on average younger, $t(3641) = 2.34$, $p = .019$; more likely to be females, $\chi^2(1) = 23.20$, $p < .001$, and White-identifying, $\chi^2(1) = 15.24$, $p < .001$ (though less likely to be Asian-identifying, $\chi^2(1) = 3.93$, $p = .047$, and "Other"-identifying, $\chi^2(1) = 23.20$, $p < .001$; less likely to have parents whose highest level of education was grammar school or less, $\chi^2(1) = 4.20$, $p = .040$, or some college $\chi^2(1) = 5.99$, $p = .014$, though more likely to have parents with a college degree, $\chi^2(1) = 19.84$, $p < .001$; less likely to be commuter students, $\chi^2(1) = 87.62$, $p < .001$; and less likely to have a history of treatment for a psychological problem, $\chi^2(1) = 4.81$, $p = .028$. Regarding the outcome variables in the main models, while completers did not differ from non-completers on baseline levels of psychological well-being at T0-T5 ($ps > .123$) and psychological distress at T0 and T2-T5 ($ps > .185$), completers did endorse on average lower psychological distress at T1, $t(1347) = 2.52$, $p = .012$, and higher GPAs ($ts \geq 6.58$, $ps < .001$)

relative to non-completers. Of note, there were few non-completers represented in certain variables (e.g., psychological well-being and psychological distress at T1-T4), thus group differences should be interpreted with caution (e.g., psychological distress at T1). Means and totals were computed for measures in which participants responded to at least 80% of the items, and these were then factored into the composite scores.

Table 1. Descriptive and Inferential Statistics for Participants who Completed At Least Two Time Points of Data versus Participants with Only One Data Point

Variable	Completers		Non-Completers		t / χ^2 statistic	p-value
	n	$M(SD)$ / %	n	$M(SD)$ / %		
Age	1634	18.49 (0.46)	2009	18.52 (0.42)	2.34	.019
Gender (n, % female)	1133	69.25%	1244	61.61%	23.20	<.001
Sexual Orientation (n, % heterosexual)	1554	96.16%	922	95.64%	0.42	.518
Race/ethnicity					26.29	<.001
White	1186	72.49%	1346	67.17%	15.24	<.001
Hispanic or Latino	151	9.23%	212	10.58%	1.57	.210
Asian	182	11.12%	269	13.42%	3.93	.047
Black or African American	33	2.02%	46	2.30%	0.28	.597
American Indian or Alaskan Native	1	0.06%	3	0.15%	0.69	.428
Native Hawaiian or Pacific Islander	4	0.24%	1	0.05%	2.52	.112
Multi-racial	37	2.26%	48	2.40%	0.05	.826

Table 1 (continued)

	n	%	n	%	χ²	p
Other	36	2.20%	79	3.94%	8.62	.003
International	6	0.37%	20	0.99%	4.95	.026
Highest Level of Parental Education					27.83	<.001
Grammar school or less	16	1.21%	30	2.23%	4.20	.040
Some high school	23	1.75%	27	2.03%	.287	.592
High school graduate	84	6.39%	108	8.13%	2.99	.084
Postsecondary school other than college	26	1.98%	19	1.43%	1.18	.278
Some college	134	10.19%	176	13.25%	5.99	.014
College degree	500	38.02%	396	29.82%	19.84	<.001
Some graduate school	42	3.19%	46	1.20%	0.15	.699
Graduate degree	490	37.26%	526	39.61%	1.54	.215
First-generation status (n, % first-generation)	149	11.33%	184	13.86%	3.82	.051
Residential/commuter status (n, % commuter)	129	7.89%	377	18.63%	87.62	<.001
Citizenship					4.72	.095
U.S. citizen	1280	97.41%	1285	96.54%	1.70	.192
Permanent resident (green card)	31	2.40%	35	2.63%	0.20	.656
Neither	3	0.23%	11	0.83%	4.49	.034
History of a diagnosis of a psychological problem at T0 (n, % yes)	43	7.06%	30	10.27%	2.74	.098

Table 1 (continued)

History of treatment for a psychological problem at T0 (*n*, % yes)	74	12.17%	51	17.59%	4.81	.028
Psych Well-Being T0	1580	0.01 (0.78)	919	-0.01 (0.81)	-0.64	.520
Psych Well-Being T1	1299	0.00 (0.81)	3	-0.72 (1.23)	-1.54	.123
Psych Well-Being T2	737	0.01 (0.83)	8	-0.13 (0.85)	-0.46	.643
Psych Well-Being T3	478	0.01 (0.82)	26	0.03 (0.83)	0.08	.939
Psych Well-Being T4	503	0.03 (0.83)	16	-0.23 (0.77)	-1.21	.226
Psych Distress T0	1623	-0.02 (0.87)	941	0.03 (0.92)	1.32	.186
Psych Distress T1	1346	-0.00 (0.91)	3	1.33 (1.63)	2.52	.012
Psych Distress T2	750	-0.00 (0.91)	8	0.16 (0.93)	0.49	.622
Psych Distress T3	485	-0.01 (0.91)	26	0.01 (0.71)	0.07	.942
Psych Distress T4	518	-0.01 (0.90)	16	0.29 (0.96)	1.33	.185
GPA T0	1621	3.77 (0.40)	1999	3.67 (0.40)	-7.95	<.001
GPA T1	1636	3.27 (0.48)	2024	3.02 (0.70)	-12.62	<.001
GPA T2	1555	3.33 (0.53)	1646	3.16 (0.62)	-8.52	<.001
GPA T3	1466	3.38 (0.57)	1492	3.24 (0.58)	-6.58	<.001
GPA T4	1340	3.45 (0.54)	1363	3.30 (0.66)	-6.59	<.001

Note. Psychological well-being and psychological distress scores are composite scores that are *z*-transformed.

Table 2 presents bivariate Pearson correlations between all variable pairs. Correlations

from T0 to T1, T1 to T2, T2 to T3, and T3 to T4 within each of the primary outcome variables

(psychological well-being, psychological distress, and GPA), which represent the autoregressive

effects in the RI-CLPM, were all significant and at least moderate in strength ($rs = .417 - .792$,

$ps < .01$). Notably, neither psychological well-being nor distress at T0 were significantly

correlated with GPA at T0 ($rs = .015 - .026$, $ps > .05$). Temporally, these time points align with

the overall experience of high school (cumulative high school GPA variable) and the cusp of

starting college (psychological functioning variables), and the overall transition period from

these two different institutions may contribute to the lack of impact of these two constructs on

each other. Similarly, high school GPA (T0 GPA) was not correlated with psychological well-

being or distress at any other time points (except for distress at T4, $r = -.106$, $p = .016$). On the

other hand, both psychological well-being and distress at T1-T4 were significantly correlated

with GPA at T1-T4 (rs $= .069 - .254$, ps $< .05$; rs $= -.209 - -.056$, ps $< .05$, respectively), with

the exceptions of T1 well-being and distress not being significantly correlated with T4 GPA ($r =$

$.049$, $p = .105$; $r = -.037$, $p = .221$, respectively) as well as T2 distress not being significantly

correlated with T4 GPA ($r = -.056$, $p = .158$).

Table 2. Correlation Matrix for Variables of Interest

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Gender T0	—																	
2. Parental Education T0	.025	—																
3. Psych Treatment T0	.095*	.029	—															
4. Psyc Well-Being T0	-.063*	-.035	-.123**	—														
5. Psyc Well-Being T1	-.038	.026	-.099*	.666**	—													
6. Psyc Well-Being T2	-.090*	.017	-.142**	.614**	.730**	—												
7. Psyc Well-Being T3	-.044	-.001	-.101	.503**	.612**	.703**	—											
8. Psyc Well-Being T4	-.021	.065	-.112	.544**	.667**	.724**	.792**	—										
9. Psyc Distress T0	.110**	.041	.149**	-.592**	-.453**	-.408**	-.318**	-.415**	—									
10. Psyc Distress T1	.094**	-.039	.149**	-.420**	-.666**	-.522**	-.378**	-.457**	.525**	—								
11. Psyc Distress T2	.088*	.025	.131*	-.373**	-.525**	-.692**	-.483**	-.498**	.455**	.628**	—							
12. Psyc Distress T3	.077	-.021	.076	-.302**	-.417**	-.425**	-.700**	-.481**	.390**	.506**	.555**	—						
13. Psyc Distress T4	.038	-.029	.014	-.316**	-.456**	-.521**	-.613**	-.690**	.461**	.537**	.613**	.608**	—					
14. GPA T0	.111**	.025	-.029	.026	.021	.035	.052	.014	.015	-.036	-.033	-.019	-.106*	—				
15. GPA T1	.059*	.150**	.014	.010	.158**	.146**	.161**	.181**	.031	-.165**	-.102**	-.111*	-.193**	.417**	—			
16. GPA T2	.020	.117**	-.011	-.008	.069*	.191**	.186**	.139**	.031	-.095**	-.153**	-.146**	-.192**	.396**	.685**	—		
17. GPA T3	.035	.115**	-.014	-.016	.072*	.134**	.254**	.225**	.042	-.076**	-.083*	-.204**	-.190**	.346**	.579**	.701**	—	
18. GPA T4	.108**	.081**	.018	-.016	.049	.115**	.254**	.240**	.030	-.037	-.056	-.197**	-.209**	.282**	.532**	.614**	.756**	—

$* p < .05, ** p < .01$

Regarding multicollinearity, most VIF (range: 1.325-10.641) and tolerance (range: .094-.755) values fell below the designated threshold (> 10 and $< .10$, respectively; Cohen et al., 2002) for high multicollinearity, with only one extraneous value corresponding to an outcome variable situated one time point prior to the dependent variable that was being regressed on (i.e., psychological well-being at T5 had high multicollinearity with the same variable at T6). These diagnostics suggest that overall, multicollinearity likely did not significantly bias the parameter estimates. Additionally, modification indices were examined in all model iterations, and it was determined that model fit would not improve from constraining any of the parameters.

