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Assessing Clinical Factor Contributions to Idaho's Higher Education Crises

by

Rachel Hulse

A doctoral dissertation

submitted in partial fulfillment

of the requirements for the degree of

Doctor of Education in the Department of Educational Leadership

Idaho State University

Spring 2019

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## **Committee Approval**

To the Graduate Faculty:

The members of the committee appointed to examine the dissertation of Rachel R. Hulse find this dissertation satisfactory and recommend that it be accepted.

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August 1, 2018

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RE: regarding study number IRB-FY2019-25 : Identifying contributions to Idaho's higher education crises

Dear Dr. Hulse:

I have reviewed your request for expedited approval of the new study listed above. This is to confirm that I have approved your application.

Notify the HSC of any adverse events. Serious, unexpected adverse events must be reported in writing within 10 business days.

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Sincerely,



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## Table of Contents

List of Figures.....	xii
List of Tables.....	xiii
List of Abbreviations.....	xiv
Abstract.....	xv
Chapter 1: Introduction.....	1
Statement of Need.....	1
Factors that lead to attrition.....	2
Purpose of the Study.....	4
Research Questions.....	6
Definition of Terms.....	9
Theoretical Perspective.....	10
Delimitations.....	10
Limitations.....	12
Significance and Conclusion.....	13
Chapter 2: Literature Review.....	15
Attrition in Higher Education.....	15
Freshman attrition.....	18
Idaho's education crises.....	19
Medical withdrawal.....	22
Theories of Retention.....	27
Early retention models.....	28
Tinto's theories on retention.....	28

Astin and Bean’s theories of retention.....	29
Retention risk instrument.....	31
Theoretical summary.....	32
From theory to health.....	33
Abnormal Psychology.....	35
Anxiety and panic disorders.....	40
Mood disorders.....	41
Suicide.....	45
Mental health in higher education.....	46
Psychological disorders and physical health.....	50
Mental health assessment and screening tools.....	51
Abnormal psychology summary.....	56
Laboratory Biomarkers.....	57
C-reactive protein (CRP) .....	60
Cortisol and depression.....	60
Thyroid stimulating hormone (TSH) and anxiety.....	62
Comprehensive metabolic panel (CMP) .....	64
Lipid panel and coronary risk profile.....	68
Complete blood count (CBC) .....	68
Biomarker summary.....	71
Chapter Summary.....	71
Chapter 3: Methodology.....	72
Purpose of the Study.....	72



Research Questions.....	72
Research Design Overview.....	72
Study Approval.....	73
General Procedure.....	73
Participant Criteria.....	73
Participation Selection and Sampling Methods.....	74
Participant Informed Consent.....	75
Participant Incentive.....	76
Facilities and Resources.....	76
Materials and Supplies.....	77
Blood Collection.....	77
Clinical Laboratory Instrumentation.....	78
Survey Instrumentation.....	78
Office of Research Data.....	80
Data Analysis.....	80
Validity and Reliability.....	82
Limitations and Assumptions in Methodology.....	83
Special Training.....	84
Ethical Considerations.....	84
Methodology Summary.....	84
Chapter 4: Results and Analysis.....	86
Participant Demographic and Descriptive Statistics.....	86
CSI and MYSA Survey Data.....	87

Office of Institutional Research Data.....	95
Research Question #1.....	97
Research Question #2.....	100
Research Question #3.....	105
Chapter Summary.....	114
Chapter 5: Discussion, Implications, and Conclusion.....	115
Statement of the Problem.....	115
Review of Hypotheses and Methodology.....	116
Discussion of Results.....	117
Participant discussion.....	117
Retention discussion.....	119
CSI and MYSA survey discussion.....	120
Research question #1.....	124
Research questions #2.....	131
Research question #3.....	135
Results summary.....	140
Ties to Theoretical Frameworks of Retention.....	141
Implications and Recommendations.....	146
Statistical Considerations.....	148
Future Directions.....	148
Conclusion.....	149
References.....	150

Appendices.....	171
Appendix A: Poster for Recruiting Participants.....	171
Appendix B: Informed Consent Form for Participants.....	172
Appendix C: First Session Survey.....	177
Appendix D: Second Session Survey.....	191
Appendix E: PHQ-9 Questionnaire and Scoring Index.....	202

## LIST OF FIGURES

Figure 2.1 Percentage of undergraduate students reporting being diagnosed with mental health disorders.....	23
Figure 2.2. Number of medical withdrawals at Idaho State University by year.....	26
Figure 2.3. 5-year trend in medical withdrawals at Idaho State University.....	27
Figure 4.1 Demographic information about participants in this study.....	87
Figure 4.2. Cortisol ratio comparison between PHQ-9 depression categories.....	102
Figure 4.3. Cortisol ratio comparison by perceived stress categories.....	103
Figure 4.4. Days rested in the past week.....	109
Figure 4.5. Sleep-loss struggles over past week.....	110
Figure 4.6. Percent alcohol consumption by group.....	111
Figure 4.7. Alkaline phosphate levels by alcohol consumption.....	112
Figure 4.8. Average sleepiness over past week.....	113
Figure 4.9. Average exercise per week.....	113

## LIST OF TABLES

Table 1.1 Complete list of clinical measurements assessed in this study.....	6
Table 2.1 Factors related to retention: Relative connection.....	34
Table 2.2 Treatment methods for different theoretical frameworks of abnormal psychology.....	38
Table 4.1 Initial summary observations.....	90
Table 4.2 Comparison of summary observations.....	91
Table 4.3 Background characteristic data for study participants.....	94
Table 4.4 Institutional impressions.....	95
Table 4.5 GPA and entrance exam scores by group.....	96
Table 4.6 Summary of significant laboratory changes.....	99
Table 4.7 Significant intercorrelations among biological markers by session.....	100
Table 4.8 PHQ-9 average cohort scores by group.....	102
Table 4.9 Depression variable correlation outcomes.....	105

## LIST OF ABBREVIATIONS

ACHA	American College Health Association
ADA	American Disabilities Act
AFF	Albertson's Family Foundation
ALT	Alanine aminotransferase
ALP	Alkaline phosphatase
APA	American Psychiatric Association
AST	Aspartate aminotransferase
CBC	Complete Blood Count
CDC	Center for Disease Control
CLIA	Clinical Laboratory Improvement Amendment
CMP	Complete Metabolic Panel
CRP	C-Reactive Protein
CSI	College Survey Inventory
DSM	Diagnostic and Statistical Manual of Mental Health Disorders
EDTA	Ethylenediaminetetraacetic acid
GPA	Grade Point Average
HDL	High-density lipoprotein
ISU	Idaho State University
IRB	Institution Review Board
LDL	Low-density lipoprotein
MLS	Medical Laboratory Sciences
MYSA	Mid-Year Student Assessment
NCHA	National College Health Assessment
OIR	Office of Institutional Research
PHQ-9	9-item Patient Health Questionnaire
RBC	Red Blood Cell
SBOE	State Board of Education
SST	Serum separator tube
TSH	Thyroid stimulating hormone
WBC	White Blood Cell

