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PROJECT INNOVATION INC.
P.O. Box 8508
Mobile, Alabama 36608.

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USING STUDENT HEALTH DATA TO UNDERSTAND AND PROMOTE ACADEMIC SUCCESS IN HIGHER EDUCATION SETTINGS

Dr. Mary Larson
Dr. Megan Orr
Dr. Donald Warne
North Dakota State University

The Problem: Institutions of higher education are interested in students' academic success as measured by GPA. Health is related to GPA and many institutions collect health data; however, this data is underutilized. This study used several health-related variables to examine relationships between health and GPA.

Method: This study utilized a cross-sectional survey of 526 students from a 4-year post-secondary institution. Stepwise, forward multiple regression analysis was used to determine which health variables best predicted GPA. Variables related to stressors, physical health, substance use, mental health, and subjective reports of physical and mental health were considered in the analysis.

Results: Variables selected accounted for 21.8% of the variance in GPA. The stressors grouping had the highest proportion of variables remaining in the regression model after stepwise selection.

Conclusions: Health factors are significantly related to students' ability to succeed. It is critical to understand the connections between student health and academic performance and fully utilize health data to promote student success.

Keywords: health factors, academic success, environment, college students, regression analysis.

Purpose

Background and Introduction

Education and health are inextricably connected (Bradley & Green, 2013; Jackson, 2009; U.S. Department of Education, n.d.a). In fact, education is one of the social determinants of health (Jemal, Thun, Ward, Henley, Cokkinides, & Murray, 2008) and is substantiated with evidence that people who achieve a post-secondary degree experience better health than those who do not (Bradley & Green, 2013). This relationship between health and educational goals is important because, according to the Department of Education's Center for Statistics, 3.2 million students graduated from high school in 2012 and most (66.2%) of these students went on to pursue post-secondary education the following fall (U.S. Department of Education, n.d.b). Of the students who enrolled in a post-secondary educational institution in

2006, 59% completed a degree within 6 years, leaving just over 40% without a degree in this time period. Substantially fewer students (39%) graduated in 4 years (U.S. Department of Education, n.d.c).

It is well known that academic success is influenced by cognitive factors such as intellectual aptitude as measured by high school GPA and standardized test scores. Therefore, it is not surprising that colleges and universities that have more selective academic admissions criteria (less than 25% accepted) also boast higher graduation rates (85.6%) as compared to less selective institutions (e.g., four-year institutions with open admissions had a graduation rate of only 32.8%) (U.S. Department of Education, n.d.c). While it is estimated that these cognitive factors account for approximately 25% of the variance in academic performance, other factors such as physical and mental health are estimated to account for a substantial portion of the remaining variance in academic success (Wolfe & Johnson, 1995). Interestingly, the health-related factors that cause the greatest challenges to student academic success include alcohol and other drug use, physical inactivity, poor nutritional intake, and poor stress management (DeBerard, Spielmans, & Julka, 2004; Dusselier, Dunn, Wang, Shelley, & Whalen, 2005; Grace, 1997). Furthermore, colleges and universities have untapped potential to promote student health, academic success, and subsequently improved quality of life post-graduation (Dooris, 2001; Dooris & Doherty, 2010). Therefore, developing a better understanding of the contributing factors for academic success is an important undertaking for college and university faculty, staff, administrators, students, and parents.

Previous studies examine the relationships between health and student success, an important area of research, using one or two health factors and academic performance (Brooks & DuBois, 1995; Dusselier et al., 2005; Grizzell & McNeil, 2007; Ryan & DeJong, 1998; Wechsler, Dowdall, Davenport, & Castillo, 1995). Nationally, the American College Health Association conducts a College Health Assessment biannually and shares this data with the intention of improving student health. In part, this data is used to develop a framework for improving the health status of college students nationwide through *Healthy Campus 2020*. The top impediments to academic performance reported by students for this assessment, stress, difficulty with sleep, anxiety, cold/flu/sore throat, and work, are included in *Healthy Campus 2020* in an effort to more closely align health factors with the academic mission of post-secondary institutions (American College Health Association, 2012). Despite these national efforts to provide data on student health and well-being, it still remains to determine the most meaningful collection, analysis, and use of data in order to help colleges and universities build an objective case for the focused health promotion critical to student academic success. In particular, differentiation of factors associated with academic success is required to better understand the contribution of non-modifiable factors, such as previous academic performance and cognitive ability, from more modifiable, health-related, and behavioral influences (Grizzell & McNeil, 2007). To facilitate this work we encourage the utilization of more advanced statistical analyses with health-related information collected from college and university students in order to draw inferences on the relationships between health and academic performance. An improved understanding of the degree to which health-related factors explain student success will facilitate the development of a holistic, comprehensive, and coordinated health promotion approach in the post-secondary setting, subsequently improving student academic success.

