Trajectories of Quality of Life in Adolescents and Young Adults with ADHD: Examination of the Impact of Transitioning to Independence

by

Margaret Elizabeth Young

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Approved by

Wendy N. Gray, Chair, Assistant Professor of Psychology
Elizabeth Brestan-Knight, Full Professor of Psychology
Steven K. Shapiro, Associate Professor of Psychology

Abstract

Attention-deficit hyperactivity disorder (ADHD) is one of the most common chronic conditions. Youth with ADHD experience psychosocial consequences, including poor academic functioning, social problems, and increased mental health and behavioral concerns. ADHD is also associated with poor quality of life (QOL) in adolescents. Little is known, however, about the impact of ADHD on QOL as adolescents transition to independent young adulthood. The current study examines changes in QOL across an academic semester in an adolescent and young adult sample with ADHD and the impact of transitioning to independence on QOL trajectories. QOL was examined in 56 undergraduate students. Participants reported their QOL on a monthly basis using the Pediatric Quality of Life Inventory- Young Adult Module. QOL increased across the semester and transition status predicted the linear slope in QOL, $B = -10.87$, $SE = 2.81$, $p < .001$, with lower rates of QOL among students who had transitioned to independence. This difference in QOL scores remained constant across the semester and did not change as a result of transition status. Additionally, we compared overall QOL in the current sample to published QOL ratings of young adults who are healthy or have a chronic illness such as cancer, sickle cell disease, or asthma/allergies, as reported in the literature. There was a significant difference in total QOL scores between students with ADHD and the comparison samples, $F (4, 1533) = 11.89$, $p < .001$. Differences in social support and academic demands may explain observed differences in overall QOL between freshmen and upperclassmen.

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ADHD   Attention-Deficit/ Hyperactivity Disorder

QOL   Quality of Life

PedsQL-YA™ Pediatric Quality of Life Inventory- Young Adult Module

Trajectories of Quality of Life in Adolescents and Young Adults with ADHD: Examination of the Impact of Transitioning to Independence

Attention-Deficit/Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder characterized by symptoms of inattention, impulsivity, and hyperactivity (American Psychiatric Association, 2013). Approximately 3-7% of the United States population has been diagnosed with ADHD (Centers for Disease Control and Prevention, 2014) and the annual economic impact of treatment of this disorder is estimated to be between $143 to $266 billion dollars, which makes up a large proportion of annual medical expenditure (Doshi et al., 2012). ADHD is primarily treated with oral stimulant and non-stimulant medication in addition to behavioral modifications (CDC, 2014). It is important to successfully treat and manage the symptoms of ADHD in order to prevent a variety of negative outcomes.

A number of research studies have documented poor outcomes in children and adolescents with ADHD. These findings indicate that ADHD has a widespread impact on an individual's overall and academic functioning. Children with ADHD are at an increased risk for overall impaired functioning (Wilens et al., 2002). Specifically, Wilens and colleagues (2002) found that youth with ADHD had higher rates of psychiatric comorbidity as well as higher rates of school dysfunction. From an academic standpoint, we know that many of the symptoms inherent to an ADHD diagnosis (i.e. inattention, impulsivity) can create barriers to academic success (Meaux, Green, & Broussard, 2009). For example, students with ADHD have been found to exhibit poor time management, poor organization skills, difficulty staying focused on academic work, failure to adhere to homework deadlines, and poor reading and study skills (Meaux et al., 2009). Taken together these challenges can make it difficult for students with ADHD perform at the same level as their non-ADHD peers.

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Although the impact of ADHD on academic functioning has been extensively researched, it important to note that ADHD also has a broader impact on an individual's life. From a social standpoint, peer relationships are a primary context to learn cooperation, negotiation, and conflict resolution (Rubin, Bukowski, & Parker, 2007). However, research shows that the peer relationships of individuals with ADHD are impaired in various ways (DuPaul, McGoey, Eckert, & VanBrakle, 2001). Due to impulsivity, individuals with ADHD may "blurt out" hurtful comments to others and be seen as blunt in social interactions (Meaux et al., 2009). Furthermore, youth with ADHD exhibit difficulties with cooperation and have been found to exhibit self-centered, intrusive, commanding, and hostile behavior in their interactions with peers (Barkley, 1997). Children with ADHD also struggle with interpreting and responding to social cues. These deficits in social functioning result in youth with ADHD receiving lower peer ratings on social preference measures meaning that they are less well-liked by their peers (Hoza et al., 2005).

Children with ADHD demonstrate higher rates of internalizing and externalizing problems (Wilens et al., 2002). When compared to children without ADHD, they display more problem behavior, such as non-compliance and inappropriate behavior (DuPaul et al., 2001). Not surprisingly, because of this poor behavior, many youth with ADHD are also commonly diagnosed with Oppositional Defiant Disorder (American Psychiatric Association, 2013). In addition to the comorbidity of ADHD with Oppositional Defiant Disorder, children with ADHD are also more likely to be diagnosed with psychiatric conditions such as anxiety and depression (Jensen et al., 2001).

It is important to note that ADHD is not just a disorder of childhood. Symptoms of ADHD are known to continue into adulthood (Barkley & Biederman, 1997; Kessler et al.,

2005a). Thus, special attention must be given to individuals with ADHD throughout the lifespan, particularly as they transition across important stages and life milestones. An important major milestone in the life of most youth is the graduation from secondary schooling and the transition to either post-secondary education or employment. As the focus of this study is on postsecondary education, we will now discuss ADHD in the college setting. For a concise summary of the impact of ADHD on employment, the reader is referred to Kuriyan et al. (2013).