## **Abstract**

Idaho is facing an educational crisis, consistently ranking 50th in the nation for high school students directly enrolling in college. A startling college attrition rate results in only one out of every ten Idaho high school graduates earning a college degree. College students have been shown to possess a unique set of stressors, which can negatively affect their academic success and lead to attrition in college. Anxiety and depression are growing concerns in the young adult population, with one out of every four college students suffering from some form of mental illness. This study uniquely combined survey-based data with clinical blood work to better identify correlations between biological markers, retention theory, and psychological survey instruments to determine the contribution of health in retention and academic success. Bloodwork and survey data were collected from Idaho-resident freshmen (n=50) at the beginning and (n=45) end of their first semester at Idaho State University (ISU). Quantitative analysis confirmed that multiple biological makers changed significantly over the course of the study, providing compelling clinical evidence that the health of freshmen at ISU was adversely affected over the course of their first semester. Several of these biological markers significantly correlated with retention choices and GPA. Negative health behaviors, such as poor sleep, alcohol consumption, and diet, also correlated with decreased academic success and changes in clinical biomarkers. This dissertation provides evidence that the declining health of freshmen students contributed to attrition and decreased academic success. Concerted efforts are needed to improve support and intervention for students' physical and mental health in future retention strategies.

Keywords: Retention, persistence, attrition, biomarkers, quantitative, theory of attrition, freshmen, higher education, clinical, depression, student health, Astin, Attinasi, Bean, Cabrera, Pascarella, Terenzini, Tinto.



## **Chapter I: Introduction**

### **Statement of Need**

Idaho consistently ranks 50th in the nation for high school students enrolling directly in college (Idaho Business, 2015). While the majority of Idaho high school seniors will graduate high school, only four in ten will advance their education by enrolling in college (Walters, 2015). A startling 75% college attrition rate results in only one out of every ten Idaho high school graduates advancing to earn a college degree (Idaho Business, 2015). As 61% of the new jobs being created in Idaho now require some form of postsecondary education, it is clear that the Idaho education system is woefully underprepared to meet the state's needs (Idaho Business, 2014). Therefore, increasing college enrollment and reducing soaring college attrition rates are vital for the health and economic welfare of the state.

While higher education retention is a serious problem in the state of Idaho, similar trends are pervasive throughout the country. Consequently, higher education administrators have been tasked with identifying contributing variables and reducing these trends. Administrators are also responsible for both state and federal governments' standards, as they have tied their resources and funding to metrics, such as graduation rates and other student success assessments (Duarte, Ramos-Pires, & Gonçalves, 2014). The pushes for greater transparency has resulted in public access to college and university metrics, including graduation and retention reports. Poor report cards in these areas may further exacerbate challenges with low enrollment (Crosling, Heagney, & Thomas 2009).

As a result of increased accountability and the need to increase retention, institutions across the country have conducted research to identify risk factors that restrict student success. There have been attempts to implement research-programs based to reduce risk in various ways, with the goal of increasing retention. These methods include, but are not limited to, investments in financial aid and scholarships, specialized advising programs, physical and mental health services, cohort groups, tutoring services, and high school-to-college bridge programs (Hotchkiss, Moore, & Pitts, 2006). The use of validated assessment tools, such as the College Survey Inventory (CSI) and other data analytic programs work to identify at-risk student populations, and offer pathways for early prevention support (DeBerard, Spielmens, Glen, & Julka, 2004).

Idaho-specific programs such as *Don't Fail Idaho* and the *Idaho Education Task Force* have been instituted with the intent of better preparing high school students for postsecondary education and increasing college enrollment. This is supported by Idaho's State Board of Education (SBOE) goal of having 60% of residents (age 25-34) earn a post-secondary degree or certificate by 2020 (Corbin, 2016). Despite these determined efforts, attrition remains a serious concern with troubling trends in higher education. In fact, one researcher claim that "higher student attrition rates at university have become one of the most challenging issues in higher education worldwide in the last five decades" (Mansouri & Moumine, 2017, p. 53). Summarily, this indicates the vital need for more research to identify factors that may lead to more effective retention strategies.

### **Factors that Lead to Attrition**

There are numerous identified indicators that influence student retention in higher education. For example, research indicates that first-generation college students drop out

without a degree nearly four times more frequently than their second-generation counterparts (Burrell, 2017). There is a disparity in retention rates among races, with Blacks, Hispanics, and Native American students having lower retention and graduation rates than White and Asian students (Burrell, 2017). Other factors include admissions selectivity, living in dorms, technology usage, campus visitations, socioeconomic background, parental educational levels, high school GPA, and self-motivation (Savage, 2006). Routine health habits such as lack of sleep, poor diet, lack of exercise, and stress are a recipe for depression among college students. Consequently, mental health and depression are key indicators in higher education attrition (Ross, Neibling, & Heckert, 1999). Not surprisingly, suicide is the second leading cause of death in the 15-34 college-aged demographic. The stigmas associated with mental illness exacerbates the reluctance of afflicted higher education students to seek treatment or help (Kerr, 2017).

In the past decade, over 31 million students who enrolled in a higher education institution left without a certificate or degree. Freshman students accounted for over a third of those losses (DeBerard, et al., 2004). The freshman year is a pivotal transitional year, with new stresses and responsibilities. Some of the most common attrition factors identified directly relate to challenges associated with the high school to higher education transition, such as financial strain, homesickness, and time management problems (Hotchkiss, et al., 2006). Additionally, today more freshmen are working longer hours than the historical traditional student. Not only does this limit time to focus on studies, but many freshmen report that higher education institutions are not supportive of the working student (Stratton, O'Toole, & Wetzel, 2007). Unhealthy patterns of self-care also emerge in the freshman year, such as poor sleep, increased substance abuse, reduced

exercise, and poor diet (DeBerard et al., 2004). All of these factors contribute to declines in both physical and mental health (Pritchard, Wilson, & Yamnitz, 2007). Despite this, biological markers of physical and mental health have been poorly studied in higher education retention studies.