Health and Academic Performance

Most studies examining health and academic performance typically report bivariate correlations between one health factor such as alcohol use, nutrition, or physical activity and academic performance. For example, a national study found an inverse relationship between student alcohol use and GPA (Wechsler et al., 1995). Alcohol use was also correlated with students' reports of poor performance on tests and projects, or missing class (Ruthig, Marrone, Hladkyj, & Robinson-Epp, 2011; Ryan & DeJong, 1998; Wechsler et al., 1995;). Other research supports the notion that health-related variables account for varying degrees of academic success or failure. Relationships between health-related factors and academic performance include negative associations with smoking (Brooks & DuBois, 1995; DeBerard et al., 2004; Dusselier et al., 2005; Ruthig et al., 2011), poor diet (Poston, Bowman, & Rouse, 1994), and mental health issues, such as anxiety and depression (Grizzell & McNeil, 2007; Hartley, 2011; Ruthig, Haynes, Stupnisky, & Perry, 2009) and mixed findings for stressors (ACHA, 2009; Brooks & DuBois, 1995; Dusselier et al., 2005; Svanum & Zody, 2001). A broad category of cold, flu, and sore throat is also included in the *Healthy Campus 2020* report (ACHA, 2012). In addition, the National College Health Assessment reports that strep throat is one of the top ten self-reported health problems that impede student academic performance (ACHA, 2009). Health factors positively correlated with GPA include breakfast consumption (Trockel, Barnes, & Egget, 2000), although after controlling for wakeup times this relationship lost its statistical significance; physical activity and use of campus recreational facilities (Belch, Gebel, & Maas, 2001; Bellar, Judge, Petersen, Bellar, & Bryan, 2014; Kampf & Teske, 2013) and positive self-report of physical or mental health (Jackson, 2009; Saab & Klinger, 2011). While informative, these bivariate analyses only go so far in describing the complexity, and maybe more importantly, the interrelated nature of personal health on academic success.

Multivariate Analysis of Health and Academic Performance

Although examining college student health data and academic performance using bivariate analyses is more likely to result in findings that are statistically significant as compared to those of multivariate analyses, many of the relationships become less meaningful because health is not bivariate, it is multivariate. In fact, the number of researchers utilizing multivariate analyses with several health-related independent variables to determine relationships to the dependent variable of academic performance, as measured by GPA, are limited in comparison to work using bivariate analysis (Chow, 2010; DeBerard et al., 2004; El Ansari & Stock, 2010; Ruthig, Haynes et al., 2009; Ruthig et al., 2011; Trockel et al., 2000). The results of these studies indicated a range of degrees of variance in GPA as a result of various health factors from a low of 9% (El Ansari & Stock, 2010) to a high of 56% (DeBerard et al., 2004). Research analyses conducted by DeBerard et al. (2004) tested a model with ten predictor variables for GPA resulting in accounting for 56% of the variance in GPA. Of the six variables that were significant, gender (males, lower GPA) and general mental health factors (lower scores predicted lower GPA) remained in the regression along with HS GPA and SAT scores (positively associated with GPA). However, after subtracting out 25% of the variance attributed to HS GPA and SAT scores, this model accounts for approximately 31% of the variance in GPA. Other researchers utilizing multivariate analyses identified several factors remaining in the regression model, including student-reported physical and psychological health (Chow,

2010; Ruthig et al., 2011), gender, perceived stress, and alcohol use (Ruthig et al., 2011). Utilizing multivariate analyses helps to illuminate connections among independent variables that are important in predicting changes in the dependent variable.

Health-related variables account for a significant proportion of the variability in grade point average. However, the factors examined—non-modifiable such as HS GPA and ACT scores and modifiable, such as degree and direction of variance and gender differences—leaves room for additional research to elucidate the connections between health and academic success.

Therefore, the purpose of this study was to expand our understanding of the relationship between GPA and several health-related variables. We examined the relationship between factors relating to physical health factors, mental health conditions, stressors, substance use and abuse variables, and academic performance as identified by self-reported GPA in a sample of students from a private liberal arts college in the Midwest. The research questions included: 1.Which grouping of health-related variables best predict GPA? 2. What percentage of variance in GPA can be explained by this group of variables? In this paper we discuss the importance of maximizing the use of health-related data to first, enhance student wellbeing and second, subsequent student academic performance.