ADHD in College

Within the walls of higher education, we know that 2-8% of college students have clinically significant symptoms of ADHD (Weyandt & DuPaul, 2006). These symptoms can have a major impact on an individual's academic and behavioral functioning. For example, compared to their peers, college students with ADHD report lower grade point averages and more academic struggles (Heiligenstein, Guenther, Levy, Savino, & Fulwiler, 1999). College students with ADHD also demonstrate compromised academic coping skills (Weyandt & DuPaul, 2006). They struggle more with receiving negative feedback and have inhibited problem solving skills when faced with academic challenges (Weyandt & DuPaul, 2006). College students with ADHD also engage in more risk-taking behavior and impulsive decision-making (Wehmeier, Schacht, & Barkley, 2010). They demonstrate lower levels of adjustment and self-esteem (Shaw-Zirt, Popali-Lehane, Chaplin, & Bergman, 2005), are more likely to have problems with drugs or alcohol, and to have an arrest record (Grenwald-Mayes, 2001). All of these factors can have important life-long implications such as lower educational achievement, poorer job performance, and more difficulties maintaining steady employment as adults (Barkley, Fischer, Smallish, & Fletcher, 2006).

The number of negative outcomes associated with poor performance in college may be due to several features of the college environment. The college environment represents a significant change from the lives youth with ADHD had during adolescence. For example, youth with ADHD benefit from structure and routine (Murphy, 2005). However, compared to high school settings, the college environment has much less structure and schedules tend to fluctuate greatly (DuPaul, Weyandt, O'Dell, & Varejao, 2009). The transition to college is also associated with decreased parental involvement and supervision (Pascarella & Terenzini, 2005). For many youth, they are living away from home and facing responsibility for a majority of their daily tasks for the very first time (Fromme, Corbin, & Kruse, 2008). Thus, youth with ADHD may be deprived of much needed social support to help them overcome challenges during the college years (Ruholt, Gore, & Dukes, 2015).

Students are also exposed to a greater amount of social pressures during college, including the pressure to engage in drinking and illicit drug use (White et al., 2006). Further, as there is a substantial amount of recreational use of ADHD stimulant medication on college campuses (Babcock & Byrne, 2000), students with ADHD may be pressured to share their medication with others, thereby depriving themselves of a necessary resource to enhance their academic success. Taken together, all of these changes represent a dramatic shift in the lives of students with ADHD from adolescence to young adulthood. The amount and extent of such changes are likely to have an impact on an individual's quality of life (QOL).

Quality of Life

QOL is an important, broad, multi-dimensional construct which encompasses an individual's functioning in physical, emotional, social, and academic/vocational domains (Varni & Limbers, 2009). QOL has garnered more attention from researchers in the past few decades, with QOL assessment being established by the American Psychiatric Association as part of a

comprehensive psychiatric assessment (Silverman et al., 2015). Poorer QOL is associated with several constructs including increased anxiety and depression (Engström, 1992), social and emotional deficits (Wehmeier et al., 2010), higher symptom burden and prevalence (Zambroski, Moser, Bhat, & Ziegler, 2005), and overall poorer functioning (Skevington, Lotfy, & O'Connell, 2004). In fact, given the pervasive impact QOL has on overall functioning, the World Health Organization has recognized QOL as being more significant in psychosocial impact than disease severity among chronic illness populations (Orley, 1994).

Findings have illustrated that ADHD has a negative impact on QOL, as children and adolescents with ADHD experience an overall lower QOL than their healthy peers (Lee et al., 2016). Although there is evidence of impaired QOL in youth with ADHD, we cannot extend these findings to college students with ADHD due to the inherent differences in their development and environment (Grenwald-Mayes, 2001).

QOL in College

While QOL itself has not been formally linked to academic success in college, multiple factors contributing to one's overall QOL such as social support, social involvement, general self-concept (Robbins et al., 2004), and emotional control (Robbins, Allen, Casillas, Peterson, & Le, 2006) positively correlate with college retention. However, QOL may be at risk in college populations due to features unique to the college environment (e.g., erratic schedules, increased autonomy) (Pascarella & Terenzini, 2005). College students with chronic illnesses that are both physical and mental in nature experience poorer overall QOL than their healthy counterparts (Herts, Wallis & Maslow, 2014). Individuals with ADHD also continue to experience poorer QOL than their healthy peers during the college years (Grenwald-Mayes, 2001). While this gap in QOL between students with ADHD and their peers remains significant

during college, research has yet to examine how QOL may fluctuate before and after the college transition**.**

QOL is a fluid construct that is known to change over time (Felce & Perry, 1995). However, our current understanding of QOL relies predominantly on cross-sectional data. Therefore, there is a need for obtaining a clear picture of QOL in students with ADHD through the examination of longitudinal changes in QOL trajectories. Given that the transition to college represents a dramatic change in one's academic, emotional, and social domains, we suspect that this transition will also have a detrimental impact on QOL. The transition to college represents a stressful life event in the lives of many young adults and research indicates a negative relationship between the occurrence of stressful life events and QOL in college students (Damush, Hays, & DiMatteo, 1997). Due to the fact that QOL is already at risk in college students with ADHD, we expect that the impact of transitioning to college on QOL may be further heightened when a student also has a diagnosis of ADHD.

The current study fills the gap in our understanding of QOL in ADHD during young adulthood. Specifically, we focus on QOL during the transition to college. We present data from a semester-long study of QOL in college students with ADHD. Based on the abundant research documenting challenges experienced by college students with ADHD, we anticipate QOL to decline over time (Hypothesis 1). Further, we expect that newly transitioned students (freshmen) will have significantly lower QOL than already transitioned students (upperclassmen) as the former population is undergoing more dramatic changes in their lifestyle and environment (Hypothesis 2). Lastly, in order to place our findings in the context of the broader literature, QOL in ADHD is compared to QOL in other young adult illness populations.

Method

Participants

This study is part of a larger research study examining correlates of adherence to prescribed medication among undergraduate students with ADHD. Participants were 54 undergraduate students at a large, southeastern public university who had (1) been diagnosed with ADHD, and were (2) receiving prescribed oral medication for ADHD. In addition, to qualify for the study, students were required to (3) be living independently (not with a caretaker). This latter criterion was set to capture those students currently undergoing the transition to independence (i.e., freshmen) as well as those who had already undergone this transition (i.e., upperclassmen living 1+ years away from home). Students with a severe comorbid condition (psychiatric, developmental, or medical) that would interfere with their ability to participate in a longitudinal observational study or complete behavioral self-report measures were excluded. Demographic characteristics of our sample were calculated using SPSS software, version 24.0 and are included in Table 1.