Many studies have identified that retention is a complex situation, involving multiple, often convoluted variables (Bean, 1980; Braxton, 2000; Cabrera, Casteñeda, Nora & Hengstler, 1992; Tinto, 1975, 1993). However, current strategies are not curtailing the retention epidemic, suggesting the need for modified and/or supplemental strategies. Mental health specifically offers its own challenges, as there is no current predictive analysis model that has worked effectively to predict the issues of mental health on campus, and consequently, mental health continues to be a crisis in higher education (Zajacova, Lynch, & Epsenshade, 2005). Improved predictive analysis models, combined with appropriate institutional services and scaffolding, will be necessary for identifying at-risk students and to better help these students succeed in higher education. In order to assist in this goal, this study sought to identify clinical factors that may contribute to Idaho's higher education attrition rate.

### **Purpose of the Study**

The focus of this study was on the retention rates of Idaho resident freshman in higher education enrolled at Idaho State University (ISU) during the 2018-2019 academic year. The purpose of the study was to identify novel factors that may be contributing to freshman attrition at ISU, specifically clinical factors. This was accomplished by first assessing the general physical and mental health status changes of a freshman cohort across their first semester of higher education at ISU. Secondly, his study explored the

correlation between validated assessment tools and clinical bloodwork markers for stress and depression. Finally, this study assessed the correlation between clinical markers, first semester GPA, and Fall-to-Spring registration attrition.

Many survey-based studies have identified that anxiety and depression are increasing concerns in the young adult population (Zajacova, Lynch, & Epsenshade, 2005; Kerr 2017). In fact, one out of every four college students suffer from some form of mental illness, with 44% of American college students reporting various forms of depression (Kerr, 2017). Additionally, college students have been shown to possess a unique set of stressors which can negatively affect their academic success and lead to attrition. Despite these concerns, 75% of affected college students decline to seek help for their mental health problems (“Mental illness facts”, 2013). This study proposed to combine survey-based data with clinical blood work to identify correlations between clinical mental health status and academic success.

In this study, validated surveys were used to assess known retention risk factors, as well as depression and stress indices. Additionally, a number of clinical laboratory tests were run to assess physical changes in freshman health across the semester. These tests were specifically chosen based on their relevance both as general health evaluators , and as assays that have strong evidential support as biological markers for common maladies of higher education students, such as stress and depression. Cortisol and thyroid stimulating hormone (TSH) levels, were specifically used as clinical measurements of anxiety/stress and depression respectively. A complete list of assays monitored in this assay can be found below in Table 1.1.

Table 1.1

*Complete list of clinical measurements assessed in this study.*

Panel or Assay	Abbreviation	General Usage
Complete blood count	CBC	Overall health screen- infection, anemia
Complete metabolic panel	CMP	Overall health screen- organ function
Thyroid stimulating hormone	TSH	Thyroid function- metabolism
Cortisol	Cortisol AM/PM	Stress and depression response
C-reactive protein	CRP	General Inflammation
Lipid Panel	Lipids	Coronary risk- cholesterol, triglycerides

This study intended to identify correlations of biological markers with student attrition, and ultimately identify areas in which Idaho postsecondary institutions can improve scaffolding and support systems for students suffering from stress, anxiety, and/or depression. The goal of this project was to produce data that will aid in increasing retention rates of Idaho higher education students.

Governmental standards, public transparency, and financial bottom lines are drawing increased scrutiny to higher education institutions, requiring them to identify risk factors, create support services, and decrease attrition rates (Elkins, Braxton, & James, 2000). Due to the complex nature of factors leading to attrition, current retention strategies need additional support in order to reverse national trends in higher education enrollment. This study will contribute to the body of research on student persistence by identifying novel risk factors or variables that may be used to combat freshman attrition.

### **Research Questions**

1. Are biological markers of health significantly changing in Idaho freshman during their first semester of higher education? Are these changes, if any, positive or negative?

**Hypothesis.** Based primarily on survey data, higher education students (particularly freshman) report adverse health trends during higher education (Pritchard, Wilson, & Yamnitz, 2007). Therefore, this study hypothesized that there were significant changes in laboratory assay values toward a negative, or adverse outcome.

**Objective.** CBC, CMP, TSH and cortisol, CRP and lipid panel testing was performed on 50 first-year enrolled Idaho college students during the beginning (baseline), and end of their first Fall semester at ISU. Statistics were run to detect significant changes in biological laboratory values over the course of the semester.

2. Are quantitative measures of stress and depression significantly changing in Idaho freshman during their first semester of higher education? Do biological markers of stress and depression correlate with changes in associated, validated assessment tools?

**Hypothesis.** Stress, anxiety, and depression are well-established maladies of higher education students (Garret, 2001; Kerr, 2017; Savage, 2006; Zajacova, Lynch, & Epsenshade, 2005). Additionally, abnormal psychology literature readily states that symptoms of stress and depression have both psychological and biological components (Nolen-Hoeksema, 2017). Therefore, this study hypothesized that validated assessment tools of stress and depression will have significantly adverse trends over the course of participants' first semester at ISU. Moreover, it was hypothesized that the biological markers of stress and depression will significantly correlate with their respective assessment responses.

**Objective.** Cortisol and TSH panel testing were performed on 50 first-year enrolled Idaho college students during the beginning (baseline), and end of their first Fall semester

at ISU in research question 1. In addition to this, the same 50 students were administered the College Survey Inventory (CSI) and Patient Healthcare Questionnaire-9 (PHQ-9) assessment surveys, supplemented with customized survey questions for this study. Statistical analysis was conducted to detect significant changes in assessment responses, across the semester, while looking for correlations to respective biological laboratory values for assessment factors.

3. To what extent do clinical bloodwork assays and the assessment tools from the second research question correlate with the first semester metrics of freshman academic success at ISU (Fall semester GPA, and Fall-to Spring retention)? Can these factors contribute as predictors of academic success or risk?

**Hypothesis.** The PHQ-9 and CSI assessments have been validated across multiple populations, and have been shown to be both reliable and repeatable (DeBerard et al., 2004; Kroenke, Spitzwer, & William, 2001). Therefore, this study predicted that risk factors and depression results from the assessment tools will significantly correlate with student success metrics. Furthermore, it was predicted that biological markers will parallel academic outcomes, with more adverse health conditions significantly correlating with adverse outcomes of student success.

**Objective.** Fall semester GPA, and Fall-to-Spring retention data were collected from the ISU Office of Institutional Research after the Spring semester drop deadline. Correlation studies were performed with this data to compare with changes in clinical laboratory across the participant's Fall semester. This study also searched for correlations of academic success combined with PHQ-9 and CSI, and health survey responses to assess relationships between identified risk factors, mental health, and academic success.



## Definition of Terms

The following definitions are listed to avoid ambiguity, as some of the terms may have several meanings:

**Clinical Markers.** For the purpose of this study, clinical markers are defined by diagnostic laboratory bloodwork performed by trained Medical Laboratory Scientists in a certified clinical laboratory. Reference ranges are set by the clinical laboratory relative to the participant's age and gender.