Methods

Measures

The College Health Survey was developed by staff at a large public university in the Midwest and has been used since 1995 to collect health behavior information of college students. The survey instrument consists of 10 sections including Health Care Coverage and Utilization (7 items), Health Status (5 items), Emotional and Mental Health (7 items), Personal Safety (11 items), Nutrition and Physical Activity (11 items), Chemical Health (19 items), Sexual Health, (15 items), Demographic Information (14 items, including GPA), Residence (2 items), and Additional Questions: Program Related (11 items).

Design and Sample

Following the approval from the Institutional Review Board at a private, liberal arts college in the Midwest, the Office of Institutional Research invited a random sample of 50% of the students attending the college to participate in the College Student Health Survey online in the spring of 2007. The initial sample size was 1,348. Of the 1,348 students who received an online survey, 526 completed a survey for a response rate of 39.0%. Students who reported being a fifth-year or graduate student were excluded from the analysis due to insufficient numbers. Students who reported GPAs outside of the acceptable range (0.00-4.00) were also excluded from analysis. Additionally, students who did not respond to all items of interest (listed in Tables 1 & 2) were excluded from analysis. Through this process, 63 surveys were removed from further analysis for a final sample size of 463.

Of the students included in the final sample, females responding to the survey outnumbered males (70.4% vs. 29.6%) which reflected the student population of 61.2% females and 38.8% males. The students were approximately evenly split between those under 21 (48.8%) and those over 21 (49.0% vs 51.0%) with 97.6% between the ages of 18 and 22. The vast majority of students completing the survey reported Caucasian ethnicity (95.5%). Outside of Caucasian, students' identified ethnicity was relatively evenly distributed among African American (1.3%), Asian (1.7%), and Latino (1.9%) with a small fraction of students reporting American Indian. There were similar percentages of first- (22.5%) and second- (21.6%) year

Table 1. Variables in the Overall Mental and Physical Health and Physical Health Categories

Variable	Variable type	Outcomes
Overall Mental and Physical Health		
# days physical health not good in past 30 days	numerical	Integer value between 0 and 30
# days mental health not good in past 30 days		
# days poor physical/mental health affected daily activities in past 30 days		
Physical Health		
Allergies – Dx lifetime	class	Diagnosed, not diagnosed
Asthma – Dx lifetime		
Mononucleosis – Dx lifetime		
Strep Throat – Dx lifetime		
Urinary Tract Infection – Dx lifetime		
Allergies – Dx 12 months		
Asthma – Dx 12 months		
Mononucleosis – Dx 12 months		
Strep Throat – Dx 12 months		
Urinary Tract Infection – Dx 12 months		
Hours/Week Strenuous Exercise	class	None < ½ hour to 2 hours/week, 2 ½ or more hours/week
Hours/Week Moderate Exercise		
Hours/Week Strengthening/Toning		
Consumption 100% Juice (past 7 days)	class	I did not eat/drink this, 1-6 times/week, 1+ times/day
Consumption of Green Salad (past 7 days)		
Consumption Potatoes (past 7 days)		
Consumption Carrots (past 7 days)		
Consumption Other Vegetables (past 7 days)		
Consumption Fruit (past 7 days)	class	I did not eat/drink this, 1-6 times/week, 1 time/day, 2+ times/day
Consumption Regular Pop (past 7 days)		
Consumption Diet Pop (past 7 days)		
Breakfast Consumption (past 7 days)	numerical	Integer value between 0 and 7
Eat Fast Food Meals (past 12 months)	class	Never, once/year to 1-2 times/month, once/week to several times/week
Eat at Restaurant	class	Never, once/week to several times/day
Regularly Take Multivitamin	class	yes, no