Procedure

Numerous recruitment strategies were used. Study personnel recruited participants at pre-semester summer orientation camps. In addition, on-campus flyers, in-class announcements in large-section psychology courses, and an email advertising the study was sent to all students registered with the university's office for students with disabilities. All recruitment methods directed interested individuals to the study's website and provided them with the study personnel's contact information so that further interest could be expressed.

Interested participants were given a brief overview of the study by members of the research team and screened for study eligibility prior to providing assent/consent to participate in the study. Following consent/assent procedure, study participants were emailed a link to an invitation to complete web-based questionnaires. Data collection occurred on a monthly basis

via online questionnaires hosted by Qualtrics, a web-based research and survey platform (Qualtrics Labs Inc., Provo, UT, USA). Qualtrics is an online data-hosting software and survey tool which collects data anonymously through online surveys and inputs responses into a statistical software program. Students were compensated upon completion of their monthly assessment, which included the completion of online forms and an in-person visit (as part of the aims of the larger study). In order to promote study retention, participants were compensated on a graduated scale, with compensation increasing over time (total possible compensation = $100).

Measures

Demographic Questionnaire

Study participants completed a questionnaire, created for this study, to obtain basic sociodemographic information such as race/ethnicity, gender, and age. In addition, participants self-reported on their ADHD treatment regimen and age at diagnosis.

Pediatric Quality of Life Inventory-Young Adult Module (PedsQL-YA™)

While a wide variety of measures exist to examine QOL, many of these are limited in their scope of practice because of restricted age-ranges and the amount of time needed to complete these measures (Varni, Seid, & Rode, 1999). The Pediatric Quality of Life Inventory (PedsQL™) is the most widely-used measure to assess QOL in pediatric and young adult populations and has proven to be useful for QOL assessment.

The PedsQL-YA™ is a 23-item measure assessing QOL in individuals between the ages of 18-25 years (Varni & Limbers, 2009). For each item, respondents were asked to indicate how much of a problem they had experienced in various areas of functioning using a 5-point scale ranging from 0-Never to 4-Almost Always. Items were reversed scored and transformed into a 0-100 scale prior to summation, with lower scores indicating more impairment. The PedsQL-

YA™ yields a total score that assesses one's overall QOL. The PedsQL-YA™ is considered highly reliable (α =.86) and valid in its ability to distinguish between healthy young adults and those with chronic conditions as well as distinguishing disease severity within chronic illness samples (Varni & Limbers, 2009). Internal consistency for the current sample is good (α = .93). A review copy of the PedsQL-YA™ is provided in Appendix A.

Comparison Populations

To help place our findings in the context of the broader literature focused on QOL in young adults, we compared our findings to that of other published studies using the PedsQL-YA™ among young adult chronic illness populations and healthy individuals (Varni & Limbers, 2009). Thus, QOL in our sample of college students with ADHD was compared to that of healthy individuals (Varni & Limbers, 2009) and those with allergies/asthma (Molzon et al., 2013), cancer (Smith et al., 2013) and sickle cell disease (Jackson, Lemanek, Clough-Paabo, & Rhodes, 2014).

Data Analytic Approach

Univariate analyses were conducted in SPSS to characterize the study sample. To examine changes in the trajectory of QOL across the semester and the impact of transition status on these trajectories, multi-level modeling was used. Multi-level modeling (MLM) was conducted with Mplus 7.31 (Muthén & Muthén, 2015) to examine individual trajectories of QOL over time (Hypothesis 1). Transition status was included as a predictor of these trajectories to examine Hypothesis 2, that students transitioning to college (i.e., freshmen) would have poorer QOL compared to those students who had already transitioned to independence (i.e., upperclassmen).

MLM is considered to be the best approach to our data analysis due to the longitudinal and multi-level nature of our data. From a longitudinal standpoint, MLM is well-equipped to manage missing data, a common problem in longitudinal research. Unlike more traditional statistical approaches which exclude individuals with missing data from analyses, maximum likelihood estimation (MLE) in MLM allows us to retain these individuals by using all of their available data to estimate their QOL trajectory. Thus, MLM minimizes the potential of conducting biased analyses that may result when only those individuals with complete data are used by researchers to examine trajectories in their entire sample. From a multi-level standpoint, MLM allows us to examine change over time in QOL within each individual (i.e., Level 1: their QOL trajectory) as well as the role of key variables (i.e., transition status) in explaining differences in trajectories between individuals (Level 2).

An important first step in conducting MLM analyses is examining the appropriateness of the data for MLM-based approaches. This is determined by building a null, or no-predictor, model. If the null model indicates there is significant variability between level two units (intraclass correlation > .05) and dependence of observations (design effect >2), an MLM-based approach can be used (Heck & Thomas, 2015). To examine linear changes in QOL over time, we created a model with QOL scores as the dependent variable, Time (month 1, 2, 3, 4) as the independent, within-subjects (Level 1) variable, and transition status (freshmen or upperclassmen) as the between-subjects (Level 2) variable. Intercepts for within- and between subjects variables were estimated at "random" given our expectations that each individual's QOL would change over time and vary across individuals. Quadratic changes in adherence were also examined in a subsequent model and fit indices (i.e., log likelihood, AIC, BIC, Adjusted BIC) were compared across equivalent models to identify the model that best represents the data (i.e., lower fit indices indicate better fit).

To conduct our third, exploratory hypothesis, in which QOL in our sample is compared with that of other young adults with and without a chronic illness, we conducted an analysis of variance test (ANOVA). This ANOVA used the published means and standard deviations of each comparison population. An average of PedsQL-YA™ scores across four time-points was used for our sample with ADHD. Separate ANOVA's were conducted for each disease group's total QOL score as well as for each subscale of the PedsQL-YA™ (e.g., physical, emotional, social, academic, psychosocial). Tukey's-corrected post-hoc probing was used to examine differences between subgroups. Tukey's post hoc analysis was chosen due to the available data of the comparison populations consisting of the means and standard deviations of the samples. In all post-hoc comparisons, our sample of college students with ADHD was the reference group.