As noted in the Methods, a maximum likelihood (ML) confirmatory factor analysis (CFA) that was previously conducted on a subsample of participants included in these analyses (Conley et al., 2014) informed the grouping of the seven Likert-scale measures into the two psychological functioning dimensions (psychological well-being and psychological distress).

Primary Analyses

For both models assessing the relations between academic achievement and (a) psychological well-being and (b) psychological distress, the best-fitting and most theoretically driven model included covarying highest level of parental education and lifetime treatment of a psychological disorder at T0. Lifetime diagnosis of a psychological disorder (at T0) and current treatment of a mental health condition (at T1-T4) were dropped as covariates since they worsened model fit. The following results include a description of the model fit, covariances of the random intercepts, autoregressive effects for the main outcomes, and cross-lagged effects for the main outcomes in each model.

Academics and Psychological Well-Being Model

The bidirectional model with psychological well-being and GPA demonstrated excellent

fit across all indices, $\chi^2(40) = 134.963$, $p < .001$, RMSEA = 0.038, SRMR = 0.047, CFI = 0.984,

and TLI = 0.974. The model showed that the random intercepts positively and significantly

covaried ($\beta = 0.104$, $p = .031$), suggesting that students with higher levels of well-being

generally have higher GPAs, and vice versa. The autoregressive effects suggest that students

elevated psychological well-being and GPA relative to their own expected scores at one time

point were positively and significantly associated with a higher likelihood of experiencing

elevated psychological well-being and GPA (respectively) relative to their own expected score at

the next time point; the exception was the non-significant autoregressive effect between T0 and

T1 GPA. In terms of cross-lagged effects, there was only one positive, significant effect of T2

psychological well-being to T3 GPA ($\beta = 0.092$, $p = .024$) while controlling for prior levels of

psychological well-being, which suggests that students with higher psychological well-being at

the end of their second year of college, relative to their own mean, subsequently earned higher

GPAs by the end of their third year. There was also a cross-lagged effect trending towards

significance from T3 psychological well-being to T4 GPA ($\beta = 0.081$, $p = .065$) relative to their

own mean and while controlling for prior levels of psychological well-being. The cross-lagged

effects of GPA to psychological well-being were positive and significant between T1 to T2 ($\beta =$

0.208, $p < .001$), T2 to T3 ($\beta = 0.201$, $p = .001$), and T3 to T4 ($\beta = 0.234$, $p < .001$) relative to

their own mean and while controlling for prior GPA, however not from T0 to T1 (see Table 3 for

the β and p-values in the model, as well as Figure 2 for a visualization of the model.

To address the exploratory hypothesis comparing the relative strength of associations between psychological well-being and academics, the standardized beta parameter estimates as well as the lower and upper 95% confidence intervals were visually and numerically examined for overlap (see Figure 2). Following the 50% overlap rule (Cumming, 2009), results reveal that while the cross-lagged effects between psychological well-being and GPA (in both directions) at T0-T1 were not significantly different from one another, the effects of GPA on psychological well-being from T1-T2, T2-T3, and T3-T4 were statistically significantly larger than the effects of psychological well-being on GPA in those same time points ($ps < .05$). Additionally, the magnitude of the effect sizes of GPA on psychological well-being in these latter time points was small (Cohen, 1988) though meaningful (Hedges & Hedberg, 2007), with a range of 2.01-2.34, in comparison to the effect size estimates of psychological well-being on GPA ranging from -0.005 to 0.092. This examination suggests that academics have a greater influence on, and are more predictive of, psychological well-being than the reverse.
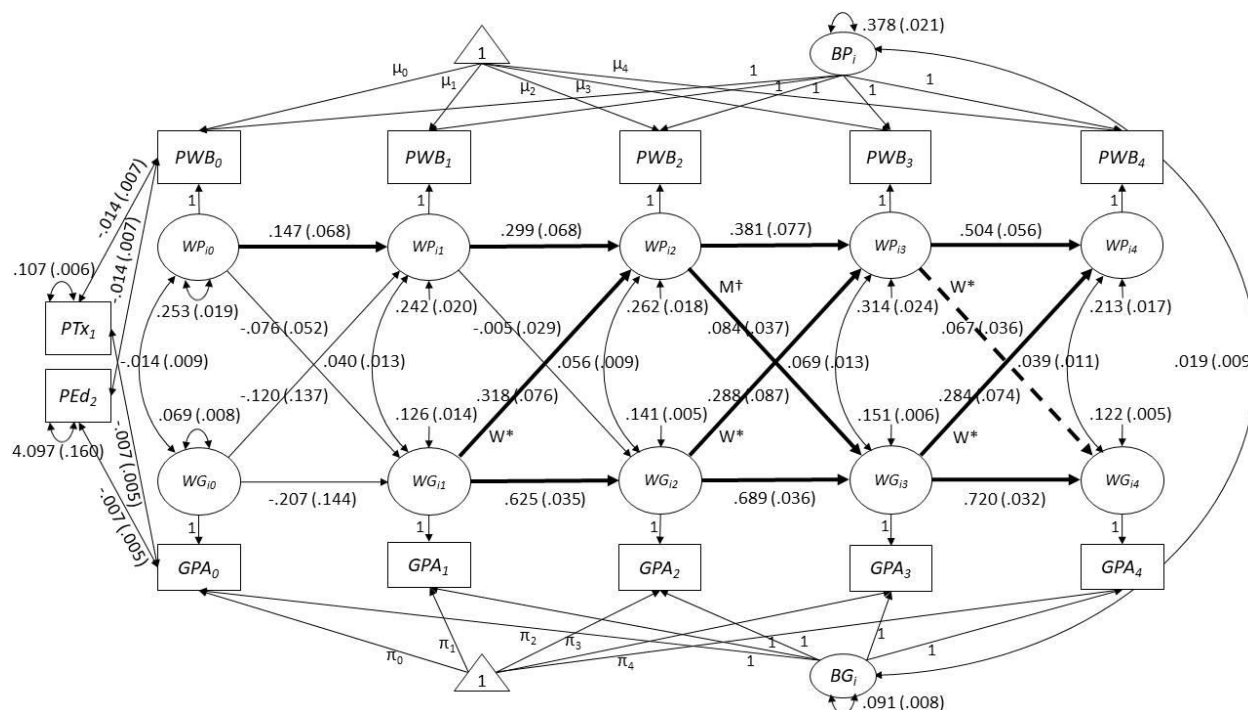
Note. BG: Random intercept for GPA. BP: Random intercept for PWB. GPA: Grade point average. Ped: Highest level of parental education. PTx: History of psychological treatment. PWB: Psychological Well-Being. WG: Within-person effects for GPA. WP: Within-person effects for PWB. All numbers reported include the unstandardized beta and standard error for the unstandardized beta. Bolded arrows represent significant pathways, while dashed arrows represent trending effects. "W" or "M" represents a pathway that was significant for women or men, respectively, while * indicates significant and † indicates trending effects.