**High School Grade Point Average (GPA).** The cumulative grade point average (GPA) was calculated by including all high school coursework taken by the student until the end of their senior year in high school.

**Fall GPA.** The semester grade point average (GPA) for the participants for all attempted and completed first semester courses in the Fall 2018 semester at ISU. Some first-time, full-time freshmen may have completed dual enrollment courses prior to beginning their on-campus ISU coursework, but only the Fall 2018 ISU semester GPA was considered in this value.

**Freshman.** For the purposes of this study, a freshman was a student who is a first-time, first-year college student, regardless of his/her number of accrued semester hours.

**Fall-to-Spring retention.** For the purposes of this study, Fall-to-Spring retention is defined as those students who maintained ISU registration past the Spring 2019 drop deadline, indicating that they were in their second consecutive semester enrolled at ISU.

**Grade Point Average (GPA):** This number is determined for each class in which the student is enrolled. It is calculated on a 4.0 scale as follows: : A = 4.0, B = 3.0, C =

2.0, D = 1.0, and F = 0.0 The GPA is determined by adding the quality points received for each class and dividing that sum by the total number of credit hours attempted.

### **Theoretical Perspective**

Student retention/attrition studies are extensive. One of the most famous theoretical frameworks for student retention was introduced by Vincent Tinto in 1975. This theory focused primarily on traditional college students, and is based on integration. Tinto's theories claimed that attrition can be predicted by the degree of a students' academic and social integration. Tinto's theory was later researched and expanded (Tinto, 1993). An alternative theory of student attrition is Bean's model of student attrition (Bean 1980; Bean & Eaton, 2000). Bean's model accounted for external factors that affected student retention, primary in non-traditional student populations. Bean's model accounted for external factors such as time constraints, family commitments, financial concerns, and well-being that ultimately influenced attrition decisions (Rovai, 2003). This study primary focused on factors external to institutional integration, therefore, aligning more closely to Bean's model of student attrition. The researcher believed that physical and mental well-being contributed significantly to a student's ability to succeed in higher education, and that identifying contribution factors will aid in developing processes to better retain at-risk students.

### **Delimitations**

Delimitations in this study include:

1. Participation in this study was limited to Idaho-resident freshman within their first semester of higher education at Idaho State University. While this was primarily a decision of convenience sampling, limiting participation to ISU students

eliminated potential confounding variables due to variations between institutions (Bean, 1980). While this study's methodology easily allow for replication at other universities, data from this study may not be representative of all Idaho higher education institutions. Furthermore, limiting this study to ISU students aligns with the theoretical framework of Tinto, evaluating longitudinal processes within a single university (Braxton et al., 2000).

2. The clinical assays used in this study are in no way exhaustive. Therefore, there may be significant correlations between biological markers and academic success or retention that will not be detected or reported in by this study. Biological assays chosen for this study were primarily chosen for their health diagnostic value and their cost-effectiveness. Many additionally relevant laboratory assays, such as neurotransmitter tests, were too cost-prohibitive to include in this present study.
3. The length of this longitudinal study was only one semester. Student participation incentives, with assessment and laboratory fees made it cost-prohibitive to extend this study longer. However, additional analyzed factors may be significant if the study extended across the entire Freshman academic year. In other words, factors may be deemed as insignificant in this study, but assessments and testing may have been prematurely analyzed, potentially resulting in false-negative results.
4. Assessment tools used in this study were chosen for their self-administering capabilities.

## **Limitations**

Limitations of this study include:

1. Samples size was limited to 50 ISU, Idaho-resident freshmen. While this is a large number for a longitudinal study of this kind, it does limit the power of the statistical analysis of the data. Therefore, some results may have been false-negative due to sample size limitations.
2. As this study was limited to Idaho-resident, ISU freshman students, the results have limited generalizability to other institutions. The results will be generalizable to the Idaho-resident freshman population at ISU.
3. Assessment tools were self-administered surveys in a proctored setting. While there were questions throughout the surveys to ensure internal validity, it is assumed that student participants answered conscientiously and honestly. Furthermore, it was assumed that questions were interpreted similarly between participants.
4. This research relied upon purposive, convenience sampling methods. Additionally, participant recruitment methods were not randomized, but voluntary. Therefore, this sample population results may not be representative of the entire ISU, Idaho-resident freshman population.
5. It cannot be determined from the scope of this study, whether participation itself was a confounding variable. In other words, it cannot be determined if the participation and monitoring provided in this study contributed to retention choices.

## **Significance and Conclusion**

Higher education institutions are facing increased levels of scrutiny and accountability, encompassing areas of cost, value, and quality (Zalaznick, 2016). This pressure has caused the federal government and accreditation agencies to conduct more rigorous evaluations, particularly looking at institutional outcomes and access. Graduation rates, time to completion, tuition costs, fee structures, student loan debt, and similar metrics are commonly gathered indicators used to assess institutional effectiveness (Ebersole, 2015). These outcomes are increasingly tied to funding and continuation of schools and academic programs (Zalaznick, 2016). As a result, higher education administrators are concerned about these numbers, and looking for ways to improve them. The financial investment needed to secure new student enrollment is less cost effective than retaining current students (Bennett, 2003). As such, prioritizing student retention efforts is necessary for the financial health of the university.

Traditional retention variables, such as GPA and entrance exam scores have been studied extensively (Pinnelli, 2017; Pritchard, Wilson, & Yamnitz, 2007). More recently, the integration of social programs, such as first-year experience programs have been utilized and researched (Hotchkiss, et al., 2006). ISU has attempted several social integration related programs, such as the freshmen Career Path Intern program and the Bengal Bridge program, each with their own levels of success. However, despite these programs and associated research, attrition remains a prevalent problem both in Idaho and throughout the country. Therefore, adding additional clinical laboratory variables may lead to another avenue for investigation. Furthermore, patterns found in this study may provide a framework for additional investigation and expansion that can be replicated at

other higher education institutions. The researcher is unaware of any studies that have included the analysis of clinical bloodwork, combined with common retention risk factor assessment evaluations to address retention issues at an institute of higher education. This information would be invaluable in contributing to a more effective predictive model that may help identify students at risk for attrition.

## **Chapter 2: Literature Review**

### **Attrition in Higher Education**

Attrition in higher education is a growing problem in our country. Attrition is defined as a student's departure from postsecondary education prior to earning a degree or certification. With over one third of higher education students falling into this category, attrition is becoming an increasingly costly concern (Johnson, 2012). Attrition results in both loss of investment and time to the student, as well as decreased revenue to already financially-burdened postsecondary institutions. Furthermore, the public at large is affected by attrition through contributions to state appropriated resources and federal financial aid (Johnson, 2012). A 2010 study estimated that taxpayers were spending more than \$9 billion in resources for first-year higher education student that would not be returning the next year, resulting in lower returns in state subsidized investments (Schneider, 2010). In 2011, a similar study found that the attrition of a single cohort of first-year students resulted in the loss of \$730 million in state and federal tax revenue, and a loss of \$3.8 billion in potential lifetime earnings for those exiting students (Schneider & Yin, 2011).