Results

Participant Demographics

A total of 54 participants took part in the study. Participant demographics are listed in Table 1. The majority of participants identified as female (N=32) and White/Caucasian (N=50). At the time of enrollment, the mean age of participants was 19.13 ± 1.35 years. Thirty-five of the 54 participants (65%) were in their freshman year of college. Average age at ADHD diagnosis was 13.03 ± 4.71 years.

No significant differences between freshmen and upperclassmen were found in terms of gender, $X^2(51) = 1.00$, $p = .32$ or ethnicity $t(49) = 1.34$, $p = .19$. Independent sample t-tests examined differences in ratings on subscales of the PedsQL-YA™ between freshmen and Upperclassmen. Upperclassmen experienced lower QOL in all domains of functioning (i.e., physical, social, academic, psychosocial) except for social functioning. Results of PedsQL-YA™ subscale comparisons between freshmen and upperclassmen are presented in Table 2.

Associations Among Variables of Interest

Correlations between QOL scores across all four time-points were strong (Pearson's r's ranging from .73 to 87, p's < .01) and are shown in Table 3. On average, QOL increased across the semester (Time 1 $M = 74.98 \pm 11.26$; Time 4 $M = 77.60 \pm 12.28$).

Impact of Transition Status and Quality of Life

Model 1: Unconditional Model Examining Appropriateness of an MLM Approach to Data Analysis

To examine trajectories of QOL over time and the role of transition status in predicting these trajectories, multiple steps were conducted. First, a null model containing only the dependent variable of QOL and no predictors was built to determine whether our data were statistically appropriate for an MLM-based approach. When determining appropriateness for MLM-based approaches, two conditions should be met: 1) there must be significant variability between Level 2 (between individuals) units (as determined by an intraclass correlation greater than .05), and 2), there must be dependence of observations over time (as determined by a design effect greater than two). In the case of our null model, both of these criteria were met (ICC = .78; design effect = 3.79). Approximately 21.7% of the variance in QOL was found to be at Level 2, between individuals, whereas 78.3% lies within individuals at Level 1.

With regard to this latter variance, there was significant within-individual variability in QOL across time ($\sigma^2 = 27.18$, $SE = 54.03$, $p < .001$). At the first QOL assessment, average QOL for the sample was 74.31. This increased by a non-significant amount (0.49 points) at each subsequent assessment (p = 0.24). Our model suggested significant variability in QOL at baseline (Time 1 Intercept; $\sigma^2 = 27.18$, $SE = 54.03$, $p < .001$) but the variability in rate of change in QOL was not significant ($\sigma^2 = 2.33$, $SE = 1.82$, $p = 0.20$).

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<u>Model 2: Conditional Model Examining Transition Status as a Predictors of Linear Trajectories</u>

<u>of Adherence</u>

Our null model was expanded in our MLM analyses to include Transition Status as a

predictor of Linear Trajectories of QOL. As previously stated, we expected students going

through the transition to college to have poorer QOL compared to upperclassmen, who have

already gone through the transition and theoretically have more stability in their lives.

Differences in QOL scores between freshmen and upperclassmen across four time points are

presented in Figure 1. Our model indicated a pattern contrary to our hypothesis. Average

baseline levels of QOL for students transitioning (freshmen QOL = 89.04) was significantly

higher than the QOL of students who had fully transitioned to independence (Upperclassmen

QOL = 78.15; $B = -10.87$, $SE = 2.81$, $p < .001$). This near 11-point difference in QOL scores

remained constant across the semester. In addition to being statistically significant, this

difference in QOL is clinically significant across all time points according to previous standard

error calculations for the PedsQL™ (Varni, Burwinkle, Seid, & Skarr, 2003). Transition was not

associated with change in QOL over time (i.e., slope), suggesting that freshmen and

upperclassmen did not significantly differ from one another in terms of rate of change in QOL

across the semester ($B = 0.06$, $SE = 0.87$, $p = 9.95$). For a summary of both models, including fit

indices, please see Table 4.

Differences in Quality of Life Between Young Adults with ADHD, Healthy Peers, and

Other Chronic Illnesses Populations

A one-way analysis of variance was conducted to compare the differences in overall

QOL across young adults with ADHD, cancer, allergies/asthma, sickle cell disease and healthy

peers. Average quality of life scores for each chronic illness population are listed in Table 5.

There was a significant main effect of illness group on total QOL scores, $F(4, 1533) = 11.89$, p < .001. Results of this one-way analyses of variance are provided in Table 6. Although the overall ANOVA was significant, a Tukey's post-hoc analysis found that the total QOL of youth with ADHD did not significantly differ from that of young adults with allergies/asthma, cancer, sickle cell anemia, or healthy peers.

One-way analyses of variance were also conducted to compare ratings of subscales of the PedsQL-YA™ between illness groups. All ANOVAs comparing the subscales of the PedsQL-YA™ were significant and are presented in Table 6. Post-hoc probing indicated that our sample of college students with ADHD exhibited higher physical functioning (85.26 ± 13.17) than the allergies/asthma (77.57 ± 16.76, $p = .01$), cancer (75.60 ± 23.24, $p < .001$), and sickle cell (71.72 ± 18.90, $p < .001$) samples.

Due to observed statistical and clinical differences between freshmen and upperclassmen, QOL in each of these groups was compared between subscales of the PedsQL-YA™. Average QOL scores for freshmen and upperclassmen are presented in Table 7 and Table 8, respectively. One-way analyses of variance were conducted in our sample of freshmen and upperclassmen with ADHD to compare the differences in QOL between young adult chronic illness populations and healthy individuals. Results of these one-way analyses of variance are presented in Table 9 for freshmen with ADHD and in Table 10 for upperclassmen with ADHD. In our sample of freshmen with ADHD, patterns and differences were similar to that of the total ADHD sample. Post-hoc probing indicated that upperclassmen in our sample of college students with ADHD exhibited an overall lower QOL (70.40 ± 9.71) than the healthy (78.18 ± 9.2, $p = .03$) sample. Results obtained from subscale comparisons indicate that upperclassmen with ADHD have lower emotional functioning (59.00 ± 15.94) than the allergies/asthma (73.61 ± 9.91, $p = .001$) and

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sickle cell disease (71.50 ± 16.15, $p = .01$) samples. Regarding academic functioning, upperclassmen in our sample with ADHD (58.75 ± 18.36) had lower ratings than the allergies/asthma (71.72 ± 20.14, $p = .004$), cancer (72.96 ± 23.76, $p = .001$), and healthy (69.47 ± 13.94, $p = .03$) samples. Upperclassmen with ADHD also exhibited lower psychosocial functioning (65.44 ± 13.04) than the allergies/asthma (77.10 ± 18.38, $p < .001$), healthy (73.87 ± 10.53, $p = .04$), and sickle cell disease (73.73 ± 15.00, $p = .04$) samples.