Figure 2. RI-CLPM Correlating Psychological Well-Being with Academic Achievement

Additionally, three constraints were imposed on the model to test whether model fit improved or worsened. It was first tested whether all of the autoregressive (α_{1-4} and δ_{1-4}) and cross-lagged (β_{1-4} and γ_{1-4}) regression coefficients were time-invariant by constraining them. The nested, unconstrained model (H1) was run first (for which results are provided above and in Table 2), followed by the constrained model (H0), and results yielded a significant chi-square difference test ($\Delta\chi^2[12, N=1636] = 180.669$, $p < .001$) as well as adequate fit statistics (RMSEA = 0.056, SRMR = 0.115, CFI = 0.956, and TLI = 0.944). These results suggest that constraining the autoregressive and cross-lagged effects to be the same over time yielded a worse-fitting

model and that ultimately the within-person effects change over time, therefore the unrestricted model fit the data best. Second, it was tested whether constraining the time-invariant variances, covariances, and residual variances and covariances in the within-person part of the model improved fit. A similar process was followed such that the unconstrained model (H1) was run first and then the constrained model (H0). Results revealed a significant chi-square difference test ($\Delta\chi^2$[9, N=1636] = 27.434, p = .001) as well as excellent fit statistics (RMSEA = 0.038, SRMR = 0.053, CFI = 0.981, and TLI = 0.974). These results suggest that allowing the variances, covariances, and residual variances and covariances to be freely estimated in the model yields slightly better model fit than constraining them, thus the unrestricted model fits the data better. Third, it was tested whether the grand means (μ_t and π_t) were time-invariant by constraining them to be the same across time points. Similarly, results showed that the chi-square difference test was significant ($\Delta\chi^2$[8, N=1636] = 1296.233, p < .001) with poor fit statistics (RMSEA = 0.133, SRMR = 0.197, CFI = 0.769, and TLI = 0.682). Results showed that constraining the grand means to be the same over time yielded a significantly worse model fit and that ultimately the grand means vary over time. Overall, adding these various constraints into the model to test their variance over time did not improve model fit, suggesting that these various components of the model are time-variant and should be freely estimated.

Academics and psychological well-being models among women and men. To assess the role of gender in the model, two separate models were fitted for women and men and results thus focus on comparing these models to the original baseline model as well as to each other to examine differences in genders. The bidirectional models with psychological well-being and GPA, run separately for women and men, both demonstrated excellent fit across all indices

(Women: $\chi^2[40] = 130.131$, $p < .001$, RMSEA = 0.045, SRMR = 0.056, CFI = 0.977, and TLI = 0.962; Men: $\chi^2[40] = 53.967$, $p < .001$, RMSEA = 0.026, SRMR = 0.051, CFI = 0.993, and TLI = 0.989). Both models showed similar patterns of effects as the baseline models, with some key differences. The random intercepts positively and significantly covaried for men ($\beta = 0.200$, $p = .029$), but not women, suggesting that men with higher levels of well-being generally have higher GPAs. In terms of the autoregressive effects, despite the baseline model showing that T0 psychological well-being significantly predicted the same variable at T1, this effect did not hold when separated for either women or men. Regarding cross-lagged effects, while the main model showed students' psychological well-being at T2 predicted their GPA at T3, this effect was washed out in the analyses separated by gender. Conversely, while the cross-lagged effect of T3 psychological well-being on T4 GPA was trending, the split analysis by gender revealed that women with higher levels of well-being at T3 had higher GPAs at T4 ($\beta = 0.100$, $p = .044$), suggesting that the trend in the main model was driven by women. Additionally, while the baseline model showed significant cross-lagged effects of T1-T3 GPA on T2-T4 well-being, respectively, the cross-lagged effects separated by gender showed that these results were only maintained in women (ps $\leq .001$) (see Table 3 for the β and p-values in the models for women and men).

Table 3. Results of the RI-CLPM for the Interplay Between Psychological Well-Being and Academics and Psychological Distress and Academics

Parameter	Psyc Well-Being Main Model		Psyc Distress Main Model		Psyc Well-Being Women		Psyc Distress Women		Psyc Well-Being Men		Psyc Distress Men	
	β	p-value	β	p-value	β	p-value	β	p-value	β	p-value	β	p-value
cov(BP_i, BG_i)	0.104	.031	-0.115	.020*	0.020	.767	-0.089	.170	0.200	.029	-0.138	.130
α_1	0.148	.025*	0.062	.278	0.127	.081	0.089	.164	0.242	.122	0.033	.766
α_2	0.270	<.001*	0.280	<.001*	0.231	.001*	0.312	<.001*	0.426	.001*	0.180	.138
α_3	0.335	<.001*	0.216	.002*	0.256	.002*	0.110	.223	0.531	<.001*	0.534	<.001*
α_4	0.517	<.001*	0.295	<.001*	0.415	<.001*	0.215	.025	0.741	<.001*	0.479	<.001*
δ_1	-0.151	.142	-0.204	.065	0.000	.999	-0.046	.632	-0.585	.185	-0.520	.178
δ_2	0.516	<.001*	0.505	<.001*	0.539	<.001*	0.531	<.001*	0.490	<.001*	0.485	<.001*
δ_3	0.598	<.001*	0.620	<.001*	0.595	<.001*	0.584	<.001*	0.640	<.001*	0.679	<.001*
δ_4	0.700	<.001*	0.702	<.001*	0.673	<.001*	0.681	<.001*	0.752	<.001*	0.738	<.001*
β_1	-0.107	0.149	0.182	.009*	-0.049	.484	0.092	.167	-0.227	.396	0.297	.114
β_2	-0.005	.878	-0.021	.510	0.037	.362	-0.029	.433	-0.061	.301	-0.006	.909
β_3	0.092	.024*	-0.047	.231	0.057	.295	-0.102	.047	0.130	.053	0.028	.615
β_4	0.081	.065	-0.093	.040	0.100	.044	-0.090	.094	0.038	.639	-0.124	.061
γ_1	-0.063	.376	0.054	.417	0.015	.839	0.020	.761	-0.142	.451	-0.009	.957
γ_2	0.208	<.001*	-0.068	.165	0.261	<.001*	-0.109	.056	0.019	.838	0.030	.732
γ_3	0.201	.001*	-0.237	<.001*	0.247	.001*	-0.232	.003*	0.111	.260	-0.258	.004*
γ_4	0.234	<.001*	-0.128	.084	0.273	<.001*	-0.247	.007*	0.137	.136	0.055	.628
$\chi^2(df)$	$\chi^2(40) = 134.963$		$\chi^2(40) = 137.284$		$\chi^2(40) = 130.131$		$\chi^2(40) = 125.451$		$\chi^2(40) = 53.967$		$\chi^2(40) = 48.349$	
p-value	<.001		<.001		<.001		<.001		<.001		<.001	
RMSEA	0.038		0.039		0.045		0.043		0.026		0.020	
SRMR	0.047		0.050		0.056		0.054		0.051		0.054	
CFI	0.984		0.980		0.977		0.974		0.993		0.995	
TLI	0.974		0.967		0.962		0.956		0.989		0.992	

Note. β: Standardized parameter estimate. Cov(BP_i, BG_i) represents the covariance between the random intercepts. α_{1-4} and δ_{1-4} represent the autoregressive effects of psychological well-being / distress and GPA, respectively, while β_{1-4} and γ_{1-4} represent the cross-lagged effects of psychological well-being / distress and GPA, respectively. (*) indicates p-values that survived Hochberg's False Discovery Rate (FDR) correction.

Academics and psychological distress model. The bidirectional model with psychological distress and academic achievement demonstrated excellent fit across all indices, $\chi^2(40) = 137.284$, $p < .001$, RMSEA = 0.039, SRMR = 0.050, CFI = 0.980, and TLI = 0.967. The model showed that the random intercepts negatively and significantly covaried ($\beta = -0.115$, $p = .020$), suggesting that students with higher levels of distress generally have lower GPAs, and vice versa. The autoregressive effects suggest that students elevated psychological distress and GPA relative to their own expected scores at one time point were significantly associated with a higher likelihood of experiencing elevated psychological distress and GPA (respectively) relative to their own expected score at the next time point; the exceptions were the non-significant