Numerous studies have sought to target the root of attrition in an effort to identify students at higher risk for attrition and improve retention. Collectively, the studies have found there is no single factor leading to attrition, rather, student attrition has been found to be multidimensional, encompassing common themes such as student demographic variables, educational background, and financial status (Lotkowski, Robbins, & Noeth, 2004; Pappas & Loring, 1985). Early institutional retention studies attributed attrition to the student's integration into the university, finding that the level of university

commitment was directly proportional to retention rates (Tinto, 1975; Bean, 1980). Baker and Siryk (1989) suggested that motivation, ability to meet academic demands, having a clear sense of purpose, and institutional satisfaction were critical for first-year students in adjusting to higher academia. Positive relationships and communication with faculty also contribute to continued enrollment (Pascarella & Terenzini, 1976). The literature further suggested that social adjustment was equally as critical as academic adjustment, citing loneliness and homesickness as compounding factors in continued enrollment (DeBerard et al., 2006).

Joe Cuseo, an emeritus educational psychologist at Marymount College claimed all student attrition can be filtered into four categories: academic, motivational, psychosocial, or financial (Cuseo, n.d.). According to Cuseo, academic attrition stems from inadequate preparation or disinterest and boredom. Motivational attrition arises from low levels of commitment, or perceived irrelevance. Psychosocial factors of attrition are rooted in either social or emotional issues. Similarly, the inability to afford college, or the perception that the cost outweighs the benefits, leads to finance-based attrition (Cuseo, n.d.).

Similar to Cuseo (n.d.), a more recent studies found that the following factors accounted for 84% of college attrition:

1. Feelings that the college doesn't care about the individual student
2. Poor service or treatment
3. Feeling that higher education is "not worth it"
4. Class schedule- not finding the right classes at the needed time (Raisman, 2013).



Common themes of personal difficulties, academic difficulties, financial difficulties', psychological difficulties, loss of interest/motivation, inability to manage time, and general dissatisfaction arise as attrition factors in other studies (Bennett, 2003; Schneider & Lin, 2011).

The changing mode of higher education delivery can further compound problems related to student academic success and persistence. Despite the increasing importance of online classes in higher education, there has been relatively little experimental evidence on its effectiveness. In fact, Xu and Jaggars (2014) provided compelling statistical evidence outlining the performance gaps created by distance education compared to traditional classroom delivery. The most significant performance gaps occurred with males, black students, younger students, and students with overall lower GPAs. Furthermore, while black students already underperformed in face-to-face courses, when compared to other racial groups, this gap widened even further in online education (Xu & Jaggars, 2014).

Additional studies have identified other student characteristics such as gender, age, race, and family income that were significantly correlated with both college graduation and length-of-time to degree (Pascarella & Terenzini, 1991). Many minority populations are at-risk for attrition. Nearly 62% of enrolled African American students, and 55% of Hispanic students never complete their degrees. This may be compounded by the fact that low-income students are 7.5 times more likely to dropout than their higher-income counterparts (U.S. College, 2018). Additionally, men have been found to be 20% more likely to drop out of college than women (Schneider & Lin, 2011).

In an era of rising attrition, student support systems have been implemented to increase retention. Higher education administrators are finding they must meet the needs of struggling students in order to be retained at their institution (Upcraft, Finney, & Garland, 1984). Student support systems vary between institutions, but include both formal and informal educational opportunities. These services range from tutoring centers and support groups, to counseling services and remedial coursework. However, it should be noted that 75% of students who were required to take remedial coursework in college never graduated, perhaps as a result of the increased time and tuition spent in pursuit of their degrees (Johnson, 2012; McGrath, 1997).

Student attrition has been a prevalent and costly issue in higher education for decades, and continues to grow. Despite countless studies and significant resources invested to address the issue, little has effectively tackled this multifaceted dilemma. Beer and Lawson (2016) followed a regional study in Australia and found that despite noble efforts and significant resource allocations, little was done to mitigate the problems of student attrition. The practical implication is that current approaches to battling attrition are failing (Beer & Lawson, 2016). Survey-based information, and data mining have provided a wealth of information, however, current literature is lacking innovative approaches that may lead to effective retention improvement plans. This study sought to contribute to the current knowledge-base of retention information by offering a novel biological perspective that may lead to better predictive models of retention.

#### **Freshmen attrition.**

Identifying which students are at risk for attrition is equally as important as ascertaining the factors leading to attrition. Research indicated that the majority of

students who drop out of college will do so in their first year (Noel, Levitz, Saluri, & Associates, 1985). In fact, in 2017, 30% of college freshman dropped out of college. That number increased to 56% when all students at undergraduate levels are included (U.S. College, 2018). The transition between high school and college is difficult for many students, particularly in the first six weeks of the semester. Adjusting to the academic demands, schedule, and lifestyle can prove insurmountable for many (Green & Greene, 2003). Furthermore, many freshmen do not have a clear declared major or career choice when they enter college, with over half of students changing their major one or more times during their educational pursuits (McGrath, 1997). Willingham (1985) and Upcraft, Finney, and Garland (1984) cited this uncertainty as a major cause for the lack of motivation and commitment that correlated with decreased persistence to graduation.

According to the Office of Institutional Research at Idaho State University (ISU), freshmen fall-to-spring retention (full-time, degree-seeking) for the Fall 2017 cohort was 80.7%. Freshmen fall-to-fall retention (full-time, degree-seeking) for the Fall 2017 cohort was 62.0% (ISU Institutional Research, 2018a). In other words, ISU saw a 38% freshmen attrition rate over the course of their first academic year, 8% over the national average. Summarily this information indicates a significant problem with freshmen retention nationally. Additionally, it indicates additional factors exacerbating early departure choices for freshmen at ISU. For this reason, this study focused specifically on Idaho-resident freshmen at ISU.