Note: Dx = diagnosis

Table 2. Variables in the Mental Health, Stressors, and Substance Use Categories

Variable	Variable type	Outcomes
Mental Health		
Social phobia/performance anxiety – Dx lifetime		
Attention deficit disorder – Dx lifetime		
Obsessive/compulsive disorder – Dx lifetime		
Bipolar disorder – Dx lifetime		
Anorexia – Dx lifetime		
Anxiety – Dx lifetime	class	Diagnosed, not diagnosed
Post-traumatic stress disorder – Dx lifetime		
Seasonal affective disorder – Dx lifetime		
Panic attacks – Dx lifetime		
Depression – Dx lifetime		
Bulimia – Dx lifetime		
Stressors		
Average level of stress (past 30 days)	numerical	Integer value between 0 and 10
Ability to manage stress (past 30 days)		
Termination of personal relationship (past 12 months)		
Diagnosed with serious physical illness (past 12 months)		
Death of someone close (past 12 months)		
Excessive credit card debt (past 12 months)		
Diagnosed with mental illness (past 12 months)		
Serious physical illness of someone close to you (past 12 months)	class	Experienced, Did not experience
Roommate/housemate conflict (past 12 months)		
Issues related to sexual orientation (past 12 months)		
Parental conflict (past 12 months)		
Excessive debt other than credit card (past 12 months)		
Substance Use		
Used alcohol (past 30 days)	class	0 days, 1-5 days, 5+ days
Used marijuana (past 30 days)	class	0 days, 1+ days
Average number of drinks in a week	numerical	Integer value between 0 and 99
Had 5+ drinks at a sitting (past 2 weeks)	class	I do not drink alcohol, 0 times, 1-2 times, 3+ times

Note: Dx = diagnosis

students among the survey participants, with the greatest number of participants from the third-year undergraduate class (28.7%) followed by fourth-year participants (27.2%). The mean reported GPA was 3.37 with a standard deviation of 0.4

Analysis

Of the 102 items contained in the survey, the specific items of interest included health status items assessing whether participants have been diagnosed with a medical condition (comprising of several mental and physical health conditions), perception of physical and mental health over the past 30 days, and how many days physical or mental health issues prevented normal daily activities over the past 30 days. Under the section assessing emotional and mental health, several items were used to determine the degree to which participants suffer from mental health concerns, including items related to stress such as "on a scale from one to ten, with one being not stressed at all and ten being very stressed, how would you rate your average level of stress in the past 30 days?" and the participant's ability to handle stress. Additionally, physical health status was assessed by four subsections within the nutrition and physical activity section, which included information related to exercise and dietary habits. Several items assessed chemical use including marijuana and alcohol. Due to the infrequent reporting of drugs other than marijuana and alcohol, these two drugs were the focus of this analysis, and information regarding quantity and frequency of use were included in a section on chemical health.

Each of the items included in the analysis were classified into one of the following categories: overall mental and physical health, physical health, mental health, stressors, and substance use. See Tables 1 and 2 for the specific items included in the analysis that fall into each of these five categories with item descriptions.

Multiple linear regression analysis was used to determine which subset of the health items of interest considered best predicted GPA. Gender and year in school were also included as demographic independent variables. Due to the large number of potential predictor variables, forward stepwise selection using AIC (Akaike, 1974) as the selection criterion was implemented. A variable was deemed significant if the p-value associated with that variable was less than 0.05 ($p < 0.05$), however, all variables remaining in the model after the stepwise selection was performed were considered important variables in the prediction of GPA. Variance inflation factors (Fox & Monett, 1992) were calculated for each variable in the resulting model to assess collinearity among the variables in the model. All analysis was performed in the statistical package R version 2.15.1.

Results

Table 3 presents the results of the multiple linear regression with stepwise selection. The coefficient estimate along with the standardized coefficient and p-value are provided for each of the variables selected to be in the model. As shown in Table 3, no variance inflation factors (VIFs) above 1.8 were observed, indicating that there were no strong collinearities among the variables in the final model.

The analysis shows that male students had a lower average GPA than females ($p < 0.001$) when all other variables were taken into account. The only variable in the Mental Health category selected for the model was lifetime diagnosis of attention deficit disorder ($p = 0.017$), which was negatively associated with GPA. For the Mental and Physical Health category, the number of days mental health was not good during the past 30 days ($p = 0.043$), also negatively associated with GPA, was the only variable selected for the model. Two variables from the Physical