autoregressive effects between T0-T1 distress and T0-T1 GPA. In terms of cross-lagged effects, there were two significant effects of psychological distress to GPA, in which students with higher distress at the beginning of college (T0) had higher GPAs by the end of their first year (T1; $\beta = 0.182$, $p = .009$) relative to their own mean and while controlling for previous levels of distress, and students with higher distress at the end of their third year (T3) had lower GPAs by the end of their fourth year (T4; $\beta = -0.093$, $p = .040$) relative to their own mean and while controlling for prior distress. The cross-lagged effects of GPA to psychological distress yielded only one negative, significant effect in which higher GPA at the end of the second year (T2) was associated with lower psychological distress by the end of the third year (T3; $\beta = -0.237$, $p < .001$) relative to their own mean and while controlling for prior GPA (see Table 3 for the β and p-values in the model, as well as Figure 3 for a visualization of the model).
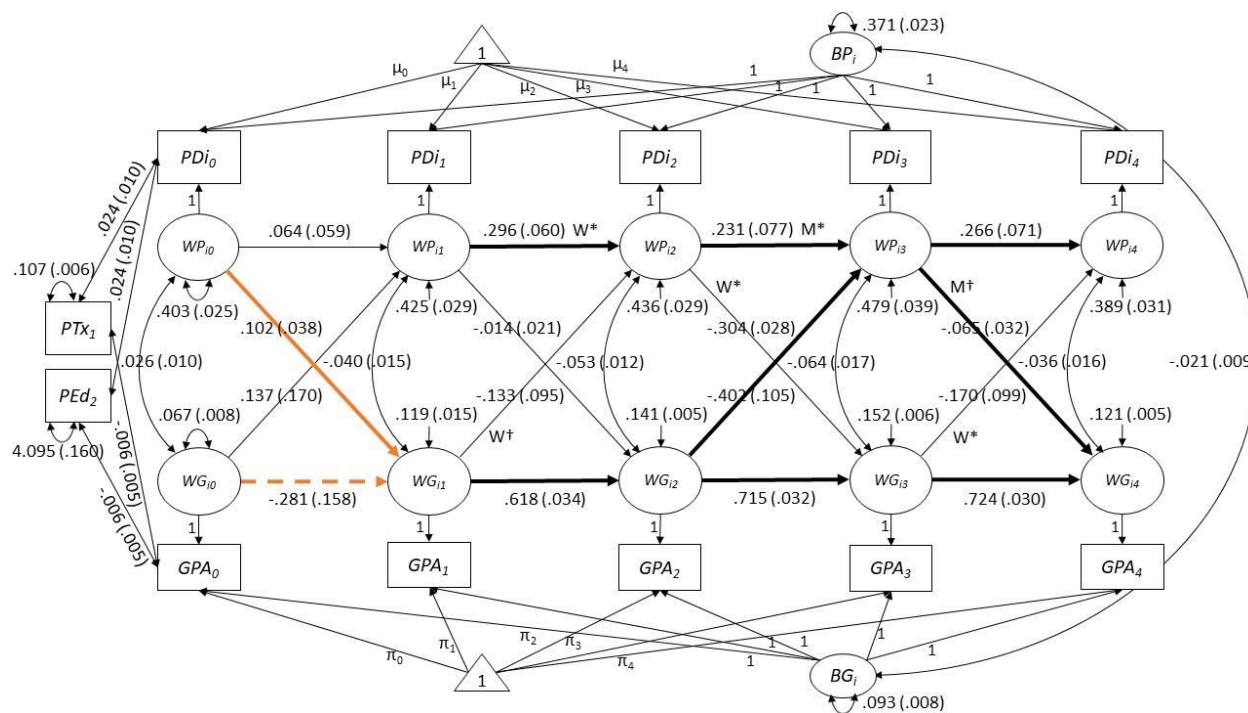
Note. BG: Random intercept for GPA. BP: Random intercept for PDi. GPA: Grade point average. PDi: Psychological Distress. Ped: Highest level of parental education. PTx: History of psychological treatment. WG: Within-person effects for GPA. WP: Within-person effects for PDi. All numbers reported include the unstandardized beta and standard error for the unstandardized beta. Bolded arrows represent significant pathways, dashed arrows represent trending effects, and orange arrows represent effects in the opposite direction as anticipated. "W" or "M" represents a pathway that was significant for women or men, respectively, while * indicates significant and † indicates trending effects.

Figure 3. RI-CLPM Correlating Psychological Distress with Academic Achievement

Visual and numerical examination of the standardized beta parameter estimates as well as the lower and upper 95% confidence intervals (Cumming, 2009) showed that the cross-lagged effects between psychological distress and GPA at T0-T1 were statistically significantly different from one another such that psychological distress at T0 had a greater influence on GPA at T1 ($p < .05$) than the reverse (see Figure 4), with an effect size estimate of small to medium magnitude ($r = 0.182$). Additionally, GPA at T2 was more predictive of psychological distress at T3 than the reverse and this pathway had a meaningful effect size ($r = -0.237$), providing additional evidence that academics have a great influence on psychological functioning (as similarly seen in

the distress model). However, the differences between the constructs at T1-T2 and T3-T4 were not statistically significant. Overall, it can be concluded that psychological distress has an overall stronger influence on GPA than does GPA on distress in the first year of college, while the reverse effect is seen mid-college (between the second and third years).
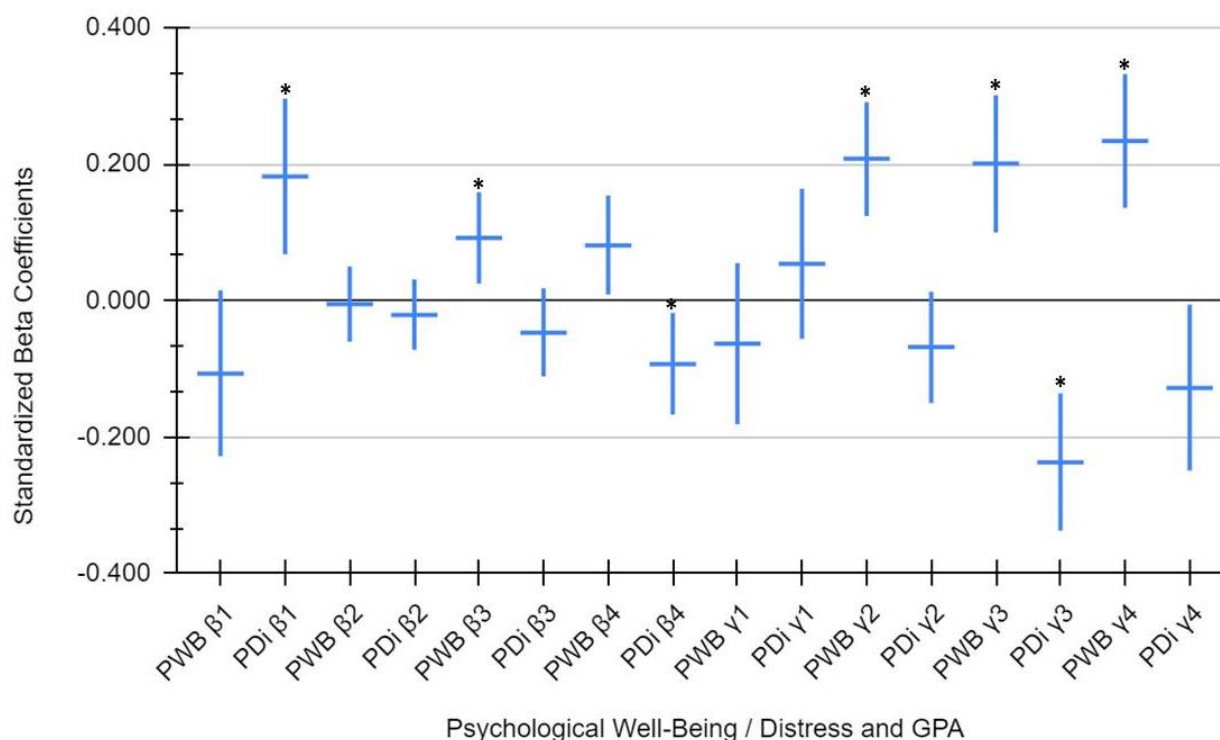
Note. β and γ represent the cross-lagged effects of psychological well-being / distress and GPA, respectively. PWB: Psychological Well-Being. PDi: Psychological Distress. * denotes the significant standardized Beta estimates (cross-lagged pathways).

Figure 4. Confidence Intervals of Main Effects for Psychological Well-Being and Distress Models

As previously conducted, the three model constraints were imposed on this nested model one at a time to test whether model fit improved or worsened. First, the autoregressive (α_{1-4} and δ_{1-4}) and cross-lagged (β_{1-4} and γ_{1-4}) regression coefficients were constrained and results yielded a significant chi-square difference test ($\Delta\chi^2[12, N=1636] = 188.74$, $p < .001$) as well as adequate

fit statistics (RMSEA = 0.057, SRMR = 0.119, CFI = 0.945, and TLI = 0.930), suggesting that

model fit slightly worsens when the autoregressive and cross-lagged effects are constrained to be

the same over time, and thus the unrestricted model fits the data best. Next, the time-invariant

variances, covariances, and residual variances and covariances in the within-person part of the

model were constrained, and results showed a significant chi-square difference test ($\Delta\chi^2$[9,

N=1636] = 24.286, p = .004) and comparable fit statistics (RMSEA = 0.037, SRMR = 0.054, CFI

= 0.978, and TLI = 0.970), suggesting that freely estimating these parameters results in a slightly

better model fit. Lastly, the grand means (μ_t and π_t) were constrained to be the same across time

points and results yielded a significant chi-square difference test ($\Delta\chi^2$[8, N=1636] = 1282.425, p

< .001) with poor fit statistics (RMSEA = 0.132, SRMR = 0.194, CFI = 0.721, and TLI = 0.617),

showing that allowing the grand means to freely vary over time is best for the model fit. Since

the model constraints did not improve model fit, it can be concluded that allowing the parameters

to freely estimate resulted in the best-fitting model.