### **Idaho's education crises.**

The Albertson Family Foundation (AFF) spent three years gathering data about the state of higher education and student achievement in the state of Idaho, confirming

the educational crisis in the state. While 92% of the state's high school students will graduate, the study found that Idaho ranked last in the country for students continuing on to pursue college or another certified degree after high school (Idaho Business, 2015). The AFF study also found that the majority of Idahoans believed the education crisis was the most important issue facing the state, with 89% of respondents agreeing that postsecondary education was vital for securing satisfactory employment. Additionally, 53% of respondents rated their local public K-12 schools with a grade of C or lower, leading to 70% of respondents wishing they could send their children to a different school (Idaho Business, 2015). Perhaps not surprisingly, Idaho ranked 49<sup>th</sup> in the nation on spending per pupil (Idaho Business, 2015). The AFF foundation has identified the following reasons for Idaho's poor outcomes:

- Lack of preparation and rigorous coursework
- Lack of access and support for parents and students, including mentoring and help with financial applications
- Lack of affordable and flexible options in things like tuition costs or course schedules
- Lack of relevance as parents and students aren't making the connection about why higher education matters
- Lack of alignment and connectedness from grades K-12 and beyond
- Current funding is based on participation rather than student progress.
- There is resistance to new methods, change is not incentivized

- The state cuts of nearly a quarter-billion dollar from the K-12 education budgets in recent years have harmed schools, teachers and students (Beech & Funk, 2012, p 14).

Armed with these results, the AFF invested \$400 million in Idaho's education system (including the "Go On" campaign) with the goal of increasing college enrollment and retention/graduation rates.

The 2017 Quality Counts report card is a 20-year national ranking system that analyzes each state's educational system. Idaho's current rank of 48th<sup>th</sup> in the nation, with a grade of a D+ (67.6%). This grade decreased from the 2016 report card earning 67.9% (Quality Counts, 2017). The Quality Counts report card was broken down into three categories: Chance for success, K-12 achievement, and school finance analysis. Idaho currently ranks 74.5%, 69.2%, and 58.9% in each of these categories, respectively (Quality Counts, 2017). The report cites that Idaho state lawmakers cut funding for higher education by 26% between 2010 and 2012, while the cost of tuition has ballooned 57% during the recession, double the national rate of inflation (Quality Counts, 2017). It is clear, that despite the efforts of AFF and others, Idaho's educational crisis has worsened, and the Idaho education system is inadequate to meet the state's needs (Idaho Business, 2014).

To compound these issues, the Idaho Business for Education Report (2014) predicted that by 2018, over 61% of the jobs in the state of Idaho will require some form of postsecondary education, while 59% of the Idaho population have only a high school diploma or less (Idaho Business, 2014). Consequently, this results in high competition at the low-end of the job market, and the inability to fill vacancies that require more

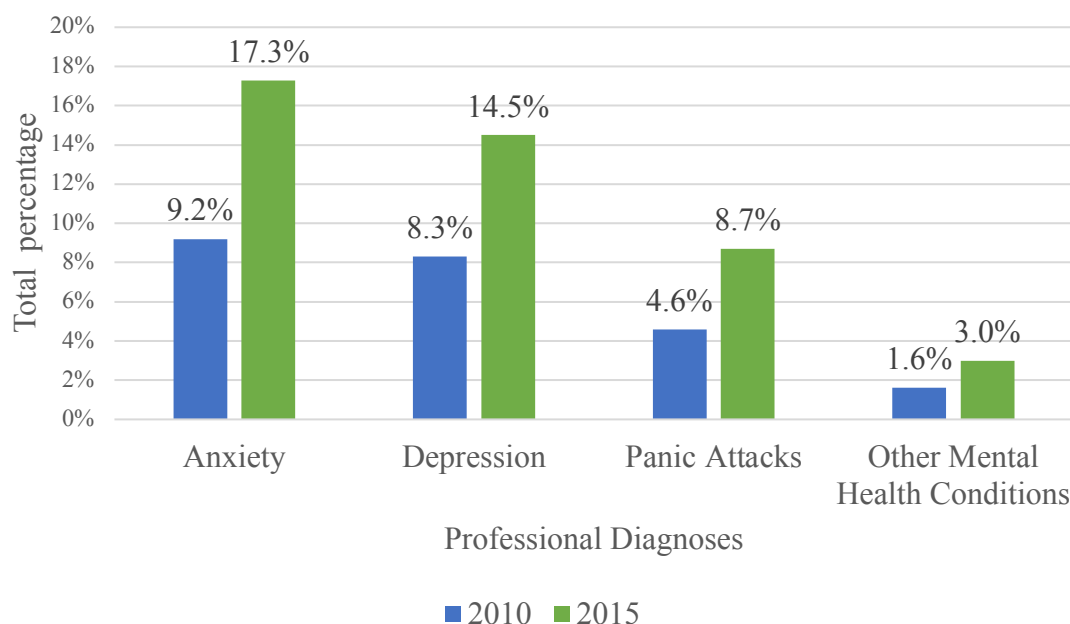
education. This is especially frightening when considering the critical need to fill rapidly growing healthcare workforce shortages in Idaho (Scott, 2015). Furthermore, the surplus of less educated workers will continue to propagate the downward pressure on wages in Idaho, which are already near the lowest in the country.

### **Medical withdrawal.**

Higher education students withdraw their enrollment for a variety of reasons. Identifying strategies to reduce withdrawal trends is a critical responsibility of higher education administration. One such area of increasing student withdrawals is due to medical or health reasons (GradGuard, 2017). The American College Health Association's (ACHA) National College Health Assessment confirmed that the national ten-year trends for higher education students demonstrated a significant increase in the number of medical withdrawals, representing 1-3% of the total student population (American College Health Association, 2017). Additionally, as the majority of higher education institutions in the country offer full or prorated tuition refunds for medical withdrawals, these occurrences create financial losses for both the student and the institution (GradGuard, 2017).

Medical withdrawals are permitted for various reasons. According to the ACHA's National College Health Assessment, some of the most common medical withdrawal causes were physical illness or injury (including events such as pregnancies, car accidents, & mononucleosis), family deaths, and mental illnesses, including depression, anxiety, and panic attacks (American College Health Association, 2017). The ACHA's assessment confirmed that the proportion of students being diagnosed and treated for anxiety, depression, panic attacks, and other mental health conditions nearly doubled

between 2010 and 2015 (GradGuard, 2017; see Figure 2.1). This may indicate that students are gaining increased access to mental health care, or alternatively, that the mental health status of students is growing and becoming an increasingly pressing issue in need of further research and examination. Mental health statistics among students cited within this paper support the latter argument.



*Figure 2.1.* Percentage of undergraduate students reporting being diagnosed with mental health disorders. Adapted from the American College Health Association-National College Health Assessment report, 2017. The blue bars represent data collected in 2010, and green bars represent data collected in 2015. The percentage values are located above the individual bars.