Table 3. Results of Multiple Linear Regression after Forward Stepwise Selection

Variable	*B*	β	*p*	VIF
(Constant)	3.046		<0.001	
Demographic				
Gender - Male	-0.183	-0.182	<0.001	1.22
Mental Health				
Lifetime diagnosis of attention deficit disorder	-0.316	-0.100	0.017	1.04
Mental and Physical Health				
# days mental health not good in past 30 days	-0.008	-0.112	0.043	1.78
Physical Health				
# of days breakfast eaten in past 7 days	0.033	0.171	<0.001	1.09
Lifetime diagnosis of strep throat	0.060	0.066	0.122	1.06
Stressors				
Diagnosed with having a mental illness in past 12 months	-0.266	-0.118	0.007	1.14
Parental conflict in past 12 months	-0.145	-0.117	0.007	1.09
Excessive credit card debt in past 12 months	-0.277	-0.139	0.002	1.20
Ability to manage stress in past 30 days	0.028	0.133	0.007	1.43
Average level of stress in past 30 days	0.035	0.161	0.003	1.68
Issues related to sexual orientation in past 12 months	0.274	0.115	0.007	1.09
Serious physical illness of someone close in past 12 months	-0.132	-0.101	0.016	1.04
Excessive debt other than credit card in past 12 months	0.149	0.092	0.045	1.25
Termination of personal relationship in past 12 months	-0.070	-0.060	0.159	1.08
Substance Use				
Average # of drinks consumed in a week	-0.011	-0.132	0.002	1.11
MODEL SUMMARY				
Multiple $R^2 = 0.243$ Adjusted $R^2 = 0.218$ $p < 0.001$				

Health category, number of days breakfast was eaten in the past seven days ($p < 0.001$) and lifetime diagnosis of strep throat (0.122), both positively associated with GPA, were selected to be in the model. Compared to the other four variable categories, the stressor category had the highest number (9) and highest percentage (75%) of its variables selected for the model. The two most significant variables in the model from this category were experiencing excessive credit card debt in the past 12 months ($p=0.002$), negatively associated with GPA, and average level of stress in the past 30 days ($p = 0.003$), positively associated with GPA. Finally, average number of drinks consumed in a week ($p = 0.002$), negatively associated with GPA, was the only variable selected for the model from the Substance Use category.

The overall model was highly significant in predicting GPA ($p < 0.001$), with an adjusted R^2 of 0.218, indicating that about 22% of the variation in GPA can be explained by the health variables in the model.

Discussion

Previous research studies examined academic success of students related to a narrow scope of health factors, rather than considering multiple health factors. Students' lives, health, and academic success are all inextricably connected; therefore, considering one health factor at a time provides too narrow of a picture to fully comprehend and address student health-related success. Additionally, a substantial body of work focuses on students in elementary and secondary school environments with fewer studies in the post-secondary environment. The studies that have been conducted in the post-secondary environment examining the degree health factors can predict academic success (e.g., GPA) contributed interesting and useful information.

The purpose of this study was to contribute to the body of knowledge regarding the degree to which health factors are related to academic success of college students through the utilization of regression analyses. Of the 55 variables used in this analysis, 15 remained in the regression model after forward stepwise selection and accounted for 21.8% of the variance in GPA. Of the variables remaining gender is an important factor and consistent with previous work illustrating a statistically significant and negative relationship between male gender and GPA. Additionally, nine of the 15 remaining variables were from the stressors grouping. Previous research highlights stress as a perennial problem for students and in particular, examines students' perception of stress and their perceived ability to handle stress (Dusselier et al., 2005; Grace, 1997; Ruthig et al., 2011; Ruthig, Haynes et al., 2009). Stressors affect physical health, including diet and sleep (Ross, Niebling, & Heckert, 1999; Voelker, 2004), and affect mental health, including depression and anxiety (Dusselier et al., 2005; Hartley, 2011). Financial stress, as identified by credit card debt, was a significant and negative predictor of GPA. In fact, perceived financial sufficiency was part of a regression equation related to academic success in an earlier study (El Ansari & Stock, 2010) and credit card abuse was related to a lower GPA (Hogan, Bryant, & Overymyer-Day, 2013; Adams & Moore, 2007). In contrast, the current study illustrated that debt, outside of credit card debt, had a positive relationship with GPA. This may relate to students' perception that accumulation of debt to attend college is a normal state and will be managed upon graduation. The stress of grappling with questions related to sexual orientation was positively related to GPA. However, the results of the survey do not afford an explanation for this relationship. Moreover, the results from this study indicate that both students' perception of degree of stress and ability to cope with the stress are positive and significant predictors of GPA,

which is contradictory from previous work (Ruthig, Haynes et al., 2009). These data suggest that as the demands of college studies increase along with students' perception of their ability to effectively manage the workload, had a positive predictive relationship with academic success. While the number of stressor variables and their significance in predicting GPA was not surprising given the affect stress has on health, the direction of some of these factors was unexpected.