Academics and psychological distress models among women and men. The

bidirectional models with psychological distress and GPA, run separately for women and men,

both demonstrated excellent fit across all indices (Women: χ^2[40] = 125.451, p < .001, RMSEA

= 0.043, SRMR = 0.054, CFI = 0.974, and TLI = 0.956; Men: χ^2[40] = 48.349, p < .001, RMSEA

= 0.020, SRMR = 0.054, CFI = 0.995, and TLI = 0.992). Both models showed similar patterns of

effects as the baseline models, with notable differences further discussed. Despite the random

intercepts covarying in the baseline model, they did not significantly covary for either men or

women separately. In terms of the autoregressive effects, while the baseline model showed that

distress at one time point predicted distress at the next time point for all but the first pathway, the

analyses split by gender revealed that T1 distress predicted T2 distress for women ($\beta = 0.312$, *SE* = 0.060, $p < .001$), T2 distress predicted T3 distress for men ($\beta = 0.534$, *SE* = 0.082, $p < .001$), and T3 distress predicted T4 distress for both women and men. The autoregressive paths for GPA among men and women followed an identical pattern of significant results to the baseline model. Regarding cross-lagged effects, while the baseline model yielded significant effects of distress on GPA between T0-T1 and T3-T4, the analysis split by gender did not yield significant results, suggesting that this finding in the baseline model may have been driven by some other effect aside from gender. The cross-lagged effects did reveal that T2 distress predicted T3 GPA among women ($\beta = -0.102$, *SE* = 0.051, $p = .047$). Lastly, in terms of cross-lagged effects in the other direction, a new effect emerged such that T3 GPA predicted T4 distress among women ($\beta = -0.247$, *SE* = 0.092, $p = .007$) (see Table 3 for the β and *p*-values in the models for women and men).

CHAPTER FIVE

DISCUSSION

The college period is associated with a variety of stressors that can place students at risk for developing mental health and academic challenges (Mofatteh, 2020), thus understanding how these constructs themselves serve as both risk and protective factors for future functioning is critical to informing educational institutions on how to best support students who, statistically, are already at a higher risk for experiencing negative outcomes (Auerbach et al., 2018; Center for Collegiate Mental Health, 2020). Additionally, exploring the role of gender as a risk factor for adverse outcomes in these domains of functioning can further assist in tailoring treatment efforts to the most vulnerable individuals. Prior research has examined the longitudinal trajectories of mental health and academic achievement among emerging adults, but typically in separate models. The current study extends the extant literature by considering the bidirectional relations between psychological and academic functioning throughout the four years of students' undergraduate careers, as well as exploring gender differences in these associations, in comprehensive models. The findings from this study show that the two baseline models, as well as the models for women and men, were reasonably consistent with the data and reproduced it well.

Autoregressive Effects

Autoregressive effects, which examined the within-person carry-over effects of psychological functioning and academics at each assessed time point, were expected to be

significant and positively valenced such that students with increased levels of well-being, distress, and GPA would have a higher probability of experiencing increased well-being, distress, and GPA at the next time point.

Psychological Functioning

Autoregressive effects of psychological functioning revealed that while each time point of psychological *well-being* was predictive of itself at the next time point, the autoregressive effect within the RI-CLPM of psychological *distress* from the cusp of college (T0) to the end of the first year (T1) was not statistically significant. In contrast, the correlation matrix shows that T0 and T1 psychological distress *are* significantly and moderately correlated with one another, in line with prior research (particularly on the same dataset) showing that students generally follow a trajectory of increased distress throughout the first year of college (Conley et al., 2014). However, the RI-CLPM in these analyses accounted for other factors, including baseline parental education and lifetime treatment of a psychological disorder, which were not controlled for in the bivariate correlation matrix or prior research. In particular, this lack of a statistically significant autoregressive effect in the RI-CLPM may be accounted for by the baseline treatment history covariate, which was significantly correlated with T0 and T1 psychological distress per the bivariate correlations and could suggest that having a recent history of treatment for a psychological problem mitigates symptoms of distress, thus explaining the lack of carry-over effects of distress at baseline (T0) to the next, most proximal time point (T1).

Regarding gender, there were a couple unexpected deviations in statistical significance from the main model to those run for women and men. Specifically, the autoregressive effect of psychological distress from the first (T1) to second (T2) year of college was only significant in

women, suggesting that the statistically significant effect seen in the main model was likely

driven by the effects among women. This finding is consistent with the extant literature showing

that women experience greater psychological distress than men at the end of their first year of

college (Bewick et al., 2010), which likely explains the significant impact of distress at the end

of the first year of college on distress in the subsequent year among women, as seen in the

current study. Additionally, the autoregressive effect of distress from the second (T2) to the third

(T3) year of college was only significant in men, suggesting that this effect seen in the main

model may have been driven by the effects among men. Again, this finding is corroborated by

literature showing that men experience declines in well-being by the end of their second year of

college as well as greater distress symptoms by the end of their third year of college (Bewick et

al., 2010), which may thus explain the current study's finding of a significant effect of distress at

the end of the second year of college on distress at the following time point among men. These

time points where women and men are shown to experience significant elevations in distress

each align with subsequent significant and trending cross-lagged effects of distress impacting

GPA (explained in further detail in the Cross-Lagged Effects section), demonstrating consistency

in patterns of effects and suggesting that women and men may benefit from interventions

targeted at reducing distress prior to or during these identified time points of vulnerability. The

other time points showed no deviation in statistical significance from the main model, suggesting

that there may be other factors aside from gender (i.e., demographic characteristics, state- or

trait-like differences, or even cross-lagged effects of academics) contributing to the statistically

significant autoregressive effects seen in the main model.

Academic Functioning

Similarly, to the bivariate correlations for psychological functioning, the bivariate correlations for GPA were significantly, moderately, and positively correlated with one another. However, the autoregressive effects of GPA revealed that high school (T0) GPA was not predictive of GPA at the end of the first year of college (T1) in either the psychological well-being or distress models, whereas all other time points were predictive in both models. Some of this finding may be related to measurement issues. For example, while college GPA time points are temporally one year apart, the high school GPA variable is a cumulative average of students' grades obtained throughout their four-year high school career and perhaps may be washing out potentially notable fluctuations in GPA from year to year in high school. Additionally, students' high school GPAs were inconsistently weighted and unweighted as they were measured using different grading and scaling systems per student's high school. While T0 GPA was not predictive of T1 GPA, the current study found significant bivariate correlations between high school GPA and GPA in the latter half of college, which is supported by a body of research suggesting that cumulative high school GPA is correlated with more distal academic outcomes (e.g., end-of-college GPA or graduation rates; Allensworth & Clark, 2020; Dennis et al., 2005; van der Zanden et al., 2019). Therefore, while cumulative high school achievement may not predict first-year college achievement, it does appear to be associated with later outcomes. Nonetheless, cumulative high school GPA has been used most consistently in the literature to characterize achievement (Richardson et al., 2012), thus the present findings are in line with prior work.

The current study also demonstrated significant bivariate correlations and autoregressive effects between T1 and T4. Research suggests that students' academic achievement *during* college is predictive of final college cumulative GPA (DeBerard et al., 2004) as well as future employment opportunities and income (Bureau of Labor Statistics, 2019). As such, the current study's finding that *college* GPA at one time point (T1-T3) predicted GPA at each subsequent time point (T2-T4, respectively) may be a result of there being shorter windows of time between each GPA measurement.

 In addition to measurement issues, there are also various confounding factors that are likely leading to the lack of a statistically significant effect between cumulative high school (T0) and first-year college GPA (T1). Notably, there is a developmental shift that students experience in the transition from high school to college, characterized by fluctuations in social supports, cognitive development, academic functioning, and more (Arnett, 2000; Wood et al., 2018), thus students may be starting college in a different developmental mindset and therefore carry-over effects of academics from high school to college may not be as present or relevant. Additionally, there may be other variables not accounted for in the current study models, aside from parental education and history of psychological treatment, that are contributing to the lack of significant effects of high school GPA on first-year college GPA. For example, Black and colleagues (2014) found that students' socioeconomic status was a stronger predictor of first-year college GPA than high school standardized testing. Future research should thus control for a more comprehensive array of participant characteristics at baseline.

Lastly, despite both psychological well-being and psychological distress models resulting in nonsignificant effects between T0 and T1, it is notable that the autoregressive effect of GPA in

the psychological distress model demonstrated a trend towards significance ($p = .065$) and the parameter estimate was negative, suggesting a trend such that higher (or lower) high school GPA was predictive of lower (or higher) first-year college GPA, respectively. The directionality of this effect is contrary to the hypothesized effects and may be a product of measurement issues, such as that the high school GPA variable is a cumulative measurement of GPA obtained throughout all of high school whereas T1 GPA captures two semesters of grades, as well as that the developmental transition from high school to college may be too great to result in an immediate carry-over effect of high school performance on students' grades in the first year of college. Lastly, there were no deviations in statistical significance from the main model to the models for women or men, suggesting that gender did not explain the autoregressive findings seen in the main models.

Cross-Lagged Effects

Cross-lagged effects, which examined the between-person effects of changes in psychological functioning at one time point on changes in academics at the next time point, and vice versa, were expected to be significant and positively valenced for well-being and GPA while negatively valenced for distress. Specifically, it was hypothesized that increased well-being / lower distress at one time point would predict higher GPA at the next time point, as well as higher GPA at one time point predicting greater well-being / lower distress. These cross-lagged effects allowed for the investigation of the bidirectional relations between the two primary constructs evaluated in the current study.