A 2017 survey of over 700 universities, representing over 800,000 students, was administered to collect data regarding student withdrawals and tuition refund policies (GradGuard, 2017). This report stated that 45% of respondent institutions were experiencing growing numbers of medical withdrawals among their students. The remaining institutions reported a steady number of medical withdrawals (34%) or did not know (21%). No institution reported a decline in medical withdrawals (GradGuard, 2017). Despite the prevalence of medical withdrawals, the majority (56%) of surveyed

institutions were not tracking these students to see if they returned to complete their degree. Of the institutions that tracked the future academic progress of medical withdrawal students, 59% reported that fewer than half of these students returned to complete their degrees (GradGuard, 2017).

Another longitudinal study from Dartmouth College followed 77 students over a three-year period who had dis-enrolled via medical withdrawal, specifically for mental health reasons (Meilman, Manley, Gaylor, & Turco, 1992). Depression accounted for half of these withdrawals. The study found that of the students that re-enrolled, those who were depressed when they withdrew, performed academically poorer upon return than those students who had not had a history of depression when they withdrew. This study concluded that procedures for handling mental health withdrawals and readmission required specialized support that these students may not be obtaining (Meilman et al., 1992). Collectively, this data suggested that the population of medical withdrawal students represented a missed opportunity for higher education institutions to increase enrollment, or create policies and/or support systems to help these students overcome their barriers. More research is needed to effectively implement strategies to identify and overcome these barriers.

According to Title IV of the Higher Education Act, any institution that provides federal financial aid must clearly make available their institution's refund policy, requirements and procedures for official withdrawal, and requirements for reacquiring Title IV financial aid. Additionally, providing non-passive notice to students about these policies was required upon withdrawal (Higher Education Act, 1965). However, guidance on these matters was otherwise vague (Mulhere, 2015). Changing trends in higher

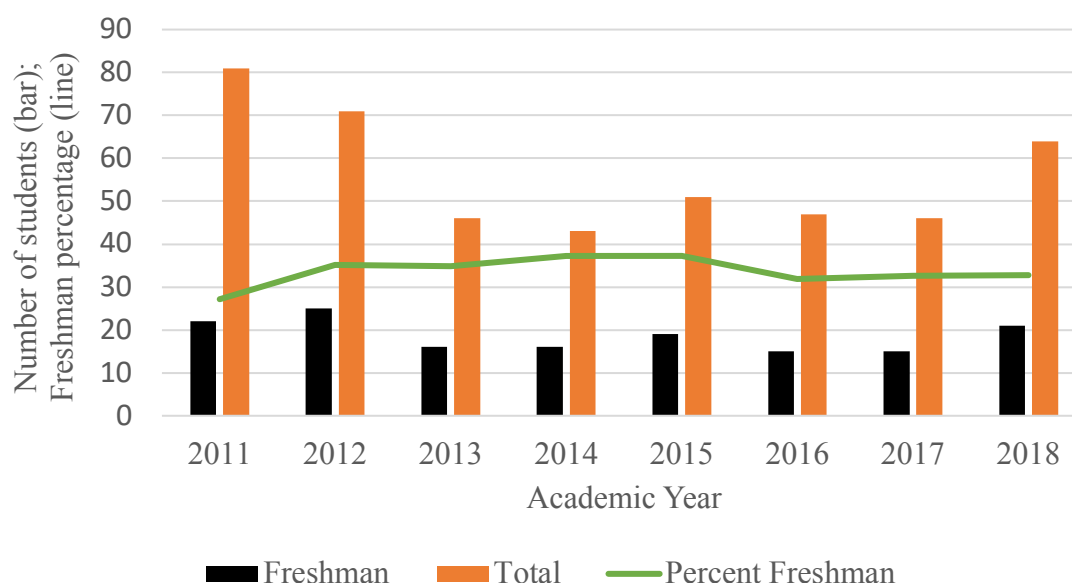


education often elicit legal ramifications, as invested parties learn to navigate new territories. Medical withdrawals are no exception. For example, in 2015 Quinnipiac University had to settle a legal dispute with a student that was placed on university-mandated medical leave after seeking on-campus help for depression (Mulhere, 2015). The university claimed they were acting under Title II of the American Disabilities Act (ADA), which allowed the removal of a student from campus if they pose a direct threat. However, the Justice Department sided with Title III of the ADA, stating this student was entitled to alternative accommodations that would have allowed her to continue her education (Mulhere, 2015). Following this settlement, Paul Lannon, a lawyer working with college clients advised that universities should “review their mandatory leave policies. Blanket policies with rigid, pre-established outcomes won’t pass muster anymore. There needs to be an individualized assessment of the risk and behaviors in every case” (Mulhere, 2015, p.1).

More recently, a class action lawsuit was brought against Stanford University for alleged violations in antidiscrimination laws towards students with mental health disabilities (Kadvany, 2018). Several students were asked to take leaves of absence, move out of campus housing, and had to meet onerous conditions in order to reenroll. The students claimed that they were not granted reasonable accommodations, nor were they given individual assessments that would have granted them equal access to school services. As part of the investigation, Stanford University indicated they have experienced a 57% increase of mental health caseloads, as compared to five years ago (Kadvany, 2018). In both cases above, there is little legal precedence to offer guidance to universities about what constitutes reasonable accommodations, and how to legally and

responsibly work with students that have mental disabilities. It is clear that higher education administrators need to closely evaluate their withdrawal-related policies, and take every opportunity to better understand the factors contributing to mental illness on campus, so they can better accommodate students with these specialized needs.

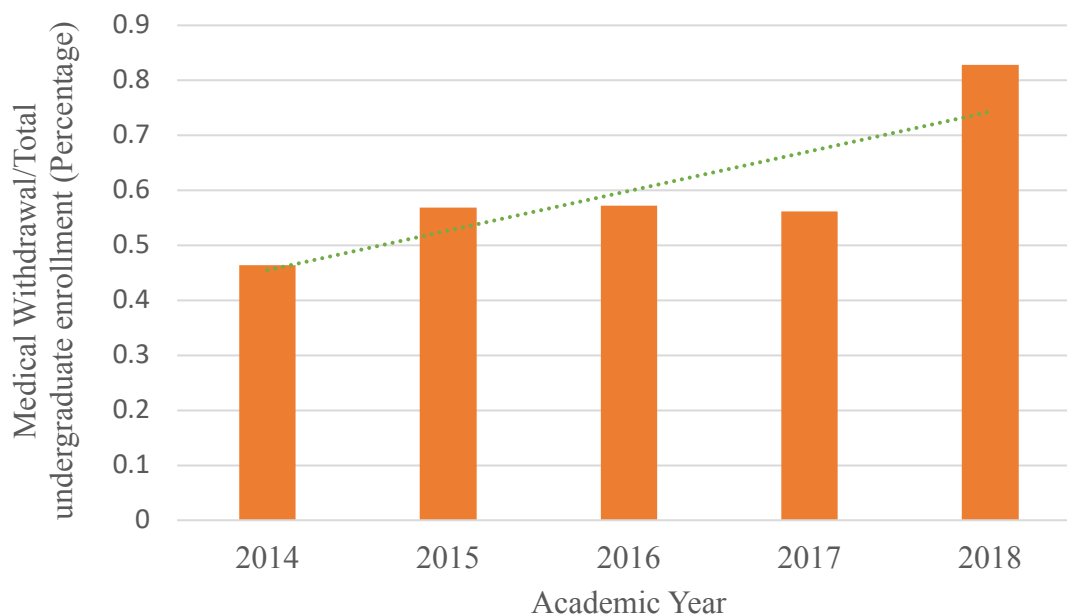
Idaho State University is no exception to medical withdrawals. In the past eight academic years, ISU has had between 43-81 official medical withdrawals, annually (ISU Institutional Research, 2018b). Freshman over-represent this population, averaging 34% of the total medical withdrawals (see Figure 2.2).