Of the 25 physical health variables used in this analysis, 2 remained in the regression analysis: number of days breakfast was consumed in the past 7 days and lifetime diagnosis of strep throat. Breakfast contributed both a significant and positive predictive relationship with GPA. Previous research illustrating relationships between physical health factors and GPA in the collegiate environment is rather limited, with one study showing a relationship between breakfast and academic performance; however, this association lost significance after controlling for wake-up times (Trockel et al., 2000). This same study did not show a correlation between aerobic physical activity and academic performance, but did find a positive relationship between strength training and academic performance. Unlike some other studies with relationships between GPA and use of recreation facilities and exercise the variables related to exercise in this study were not selected as important predictors of GPA this regression analysis. It may be that the connection between nutrition and exercise and academics in a post-secondary setting are covariates related to students' level of conscientiousness regarding overall health as opposed to being specifically influential in the improvement or detriment of academic achievement.

According to previous work, substance use, particularly alcohol, is inversely related to academic performance (Ryan & DeJong, 1998; Wechsler et al., 1995). The analyses reported here supports previous work. The average number of drinks remained in the regression model and was significantly and inversely related to GPA. Whereas, the question related to binge drinking, had 5 or more drinks at a sitting in the past 2 weeks, did not remain in the analysis. The significance of the predictive nature substance use has on GPA in this study is not surprising, but the elimination of the binge drinking question was unexpected.

An increase of reported days of poor mental health was a significant and negative predictor of GPA, which was not surprising. It was surprising, however, to find that number of days of poor physical health and a combination of poor physical and mental health were not selected as factors for the regression analysis. It was also unexpected that of the 11 mental health variables (including depression and anxiety) entered into the analysis lifetime diagnosis of attention deficit disorder was the only variable remaining in the regression. This corresponds to previous work on attention deficit and academic performance that found students who live with attention deficit have lower HS and college GPAs (Advokat, Lane, & Luo, 2011), but differs from previous work indicating a relationship with GPA and anxiety or depression (Grizzell & McNeil, 2007; Hartley, 2011; Ruthig, Haynes et al., 2009).

Conclusions

Provision of services is a good foundation for promoting student health; however, efforts to make continued improvement should be guided by data. For example, students have identified the college environment as one in which it is difficult to be healthy due to the challenges of balancing academics, work, and social life (Brooks & DuBois, 1995; Ross et al., 1999). This information provides a foundation for further examination of the campus environment to identify potential

interventions that are focused more broadly on making the healthy choice the easy choice in coordination with interventions focused on the individual.

Research conducted by Brown and Grizzell (1998) found that students are very interested in working on improving time management, which is arguably important to successfully manage their competing priorities. Furthermore, research by Reynolds (2013) found that professionals working in Student Affairs ranked student stress as both important and difficult to address. Merging this information with data that illustrates poor academic performance is related to a stressful college environment creates a compelling case for developing policies, systems, environments, programs, and services to address student health. Aligning students' needs and interests with the mission of Student and Academic Affairs provides an excellent opportunity to find points of collaboration. Mining information from the work of researchers illuminates several implications for improving student health.

Despite these studies which connect health and academic success, gaps exist between what institutions of higher education understand and what they subsequently do to promote health and student success (Dooris, 2001; Dooris & Doherty, 2010). These gaps are concerning when one considers the time and money colleges and universities expend to attract qualified students into post-secondary institutions and the number of students who stop-out or drop-out and therefore do not complete their degrees. A substantial portion of students do not successfully obtain an undergraduate degree due to health factors that may be prevented or averted with proper support and assistance. We concur with DeBerard et al. (2004) in the use of data by college and university leaders to proactively address student health related to academic success.

Efforts to improve students' health and subsequently their academic success require collaboration and coordination among all facets of academic and student affairs and may be bolstered by working with local, state, and national public health leaders. These efforts must focus more broadly on campus and community policies, systems, and environments affecting students' behaviors in addition to offering programs and services focused on individual student's behavior change.

This study exposed one important implication for future research: colleges and universities that are already collecting health behavior data, whether for the purposes of a federal mandate (e.g., alcohol and other drug use) or for programmatic efforts, may consider adding a few questions and revising other questions to align these surveys in a manner that facilitates advanced statistical analysis (e.g., multiple regression analysis). Cost implications are low, and the resulting information may prove useful in the institution's efforts to improve campus programs, services, and environment, in ways that facilitate early identification of students needed extra support, subsequently improving student health and academic success.

Limitations

Although this study advances the understanding of student health factors and academic success, there are some limitations. First, this work was conducted with a sample from one college campus with a homogenous student population. Therefore the results are not generalizable to institutions with greater heterogeneity. Second, limitations are inherent in self-reported information, including student-reported health factors and GPA.

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