Discussion

Our findings indicate that upperclassmen with ADHD experience an overall lower QOL than their freshmen counterparts. Further, QOL was found to increase across the course of an academic semester. Therefore, QOL didn't appear to be affected by increased academic demands as the semester progressed. These findings are contrary to our hypotheses that (1) freshmen would experience a lower QOL than upperclassmen and (2) QOL would decrease across the academic semester.

We expected that freshmen would have lower QOL than upperclassmen due to their undergoing abrupt changes from the high school to college environment. On the contrary, they experienced higher QOL. Previous studies have documented increased stress and rates of anxiety and depression in upperclassmen compared to their freshmen counterparts (Beiter et al., 2015). Academic demands increase each year of college and new challenges present with the onset of each semester. For upperclassmen there are many additional pressures, including verifying if one's prior academic performance was sufficient to gain entry into their initial desired major and excelling academically in order to graduate and/or compensate for poor academic performance in their early college years. They may also face more pressure to determine their long-term career path and secure employment. These added stressors can negatively impact QOL. In contrast, the

pressures to decide on a career path or secure employment are less salient to freshmen. Because youth struggle with appreciating the long-term consequences of their current behavior (e.g., poor academic functioning), freshmen may be less likely to experience an immediate negative impact on their QOL in their first semester.

While we expected QOL to decrease over time, other research indicates that the college transition represents a relatively acute stressor, after which students steadily improve in areas of adjustment (e.g., mental, physical) (Gall, Evans, & Bellerose, 2000; Pittman & Richmond, 2008). Our finding of lower QOL in both freshmen and upperclassmen at the beginning of the semester with a linear increase over time is consistent with this research. However, we do note that the beginning of the fall college semester continues to serve as a stressor regardless of year in college. Thus, for most students with ADHD, the beginning of the academic semester is an acute, rather than a chronic, stressor. However, as students with ADHD experience more academic struggles (Blase et al., 2009) and compromised academic coping skills (Weyandt & DuPaul, 2006) compared to their non-ADHD peers, they may be at greater risk for experiencing academic stress at the start of, and throughout, the academic semester. Longitudinal comparisons with similarly-educated comparison populations are needed to explore this hypothesis.

Regarding our third exploratory hypothesis, total QOL ratings and those of individual subscales in our sample of college students with ADHD did not differ from any of the other chronic illness populations. However, when QOL ratings from our sample with ADHD were divided between freshmen and upperclassmen, upperclassmen exhibited a total lower QOL than that the healthy sample. Upperclassmen also exhibited lower emotional functioning than the allergies/asthma and sickle cell sample; lower psychosocial functioning than the healthy and allergies/asthma samples; and lower academic functioning than the healthy, allergies/asthma, and

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cancer samples. These findings of lower functioning across various domains in upperclassmen indicate that upperclassmen with ADHD are experiencing impairment akin to or even worse than that of other chronic illness populations. Therefore, despite ADHD being an invisible disorder, this population is still experiencing substantial negative outcomes as a result of their diagnosis.

Study Strengths and Limitations

Multiple strengths can be observed within this study. This is the first project that has examined QOL at multiple timepoints in a sample of college students with ADHD. Given that QOL is fluid, the use of multiple assessment timepoints mirrors the inherent nature of this construct. The longitudinal nature of this project warranted the use of a Multi-Level Modeling statistical approach. This advanced statistical approach afforded the retention of all participant data regardless of attrition, which was low in this study. Additionally, the use of MLM allowed for both within-individual and between-group analysis. Observing results found from within-individuals and between-groups offers us a more comprehensive understanding of influencers of QOL that are unique to time-points in a semester and college transition status.

Despite the considerable strengths of this study, limitations exist. While our longitudinal statistical approach reflects the properties of QOL as a construct, the instability of this construct presents challenges in obtaining a concrete picture of an individual's QOL.
Our examination of trajectories of QOL over a semester only accounts for an eighth of an average student's collegiate career. Psychosocial factors are known to fluctuate between each year of college (Foubert, & Urbanski, 2006). Therefore, our findings of changes in QOL during the semester may not hold true over longer periods of time.

In our attempt to compare QOL in our sample with ADHD to that of other chronic illness samples we were unable to control for the educational status of comparison populations. Two of

the four comparison populations (i.e., healthy, asthma/allergies) in our study consisted solely of college students. Comparisons between college students and non-student populations should be interpreted with caution given the inherent differences between these two groups. For example, data gathered from college students is characterized by more homogeneity and different effect sizes than that of non-student cohorts (Peterson, 2001). Consequently, observed differences between college students and non-students may reflect unique characteristics of the sample rather than true differences that exist between groups.

As previously mentioned, the transition to college represents a substantial stressor in the lives of young adults. As such, this process is characterized by changes in psychosocial functioning in multiple domains (i.e. academic, emotional, and social) compared to that experienced in other years of college (Pascarella & Terenzini, 2005). This study has a disproportionate number of respondents in their first year of college. Therefore, our study's aggregate reports of QOL may be more representative of the QOL experienced by students undergoing the college transition.

Our sample was comprised of more females than males despite the general population with ADHD being made up of with more males than females (Rucklidge, 2010). Gender differences account for a significant portion of symptom presentation and psychosocial impairment, with females with ADHD experiencing significantly higher psychosocial impairment compared to their male peers (Rucklidge & Tannock, 2001). The ethnic makeup of our study reflects the greater undergraduate population of Auburn University and is largely homogenous (90.9% Caucasian/White). Ethnic minorities experience more stigma related to seeking out mental health services despite the use of these services resulting in better psychosocial outcomes (Eisenberg, Downs, Golberstein, & Zivin, 2009) (Hunt & Eisenberg,

2010). As a result of this stigma, minority populations may be at a greater risk for decreased overall psychosocial functioning and lower QOL than that observed in our predominantly Caucasian/White sample. Consequently, a more ethnically representative population of students with ADHD may show different findings. Our sample of college students with ADHD also had a later average age of diagnosis () than the general population with ADHD.