Effects of Psychological Functioning on Academic Functioning

Cross-lagged effects examining the relations between psychological functioning and GPA revealed that psychological distress at T0 was predictive of GPA at T1, though such that higher levels of distress at baseline were predictive of higher GPA by the end of the first year of college. This finding is surprising given the literature suggesting that poor psychological functioning (or in other words, more impairing levels of distress) is not conducive to achieving high grades. The current study also found that psychological well-being at T0 and at T1 was not statistically significantly predictive of GPA at T1 and T2, respectively, though the directionality of these findings was consistent with that of the psychological distress finding such that lower levels of well-being (poorer psychological functioning) were non-significantly associated with higher GPA (improved academic functioning). When examined together, both of these findings suggest that the cusp of college may be a time of particular vulnerability whereby students experience a variety of mental health challenges and symptoms (e.g., stress and distress; Auerbach et al., 2018; Garett et al., 2017; Howard et al., 2006) that impact their ability to perform well academically in school (Andrews & Wilding, 2004; Arria et al., 2013; Bruffaerts et al., 2018).

It is interesting that there was a significant effect of psychological distress, but not of psychological well-being, on academic functioning. Arria and colleagues (2013) found that greater depression (a facet of distress) at the start of college was associated with a higher likelihood for discontinuous college enrollment during the first two years of college; while the authors controlled for background characteristics (including highest level of parental education, mean income for home ZIP code, race, and high school GPA), the multinomial logistic

regression models they conducted were not as complex as the RI-CLPM performed in the current study in which between- and within-person effects were separated. Moreover, authors conceptualized psychological functioning as psychiatric symptoms (assessed via the Beck Depression and Anxiety Inventories) and substance use, therefore psychological distress – as compared to psychological well-being – may be more strongly predictive of academic functioning at the cusp of college entry.

It is particularly curious that greater distress at baseline was predictive of higher GPA at the end of the first year of college. It is well-known that some stress is necessary for optimal performance (Yerkes & Dodson, 1908), thus the magnitude of reported distress among the current study participants may possibly be in the optimal zone and thus contribute to improved academic performance. Relatedly, another explanation for this finding could be that the students who are more focused on academics and studying in their first year of college have higher trait anxiety (Dong et al., 2021). Additionally, as the T0 assessment time point overlapped with students' move-in week to campus, it could be that the students who completed the baseline survey had greater conscientious traits, and relatedly more anxious traits (Endler & Kocovski, 2001), and thus were more likely to complete the survey. Even further, this surprising finding may be understood by the stage-environment fit model (Midgley et al., 2002), which proposes that if developmental changes in needs are aligned with changes in opportunities afforded by the learning environment during the transition from one educational setting to the next, positive outcomes will result. Although this model was originally conceptualized to explain the transition from primary to middle school, the authors' findings are also relevant to the transition from high school to college. Specifically, despite the authors' hypothesis that students' needs would change

but educational opportunities would not, they found that the learning environment changed in a way that resulted in lower performance and motivation to achieve (Eccles & Midgley, 1989). The current study finding that students who experienced distress (which likely is in part academic-related distress) at the cusp of college attained higher GPAs at the end of their first year may be an example of the learning environment of college not meeting students' developmental needs. For example, students are often expected to navigate the transition into college with limited support from adults in comparison to the level of support and monitoring they likely received in high school from their parents and teachers. As such, the level of independence, personal responsibility, and academic rigor that college demands of students may inadvertently elicit greater stress and subsequently reward students who channel this stress toward their academic studies. All in all, it is important to highlight that poor mental health at the start of college is not to be promoted. Rather, universities should make concerted efforts to provide greater scaffolding for students in this transition into college via social-emotional and academic supports. Future research should also further examine the impact of additional factors, including trait-level and social factors, on mental health functioning and the subsequent implications for academic achievement among this developmental sample.

Additional cross-lagged effects showed that there was a significant effect in the latter half of college such that students with higher psychological well-being at T2 earned significantly higher GPAs by T3. Additionally, students with lower psychological distress at T3 earned significantly higher GPAs by T4, with a similar trending yet nonsignificant result between T3 well-being and T4 GPA. An explanation for these findings could be that students in the latter half of college may be experiencing greater distress as they prepare to transition to postgraduate

life (e.g., internships, job applications, etc.). For example, research has shown that upper-class students exhibit higher levels of anxiety, stress, and depression compared to first- and second-year students due to the impending possibility of entering a difficult job market (Beiter et al., 2015; Ran et al., 2016). Taken together with the finding that first-year students experience distress that significantly impacts their subsequent academics, an interesting pattern is painted such that the beginning and end of college represent points of academic vulnerability for students as they navigate their mental health. Overall, these findings call for greater efforts to implement screening procedures at the onset of college to identify students who are at-risk for experiencing mental health symptoms that may jeopardize their later functioning, as well as targeted prevention programs during college to bolster students' psychological health and promote psychosocial strengths to better prepare them for post-graduation (e.g., Conley et al., 2015, 2021).

Regarding gender differences, it is notable that there were no significant cross-lagged effects that emerged in either women or men during the first two years of college, which contrasts some prior literature showing that women are more susceptible to experiencing declined mental health and academic-related pathology in the beginning of college (Alfeld-Liro & Sigelman, 1998; Bewick et al., 2010; Gao et al., 2020; Misra & McKean, 2000). The body of literature showing causal relations between these constructs is limited, though. Gender differences did emerge in the latter half of college such that women experienced greater distress at T2 predicting poorer academic outcomes at T3, while men demonstrated a trending though nonsignificant effect of lower well-being at T2 resulting in lower academic achievement at T3. Conversely, women experienced lower well-being at T3 predicting lower academics at T4, while

men demonstrated a trending yet nonsignificant effect of greater distress at T3 resulting in poorer academic performance at T4. These findings suggest that women may generally be more susceptible to experiencing negative effects of their mental health on their academics as they approach the end of college, and offer a new contribution to the literature given the limited and mixed research that currently exists (Conger & Long, 2010; D'Lima et al., 2014; Sher et al., 1996). Additionally, the time points at which women (T2-T3) and men (T3-T4) were susceptible to negative effects of their distress levels on their academic outcomes were each preceded by respective increases in distress (via the autoregressive effects of distress; T1-T2 for women and T2-T3 for men); this illustrates a pattern such that elevations in distress starting in one year of college predicted worsening academic performance two years later. These findings are particularly important as they suggest that poor academic outcomes can be predicted not one but two years in advance for certain subgroups of students, which is relevant for informing the timing of implementation of prevention programs to maximize positive outcomes.

Effects of Academic Functioning on Psychological Functioning

Cross-lagged effects examining the relations between GPA and psychological functioning revealed that high school GPA was not predictive of psychological well-being or distress at the end of the first year of college is consistent with both the bivariate correlations showing no significant association between high school GPA and first-year mental health as well as the autoregressive effects showing no carry-over of academic functioning in high school on performance in college. As suggested, this finding may be explained by a plethora of reasons, including measurement issues with the high school GPA variable, developmental differences in high school versus college, and differences in academic expectations between high school and

college. Additionally, Crede and Niehorster (2012) found that students' academic achievement in their first year of college was predictive of their adjustment to academics in the same year, further suggesting that students' academics in college (rather than in high school) are most predictive of their mental health experiences in college.

On the other hand, the cross-lagged effects also found that only academic functioning *during* college was predictive of future time points of psychological functioning. Specifically, there was a consistent pattern such that higher GPA in the first, second, and third years of college was predictive of greater well-being in the second, third, and fourth years, respectively. Additionally, higher GPA in the second year of college was predictive of lower levels of distress in the third year of college. This suggests that the overall college period is a vulnerable time for students academically, and that they are likely to experience negative impacts on their mental health functioning as a result of poor academic performance. This finding is somewhat surprising given that the vast majority of related literature examines the causal effects of mental health on academics and largely overlooks effects in the opposite direction. Additionally, the literature that does examine this directionality has commonly examined the effects of start-of-college GPA on more distal time points of mental health post-graduation (Aselton, 2012; Rehman, 2016), thus the current study fills a gap in the extant body of literature as it provides further insight into patterns of academic and psychological functioning at various time points within the college period. Moreover, it is interesting that all three pathways within college were significant in the psychological well-being model while only one of the pathways was significant in the distress model. This may suggest that academic performance throughout college is more related to

students' general well-being than it is to specific clinical symptomatology (Beattie et al., 2019;

Gallagher et al., 2017).