This study relied on ratings from the PedsQL-YA™. While the PedsQL-YA™ is a highly reliable and valid assessment measure (Varni & Limbers, 2009), its primary utility is to examine QOL in medical illnesses. The PedsQL-YA™ emphasizes factors related to physical functioning rather than those areas contributing to one's overall QOL that may be most heavily affected by the symptoms of ADHD. Therefore it is likely that some of the factors that impact QOL in illnesses that are more psychiatric in nature, such as ADHD, may not have been adequately assessed using this questionnaire. While our statistical approach worked to control for the medical focus of the PedsQL-YA™ by isolating subscales of this questionnaire (i.e., social, emotional, academic, psychosocial), a measure more geared towards a population with ADHD would allow for an all-encompassing outlook of the impact of ADHD on QOL.

Current research supports the need for disease-specific measures in QOL assessment (Wiebe, Guyatt, Weaver, Matijevic, & Sidwell, 2003) (Wilson & Cleary, 1995). Features unique to ADHD have been found to have a negative impact on QOL in people with ADHD. Specifically, areas related to executive functioning, including: sluggish cognitive tempo (SCT) (Combs, Canu, Fulks, & Nieman, 2013), inhibited reward-processing (Barkley, 2014), and poor emotion-regulation (Wehmeier et al., 2010) are related to lower QOL. ADHD-specific assessment measures of QOL should properly assess these neurocognitive factors that are representative of an ADHD diagnosis.

The World Health Organization (WHO) Adult ADHD Self- Report Scale (ASRS) (Kessler et al., 2005b) and the Adult Attention-deficit/hyperactivity Disorder Quality of Life Scale (AAQoL) (Brod, Johnston, Able, & Swindle, 2006) may be better suited for QOL assessment in ADHD populations as they include areas of impairment specific to ADHD. Neither of the above reported assessment measures of QOL are normed for use in college populations. Therefore they may not be able to capture the factors unique to the college environment that impact one's QOL.

As is the case with any self-reported measure, it is possible that the answers reported may not reflect the true experiences of our study participants. The self-report nature of our study may have skewed the data gathered from participants with ADHD. As a whole, adolescents and young adults with ADHD are inaccurate self-reporters on psychological questionnaires (Smith, Pelham, Gnagy, Molina, & Evans, 2000). However we do note that our study of college students with ADHD did not significantly differ from their peers regarding physical functioning, as would be expected due to the non-medical nature of ADHD symptomatology. This may suggest that students with ADHD are accurate reporters of QOL. While research has acknowledged the limitations of using people with ADHD as self-informants, previous research has found that this population does possess the ability to report on their own functioning in psychological studies (Connors, Connolly, & Toplak, 2012). Future studies may benefit through the incorporation of collateral reports from parents to minimize the impact of self-report on response styles.

Future Research Directions

Future directions for our study should focus on obtaining a better understanding of changes in QOL across a longer period of time. This more extensive time span would allow for a more detailed outlook of why these discrepancies exist between freshmen and upperclassmen.

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Our findings of variation in QOL across various stages in our college sample suggest that young adults in the college environment experience influencing factors of QOL that are unique to the college setting. This is commensurate with findings that show that college students may lack the coping skills needed to properly adapt to the demands of the college environment, resulting in worse psychosocial outcomes (Vredenburg, O'Brien, & Krames, 1988). Therefore, future comparisons in QOL between young adults with chronic conditions should control for the educational status of participants. This would allow for a more analogous assessment and differentiation of factors impacting QOL that exist in the college setting as well as a differentiation of those factors that may be disease-specific.

Clinical Implications

Our finding of lower QOL in college upperclassmen indicates that a higher focus must be placed on providing support services to upperclassmen on college campuses. Most academic accommodations emphasize freshmen despite our study's finding of upperclassmen being at a higher risk for negative psychosocial outcomes. Therefore, the psychosocial functioning of students with ADHD should be routinely evaluated and monitored over the years of college. In order for college students with ADHD to effectively manage the stressors related to college life, services should emphasize the adaptation of healthy means of coping in order to prevent negative outcomes for upperclassmen (Fisher & Hood, 1987). Additionally, services should work to connect upperclassmen with resources more pertinent to their identified needs (e.g., career resources, graduate test prep). This systematic implementation of services will allow us to understand factors unique to each stage of an undergraduate college career and assist in providing adequate support to this overlooked and at-risk population.

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Table 1.

Participant Demographics

	Mean ± SD or %	
	Freshmen	Upperclassmen
Age	18.26 ± .70	20.74 ± .45
Year in College	65%	35%
Gender		
Male	37.1%	47.4%
Female	62.9%	52.6%
Ethnicity		
White/Caucasian	91.4%	94.7%
Other race/ethnicity	8.60%	5.3%
QOL Over Time for ADHD Population		
Time 1	79.64 ± 10.37	69.20 ± 6.09
Time 2	79.38 ± 10.08	70.65 ± 8.72
Time 3	80.36 ± 11.23	69.78 ± 11.79
Time 4	80.03 ± 11.51	71.96 ± 12.22

Table 2.

T-tests and Descriptive Statistics for PedsQL-YA™ subscales by Year in College

	Freshmen		Upperclassmen		
Quality of Life	*M*	*SD*	*M*	*SD*	*t* (43)
Physical	88.05	12.82	79.69	12.34	2.09*
Emotional	71.71	20.12	59.00	15.94	2.13*
Social	84.92	13.22	78.58	16.19	1.41
Academic	70.63	14.15	58.75	18.36	2.40*
Psychosocial	75.75	12.68	65.44	13.04	2.55*

*p < .05.

Table 3.