In terms of gender differences, there was also a consistent pattern such that the effects of

academic functioning during college on subsequent time points of well-being and distress were

primarily salient among women. This finding is consistent with literature examining academic-

related pathology among college students, which shows that women, relative to men, are more

vulnerable to experiencing school spillover, or negative mental health effects as a result of their

academic workload and performance (Greer, 2008; Misra & McKean, 2000; Pedersen et al.,

2017; Surtees et al., 2002). These findings in sum shed light on the need for interventions to be

infused into the college environment (e.g., via college counseling centers, academic courses, etc.)

that particularly target the unique experiences and needs of women.

Strength and Interplay of the Bidirectional Effects

In addition to understanding the individual patterns of effects of psychological and

academic functioning on one another over the college period, it is also critical to consider the

relative strength of these various pathways to obtain a more nuanced understanding of the

relative importance of each variable in the model in shaping certain patterns of functioning over

time. Due to the exploratory nature of this analysis, it was originally unclear whether one

construct would demonstrate greater importance in the model than the other, or if particular

patterns would emerge. Upon initial visual and numerical examination of the main findings in

Table 3 and the model diagrams in Figures 2 and 3, a three-part pattern can be examined such

that (1) psychological functioning at the onset of college immediately impairs academic

performance, which then (2) has a consistent and robust impact on mental health through the

remainder of college, with the final year characterized again by (3) psychological impairments on academics. The comparison of regression coefficients and confidence intervals (as seen in Figure 4) revealed that while distress more strongly predicts academics in the first year of college, academic functioning during the college period is consistently a stronger predictor of subsequent psychological functioning. Given the abundance of literature that has studied mental health impacts on academics but the dearth of research demonstrating reverse directionality, this study's finding highlights a *critical* gap in the literature in the conceptualization of how college students' academic functioning impacts their mental health. This study calls for further research to examine this specific directionality via the inclusion of moderators and additional covariates in the models to elucidate which students may be at greatest risk for experiencing these negative outcomes. While most research calls for prevention and intervention efforts to formally and informally bolster mental health supports for students on campus, these findings suggest that interventions that target academic outcomes, including grades, course taking, career plans, and academic-related distress, would benefit students.

Strengths, Limitations, and Future Directions

The current study built on prior research by examining the interplay between psychological and academic functioning in a more comprehensive manner. As mentioned, past research has examined prevalence rates and trajectories of mental health and academic achievement separately, thus the investigation of the interplay between these constructs via the RI-CLPM, which allows for an investigation of both within- and between-person effects, is a strength of this study. Moreover, past research has called for the assessment of the interplay between these constructs longitudinally, and thus the longitudinal design of the current study

allows for the examination of relations between variables over time and for causal conclusions to be made. Another strength of the current study is that, in contrast to prior work that has typically assessed psychological functioning using one or a few measures, this study combined measures covering a variety of sub-constructs of mental health and well-being to conceptualize these constructs. Lastly, the separate analyses of well-being and distress allow for a richer and more nuanced understanding of how these two constructs relate to academic functioning among college students.

Despite these strengths, there are several limitations in the current study that are important to consider. There were several limitations with respect to the primary outcome variables. First, while the academic data was more objectively measured via GPA, the study relied heavily on self-reported data to conceptualize mental health functioning, which introduces bias into the analyses such that students' self-perceptions of their levels of functioning may be impacted by a variety of internal and external factors. Second, there was a measurement issue with the T0 assessment of the academic functioning outcome, GPA, such that there was inconsistency in this variable being weighed or unweighted between students since each high school provided the university with cumulative GPAs on varying grading scales (e.g., not all GPAs were on a standard 4.0 scale). Additionally, T0 GPA aggregated students' academic performance across all four years of high school, whereas T1 to T4 college GPAs represented performance over one year of schooling, thus there was less temporal consistency in how this variable was assessed between baseline and the latter time points. Future research could assess GPA in the final year of high school, rather than cumulatively across all four years of high school, to better assess the influence of GPA from year to year as students transition from high

school to college. Moreover, while college GPA has been consistently used in the literature to conceptualize academic performance (Richardson et al., 2012), an inherent limitation of this variables is that it does not specifically account for the amount of work that students put into their schooling to achieve their grades; as such, while the GPA variable itself is calculated with the number of credits or units taken in the denominator, it does not allow for an obvious comparison of the amount of work taken on and completed between students. For example, one student may have achieved a high GPA from completing three classes in one semester, while another student received a relatively lower GPA from completing six classes, thus this represents a lack of nuance in the GPA variable for capturing these potentially important differences in students' overall functioning as it relates to their academic workload. Future research should further examine between-person differences in students' workloads in the context of this overall model to better understand whether and how the amount of coursework students engage in impacts their academic and psychological functioning.

Another measurement issue pertains to the current study evaluating students solely through four years of college, and thus does not capture levels of functioning beyond four years for students who may have taken longer to complete their degree. Regarding the period of degree completion itself, there are various reasons as to why students take longer to finish their degrees, including but not limited to medical, mental health, and financial reasons, all of which may be associated with varying levels and patterns of psychological and academic functioning (Adams et al., 2016) that are not accounted for in the present analyses. Future research should thus examine these constructs among students for the entire length of their degree completion to better

understand patterns of functioning among students who experience various hardships throughout college in order to best tailor prevention and intervention efforts to these vulnerable individuals.

There were also some limitations in the current study with respect to various demographic characteristics. Regarding the contribution of gender in the analyses, models were run separately for men and women to explore whether differences existed in the overall patterns of psychological and academic functioning of students over the college period. However, this analytical approach did not allow for the examination of gender as a true moderator of various pathways, thus future analyses should more robustly examine the contribution of gender in the model to identify whether women and/or men are specifically at risk for poor outcomes at particular time points throughout college. There was an additional limitation in the gender variable itself, as it was assessed as a binary construct in the study (with the current study sample being predominantly female). More recent literature in this field has assessed gender in a broader way by including a variety of gender identities (e.g., cisgender, transgender, nonbinary, etc.; Tate et al., 2013), and thus findings from the current study may not be representative of and generalizable to the current college student body. Importantly, recently published literature has shown that students of marginalized gender identities are more vulnerable to experiencing adverse effects regarding their mental health and academics relative to their cisgendered peers (Goldberg et al., 2019; Hershner et al., 2021; Lipson et al., 2019), and may present with different prevalence rates and treatment needs for these varying problems (Lipson et al., 2019; Rider et al., 2018). Lastly, the current study assessed gender solely at baseline rather than capturing potential variations in students' gender identification throughout the college period, hence it may further lack generalizability to the current student body.

Further, the current study sample was predominantly female, heterosexual, White, and drawn from a single university, thus the findings from the current study may be limited in generalizability to students of other identities, which may be important factors in individuals' experiences with the primary variables examined. In light of the lack of racial and ethnic diversity and representation in the current study sample that precludes a deeper exploration of individual-level differences in the outcomes, it is important to consider how individuals with oppressed racial identities may experience more distress and lower well-being at the onset of college (D'Lima et al., 2014) and thus may be more vulnerable to poorer outcomes over the course of college (Dennis et al., 2005).

It is also important to consider that the current study sample of participants who completed at least two assessment time points did significantly differ from students who completed only the first time point on a variety of baseline characteristics, including but not limited to age, gender, presence, or absence of a history of treatment for a psychological problem, and GPA at all time points. Notably, while completers and non-completers did not significantly differ in whether or not they had a baseline history of a psychological diagnosis, there was a significantly larger percentage of non-completers with a history of treatment for a psychological problem compared to completers, suggesting that the current study sample may have been comprised of students with more elevated, untreated distress. Relatedly, completers consistently had higher GPAs at all time points relative to non-completers, further supporting the theory that the students who were more inclined to continue participating in the study were those who made academics a greater priority, and had more trait-like distress both early and later on in

college. Therefore, it is important for future investigations to improve recruitment and retention strategies to improve generalizability of findings.

Moreover, while the complexity of the RI-CLPM provides a more nuanced understanding of the interrelations between psychological and academic functioning than a simpler regression model could, it poses some limitations with respect to including more covariates in the model for risk of overidentifying it with too many parameters; thus, there may be key variables that were not able to be controlled for in the present study. For example, prior work assessing relations between mental health and academic outcomes via regression models has controlled for variables such as gender, age, race, ethnicity, and socioeconomic status given research showing that these factors are associated with mental health functioning (Eisenberg et al., 2009). Additionally, due to decreased model fit when the history of psychological treatment variable was covaried at all assessment time points, as well as limited data available for this particular variable, the current findings do not account for any psychological treatment that participants may have sought out during college and therefore may misrepresent or misattribute the severity of students' psychological functioning. The current study was also observational in nature, thus in sum, the findings cannot necessarily be generalized to either a non-treatment- or treatment-seeking population due to these various data limitations.

Implications and Conclusions

The current study has important implications for considering the ways in which psychological functioning and academic outcomes relate to one another over the college period. Though previous research has focused primarily on understanding how mental health functioning and trajectories predict academic achievement, the current study findings suggest that it is just as

important to examine how academic functioning impacts students' mental health. Additionally, the present study elucidates an important pattern in the interplay between the primary outcomes, such that first- and fourth-year students are particularly vulnerable to experiencing poorer academic outcomes as a result of prior fluctuations in their mental health, while students in the middle of college are likely to experience negative psychological health outcomes as a result of lower achievement. Additionally, the current study identified women as particularly at-risk for poorer outcomes across these various pathways in comparison to men. Given these identified critical periods of risk, it is critical that research continue to study these relationships to better identify those most vulnerable, as well as that colleges and universities implement campus-wide screening procedures to identify those at risk as well as targeted prevention programs to boost students' psychological and academic functioning.

APPENDIX A

GENERAL SELF-EFFICACY SCALE (GSES)

Please select the answer choice that best describes your beliefs about your abilities.

1	2	3	4	5
Strongly Disagree	Disagree	Indifferent	Agree	Strongly Agree

1. When I make plans, I am certain I can make them work.

2. One of my problems is that I cannot get down to work when I should. I

3. If I can't do a job the first time, I keep trying until I can.

4. When I set important goals for myself, I rarely achieve them. I

5. I give up on things before completing them. I

6. I avoid facing difficulties. I

7. If something looks too complicated, I will not even bother to try it. I

8. When I have something unpleasant to do, I stick to it until I finish it.

9. When I decide to do something, I go right to work on it.

10. When trying to learn something new, I soon give up if I am not initially successful. I

11. When unexpected problems occur, I don't handle them well. I

12. I avoid trying to learn new things when they look too difficult for me. I

13. Failure just makes me try harder.

14. I feel insecure about my ability to do things. I

15. I am a self-reliant person.

16. I give up easily. I

17. I do not seem capable of dealing with most problems that come up in life. I

I Reverse-coded item

APPENDIX B

ROSENBERG SELF-ESTEEM SCALE (RSES)

Below is a list of statements dealing with your general feelings about yourself. If you strongly agree, circle **SA**. If you agree with the statement, circle **A**. If you disagree, circle **D**. If you strongly disagree, circle **SD**.

1. I feel that I am a person of worth, at least on an equal plane with others.	SA	A	D	SD
2. I feel that I have a number of good qualities.	SA	A	D	SD
3. All in all, I am inclined to feel that I am a failure.*	SA	A	D	SD
4. I am able to do things as well as most other people.	SA	A	D	SD
5. I feel I do not have much to be proud of.*	SA	A	D	SD
6. I take a positive attitude toward myself.*	SA	A	D	SD
7. On the whole, I am satisfied with myself.	SA	A	D	SD
8. I wish I could have more respect for myself.*	SA	A	D	SD
9. I certainly feel useless at times.*	SA	A	D	SD
10. At times I think I am no good at all.*	SA	A	D	SD

Scoring: SA=3, A=2, D=1, SD=0. Items with an asterisk are reverse scored, that is, SA=0, A=1, D=2, SD=3.

APPENDIX C

10-ITEM CONNOR DAVIDSON RESILIENCE SCALE (CD-RISC)

Please indicate how much you agree with the following statements as they apply to you over the last **month**. If a particular situation has not occurred recently, answer according to how you think you would have felt.

	Not true at all	rarely true	sometimes true	often true	true nearly all the time
1. I am able to adapt when changes occur.	0	1	2	3	4
2. I try to see the humorous side of things when I am faced with problems.	0	1	2	3	4
3. I try to see the humorous side of things when I am faced with problems.	0	1	2	3	4
4. Having to cope with stress can make me stronger.	0	1	2	3	4
5. I tend to bounce back after illness, injury, or other hardships.	0	1	2	3	4
6. I believe I can achieve my goals, even if there are obstacles.	0	1	2	3	4
7. Under pressure, I stay focused and think clearly.	0	1	2	3	4
8. I am not easily discouraged by failure.	0	1	2	3	4
9. I think of myself as a strong person when dealing with life's challenges and difficulties.	0	1	2	3	4
10. I am able to handle unpleasant or painful feelings like sadness, fear and anger.	0	1	2	3	4

APPENDIX D

ADULT DISPOSITIONAL HOPE SCALE (ADHS)

Read each item carefully. Using the scale shown below, please select the number that best describes YOU and put that number in the blank provided.

 1 = Definitely False   2 = Mostly False   3 = Mostly True   4 = Definitely True

_____ 1. I can think of many ways to get out of a jam.

_____ 2. I energetically pursue my goals.

_____ 3. There are lots of ways around any problem.

_____ 4. I can think of many ways to get the things in life that are most important to me.

_____ 5. Even when others get discouraged, I know I can find a way to solve the problem.

_____ 6. My past experiences have prepared me well for my future.

_____ 7. I've been pretty successful in life.

_____ 8. I meet the goals that I set for myself.

APPENDIX E

SATISFACTION WITH LIFE SCALE (SWLS)

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

1 = Strongly Disagree
2 = Disagree
3 = Slightly Disagree
4 = Neither Agree or Disagree
5 = Slightly Agree
6 = Agree
7 = Strongly Agree

_____1. In most ways my life is close to my ideal.

_____2. The conditions of my life are excellent.

_____3. I am satisfied with life.

_____4. So far I have gotten the important things I want in life.

_____5. If I could live my life over, I would change almost nothing.

APPENDIX F

21-ITEM DEPRESSION, ANXIETY, AND STRESS SCALE (DASS-21)

Please read each statement and circle a number 0, 1, 2 or 3 that indicates how much the statement applied to you *over the past week*. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

0 Did not apply to me at all
1 Applied to me to some degree, or some of the time
2 Applied to me to a considerable degree, or a good part of time
3 Applied to me very much, or most of the time

1. I found it hard to wind down	0	1	2	3
2. I was aware of dryness of my mouth	0	1	2	3
3. I couldn't seem to experience any positive feeling at all	0	1	2	3
4. I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5. I found it difficult to work up the initiative to do things	0	1	2	3
6. I tended to over-react to situations	0	1	2	3
7. I experienced trembling (eg, in the hands)	0	1	2	3
8. I felt that I was using a lot of nervous energy	0	1	2	3
9. I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
10. I felt that I had nothing to look forward to	0	1	2	3
11. I found myself getting agitated	0	1	2	3
12. I found it difficult to relax	0	1	2	3
13. I felt down-hearted and blue	0	1	2	3
14. I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
15. I felt I was close to panic	0	1	2	3
16. I was unable to become enthusiastic about anything	0	1	2	3
17. I felt I wasn't worth much as a person	0	1	2	3
18. I felt that I was rather touchy	0	1	2	3
19. I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)	0	1	2	3
20. I felt scared without any good reason	0	1	2	3
21. I felt that life was meaningless	0	1	2	3

APPENDIX G

PERCEIVED STRESS SCALE (PSS)

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, please indicate with a check how often you felt or thought a certain way.

R. In the last month, how often have you been upset because of something that happened unexpectedly?

___0=never   ___1=almost never   ___2=sometimes   ___3=fairly often   ___4=very often

2. In the last month, how often have you felt that you were unable to control the important things in your life?

___0=never   ___1=almost never   ___2=sometimes   ___3=fairly often   ___4=very often

3. In the last month, how often have you felt nervous and "stressed"?

___0=never   ___1=almost never   ___2=sometimes   ___3=fairly often   ___4=very often

4. In the last month, how often have you felt confident about your ability to handle your personal problems? I

___0=never   ___1=almost never   ___2=sometimes   ___3=fairly often   ___4=very often

5. In the last month, how often have you felt that things were going your way? I

___0=never   ___1=almost never   ___2=sometimes   ___3=fairly often   ___4=very often

6. In the last month, how often have you found that you could not cope with all the things that you had to do?

___0=never   ___1=almost never   ___2=sometimes   ___3=fairly often   ___4=very often

7. In the last month, how often have you been able to control irritations in your life? I

___0=never   ___1=almost never   ___2=sometimes   ___3=fairly often   ___4=very often

8. In the last month, how often have you felt that you were on top of things? I

___0=never   ___1=almost never   ___2=sometimes   ___3=fairly often   ___4=very often

9. In the last month, how often have you been angered because of things that were outside of your control?

___0=never   ___1=almost never   ___2=sometimes   ___3=fairly often   ___4=very often

10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

___0=never   ___1=almost never   ___2=sometimes   ___3=fairly often   ___4=very often

I Reverse-coded items

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VITA

Ms. Hareli was born in Israel and raised in Boston, MA. Before attending Loyola University Chicago, she attended the University of Massachusetts Amherst in Amherst, MA, where she earned a Bachelor of Arts in Psychology, graduating in 2017. After graduation, Ms. Hareli worked as a clinical research coordinator at the Center for Addiction Medicine at Massachusetts General Hospital in Boston, MA.

While at Loyola, Ms. Hareli worked as a research assistant in the lab of Dr. Colleen Conley and served as a teaching assistant for several professors within the psychology department. This year, she is an extern at the Pediatric Developmental Center in Chicago, IL.