Intercorrelations for Quality of Life Scores across an Academic Semester

	1	2	3	4
1. Time 1	--			
2. Time 2	.728	--		
3. Time 3	.749	.776	--	
4. Time 4	.723	.776	.868	--

All correlations are significant at p < .01.

Table 4.

Results of Linear Models of Adherence

	Model 1- Unconditional Linear σ^2 (SE)	Model 2- Conditional Linear B (SE)
Intercepts		
Quality of Life *(outcome)*	74.31 (1.52)*	89.04 (4.02)*
Transition status *(predictor)*	--	-10.87 (2.81)*
Level 1 (within individual) slopes		
Time	0.49 (0.41)	0.41 (1.22)
Level 2 (between individual) slopes		
(i.e., predictor x time interaction)		
Transition status X Time	--	0.06 (0.87)
Fit Indices		
Log Likelihood	-671.89	-664.55
AIC	1355.76	1345.11
BIC	1375.33	1371.21
Adjusted BIC	1356.33	1345.87

*$p < .001$.

Table 5.

Descriptive Statistics for QOL of Comparison Populations

QOL	ADHD	Allergies/Asthma	Cancer	Healthy	Sickle Cell
Total					
M	76.82	77.10	71.17	78.18	73.03
SD	11.37	15.47	20.42	9.20	15.60
n	45	167	135	1171	20
Physical					
M	85.26	77.57*	75.60***	86.25	71.72***
SD	13.17	16.76	23.24	10.63	18.90
n	45	167	136	1171	20
Emotional					
M	67.47	73.61	66.21	66.68	71.50
SD	19.76	19.91	25.24	15.00	16.15
n	45	167	135	1171	20
Social					
M	82.81	85.51	80.70	85.48	87.00
SD	14.44	16.73	23.47	11.90	13.90
n	45	167	133	1171	20
Academic					
M	66.67	71.72	72.96	69.47	62.75
SD	16.54	20.14	23.76	13.94	25.88
n	45	167	129	1171	20
Psychosocial					
M	72.31	77.10	71.70	73.87	73.73
SD	13.63	13.63	20.96	10.53	15.00
n	45	167	134	1171	20

Note. All differences are in relation to the sample with ADHD.

*p < .05. **p < .01. ***p < .001.

Table 6.

One-Way Analysis of Variance for Effects of Chronic Illness Population on Quality of Life Scores

Variable and source	*df*	*SS*	*MS*	*F*
Total QOL				
Between Groups	4	6358.36	1589.59	11.89***
Within Groups	1533	204944.84	133.69	
Physical Functioning				
Between Groups	4	25490.85	6372.71	36.73***
Within Groups	1534	266134.11	173.49	
Emotional Functioning				
Between Groups	4	7574.94	1893.74	6.65***
Within Groups	1533	436513.66	284.74	
Social Functioning				
Between Groups	4	3068.76	767.19	3.95**
Within Groups	1531	297715.44	194.46	
Academic Functioning				
Between Groups	4	3465.82	866.45	3.38**
Within Groups	1527	391738.77	256.54	
Psychosocial Functioning				
Between Groups	4	2465.40	616.35	3.67**
Within Groups	1532	256712.94	167.57	

***$p < .001$. **$p < .01$.

Table 7.

Descriptive Statistics for QOL of Comparison Populations in Freshmen with ADHD

QOL	ADHD	Allergies/Asthma	Cancer	Healthy	Sickle Cell
Total					
M	80.03	77.10	71.17**	78.18	73.03*
SD	10.80	15.47	20.42	9.20	15.60
n	30	167	135	1171	20
Physical					
M	88.05	77.57***	75.60***	86.25	71.72***
SD	12.82	16.76	23.24	10.63	18.90
n	30	167	136	1171	20
Emotional					
M	71.71	73.61	66.21	66.68	71.50
SD	20.12	19.91	25.24	15.00	16.15
n	30	167	135	1171	20
Social					
M	84.92	85.51	80.70	85.48	87.00
SD	13.22	16.73	23.47	11.90	13.90
n	30	167	133	1171	20
Academic					
M	70.63	71.72	72.96	69.47	62.75
SD	14.15	20.14	23.76	13.94	25.88
n	30	167	129	1171	20
Psychosocial					
M	75.75	77.10	71.70	73.87	73.73
SD	15.00	13.63	20.96	10.53	15.00
n	30	167	134	1171	20

Note. All differences are in relation to the sample with ADHD.

*p < .05. **p < .01. ***p < .001.

Table 8.

Descriptive Statistics for QOL of Comparison Populations in Upperclassmen with ADHD

QOL	ADHD	Allergies/Asthma	Cancer	Healthy	Sickle Cell
Total					
M	70.40	77.10	71.17	78.18*	73.03
SD	9.71	15.47	20.42	9.20	15.60
n	15	167	135	1171	20
Physical					
M	79.69	77.57	75.60	86.25	71.72
SD	12.34	16.76	23.24	10.63	18.90
n	15	167	136	1171	20
Emotional					
M	59.00	73.61**	66.21	66.68	71.50*
SD	15.94	19.91	25.24	15.00	16.15
n	15	167	135	1171	20
Social					
M	78.58	85.51	80.70	85.48	87.00
SD	16.19	16.73	23.47	11.90	13.90
n	15	167	133	1171	20
Academic					
M	58.75	71.72**	72.96**	69.47*	62.75
SD	18.36	20.14	23.76	13.94	25.88
n	15	167	129	1171	20
Psychosocial					
M	65.44	77.10***	71.70	73.87*	73.73*
SD	13.04	13.63	20.96	10.53	15.00
n	15	167	134	1171	20

Note. All differences are in relation to the sample with ADHD.

*p < .05. **p < .01. ***p < .001.

Table 9.

One-Way Analysis of Variance for Effects of Chronic Illness Population on Quality of Life Scores in Freshmen with ADHD

| Variable and source	*df*	*SS*	*MS*	*F*
Total QOL				
Between Groups	4	6555.45	1638.86	12.28***
Within Groups	1518	202636.87	133.49	
Physical Functioning				
Between Groups	4	25888.17	6472.04	37.34***
Within Groups	1519	263277.01	173.32	
Emotional Functioning				
Between Groups	4	8101.31	2025.33	7.13***
Within Groups	1518	431086.30	283.98	
Social Functioning				
Between Groups	4	2844.10	711.02	3.67**
Within Groups	1516	293610.90	193.67	
Academic Functioning				
Between Groups	4	3013.16	753.29	2.95*
Within Groups	1512	385511.17	254.97	
Psychosocial Functioning				
Between Groups	4	24222.63	605.66	3.63**
Within Groups	1517	253204.97	166.91	

***$p < .001$. **$p < .01$.

Table 10.

One-Way Analysis of Variance for Effects of Chronic Illness Population on Quality of Life Scores in Upperclassmen with ADHD

Variable and source	*df*	*SS*	*MS*	*F*
Total QOL				
Between Groups	4	7064.63	1766.16	13.23***
Within Groups	1503	200573.54	133.45	
Physical Functioning				
Between Groups	4	25724.74	6431.19	37.11***
Within Groups	1504	260639.54	173.30	
Emotional Functioning				
Between Groups	4	8642.30	2160.58	7.68***
Within Groups	1503	422899.38	281.37	
Social Functioning				
Between Groups	4	3469.60	867.40	4.46**
Within Groups	1501	92214.07	194.68	
Academic Functioning				
Between Groups	4	4857.07	1214.27	4.73***
Within Groups	1497	384426.13	256.80	
Psychosocial Functioning				
Between Groups	4	3432.08	858.02	5.14***
Within Groups	1502	250922.62	167.06	

***$p < .001$. **$p < .01$.

Figure 1.
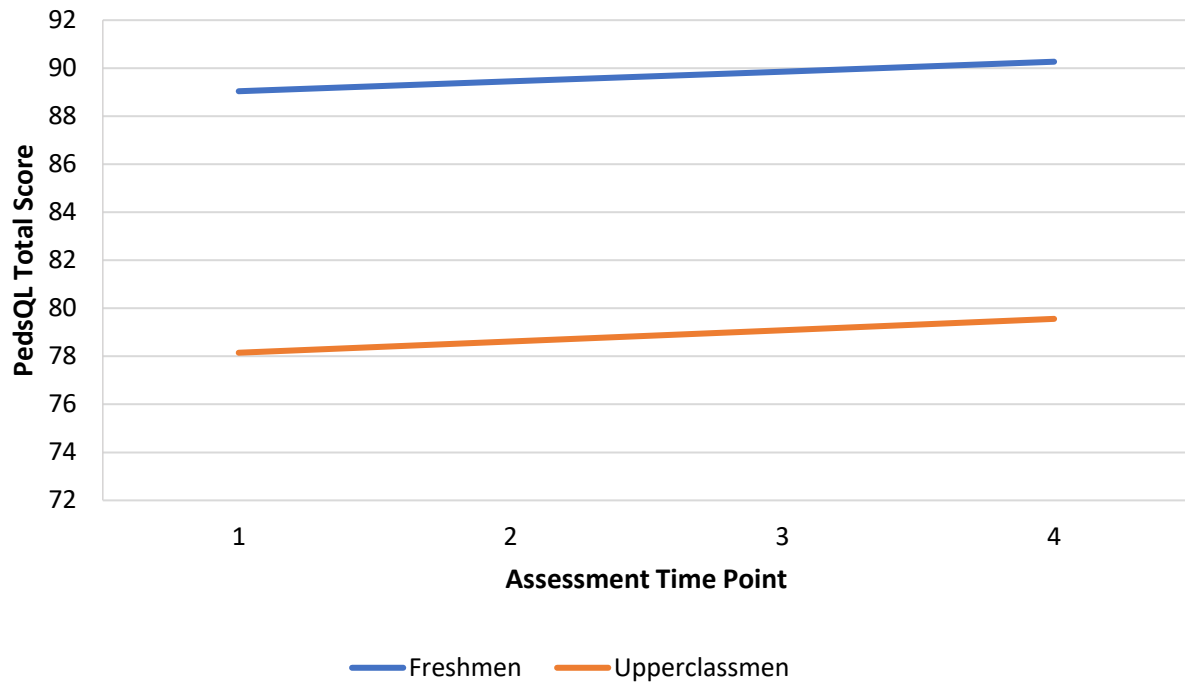
Appendix A.

*In the past **ONE month**, how much of a **problem** has this been for you …*

ABOUT MY HEALTH AND ACTIVITIES (problems with…)	Never	Almost Never	Some-times	Often	Almost Always
1. It is hard for me to walk more than one block	0	1	2	3	4
2. It is hard for me to run	0	1	2	3	4
3. It is hard for me to do sports activity or exercise	0	1	2	3	4
4. It is hard for me to lift something heavy	0	1	2	3	4
5. It is hard for me to take a bath or shower by myself	0	1	2	3	4
6. It is hard for me to do chores around the house	0	1	2	3	4
7. I hurt or ache	0	1	2	3	4
8. I have low energy	0	1	2	3	4

ABOUT MY FEELINGS (problems with…)	Never	Almost Never	Some-times	Often	Almost Always
1. I feel afraid or scared	0	1	2	3	4
2. I feel sad or blue	0	1	2	3	4
3. I feel angry	0	1	2	3	4
4. I have trouble sleeping	0	1	2	3	4
5. I worry about what will happen to me	0	1	2	3	4

HOW I GET ALONG WITH OTHERS (problems with…)	Never	Almost Never	Some-times	Often	Almost Always
1. I have trouble getting along with other young adults	0	1	2	3	4
2. Other young adults do not want to be my friend	0	1	2	3	4
3. Other young adults tease me	0	1	2	3	4
4. I cannot do things that others my age can do	0	1	2	3	4
5. It is hard to keep up with my peers	0	1	2	3	4

ABOUT MY WORK/STUDIES (problems with…)	Never	Almost Never	Some-times	Often	Almost Always
1. It is hard to pay attention at work or school	0	1	2	3	4
2. I forget things	0	1	2	3	4
3. I have trouble keeping up with my work or studies	0	1	2	3	4
4. I miss work or school because of not feeling well	0	1	2	3	4
5. I miss work or school to go to the doctor or hospital	0	1	2	3	4