*Figure 2.2.* Number of medical withdrawals at Idaho State University by year. Black bars represent the number of freshman student medical withdrawals, and orange bars represent the total number of undergraduate student withdrawals. The green line represents the proportion of freshman medical withdrawals (freshman/total).

While these numbers represent less than 1% of the total student population, five-year data mirrors national trends, exposing a concerning increase in medical withdrawals (ISU Institutional Research, 2018b; see Figure 2.3). The exact causes of these medical withdrawals were not ascertained for the purposes of this study, however, based on

national data, it is a valid assumption that a significant proportion of these students were withdrawing for reasons associated with mental illness. Better understanding factors leading to stress, anxiety, and depression is critical in reversing these trends and better serving this student population.



*Figure 2.3.* 5-year trend in medical withdrawals at Idaho State University. Orange bars represent the total proportion of medical withdrawals among the undergraduate student population (medical withdrawals/undergraduate enrollment). The green dashed line represents the linear trend over the five-year time period.

### Theories of Retention

Scholarly research focusing on retention seemed to gain traction in the 1960s, with the corresponding growth of enrollment in higher education. This research has only gained momentum since then, primarily due to the enormous financial implications on both the student and the education system (Berger & Lyons, 2005). Theoretical retention models are numerous, yet there have been predominating themes in their historical succession. Each new theory adds unique insights, however, the underlying theme of all

frameworks seek to answer the question, why do students leave, or why do students stay? Furthermore, it becomes apparent that even in theoretical models, there are multiple complex relationships when identifying factors contributing to retention. For this study, the researcher chose to establish the foundation of this research on non-cognitive theoretical frameworks, particularly focusing on theories describing the well-being of the student, and its impact on early departure. The theories in this literature review have been widely cited and tested in retention research.

### **Early retention models.**

One of the earliest theoretical perspectives of retention emerged in 1962, when John Summerskill attributed retention to the student's cognitive abilities and personality traits (Summerskill, 1962). This shaped the theoretical framework for research of the psychological factors that contribute to attrition or persistence over the next decade (Berger & Lyons, 2005). Despite the great contributions established by this theoretical framework, it became apparent that cognitive and psychological traits were an incomplete model to explain attrition. In 1971, William Spady introduced both academic and social variables into his model of student retention, which laid the foundation for one of the most cited retention models provided by Vincent Tinto (Spady, 1971).

### **Tinto's theories on retention.**

Vincent Tinto's research opened the way for a theoretical framework that included sociological factors and analyses (Tinto, 1975, 1987, 1993). Tinto particularly focused on the idea of integration, both academic and social, identifying institutional (non-cognitive) elements that contributed to persistence in higher education. Academic integration relates to sharing academic values, as well as grades and intellectual

development. Social integration, on the other hand, considered the development of positive relationships with friends, faculty, and staff.

In 1987, Tinto published his Model of Institutional Departure, primarily associating attrition with academic difficulties, the inability of student to integrate into the academic mission or social life of their institution, or the inability of the student to resolve their vocation with their education (Tinto, 1987). Tinto's theory was modified and updated over time to incorporate additional factors of successful integration practices, such as separation from family and associates during the transition from high school to higher education. After separation, Tinto claims retention will best be influenced by integration, and ultimately integration into the norms of their campus (Tinto & Pusser, 2006). Later renditions of Tinto's theme resonate with the premises of this study, as the inability to successfully separate, integrate, and incorporate may lead to additional attrition-related factors such as physical and mental health-related issues.

#### **Astin and Bean's theories of retention.**

During the prevalence of Tinto's emerging theoretical frameworks, Alexander Astin published his Theory of Involvement in 1984. The core concept of Astin's theory included five postulates of student involvement: psychological and physiological investment, continuous involvement, the qualitative and quantitative nature of the involvement, the proportionality of student gains to involvement, and finally, the correlation of involvement to academic success (Astin, 1984, 1997). Astin reported that strains on the students' time, such as being over-committed by work, negatively impacted academic integration (Astin, 1997). This study surveyed the number of hours participants were working to take this variable into account. Similar to Tinto, Astin's theoretical

framework has facets that are interwoven with this research. For example, over-commitment of time may lead to stress, lack of sleep, and other poor health behaviors that could limit integration.

In 1985, Lee Noel identified four themes of retention research: retention as a factor of enrollment management, identifying strategies to help at-risk student populations, utilizing organizational factors of success, and incorporating competence as well as caring (Berger & Lyons, 2005). These research themes have resulted in retention strategies such as developing predictive models of attrition, campus-wide service integration, and implementing policies and programs to increase verifiable outcomes (Berger & Lyons, 2005). The underlying questions in all retention theory is why do students leave, and also, why do students stay? Understanding both of these questions is critical for an institution to understand the complexities associated with higher education retention.

In 1980, John Bean began publishing his theoretical frameworks, to include student background characteristics, as well as student satisfaction in determining early departure (Bean, 1980). Bean continued to develop his theory over decades to include student loyalty, institutional views and commitment (Berger & Lyons, 2005). In 2000, Bean and Eaton introduced a multi-level theoretical framework of retention to include factors of background and the student's well-being (Bean and Eaton, 2000). While acknowledging Tinto's theory of integration and Summerskill's theory of cognitive factors, Bean also included factors such as institutional loyalty, family support, high school experiences, coping strategies, perceived abilities, and receptivity to institutional support (Bean and Eaton, 2000). These psychological factors relate back to early

retention models, but have the ability to incorporate aspects of mental health in addition to cognitive abilities. This study, particularly the second research question in this study, sought to identify correlations between mental health struggles, and potential biological contributors. Advancements in this area of research will lead to improved strategies in confronting Bean's identified variables of poor coping and perceived lost loci of control. Better understanding biological markers that may contribute to these variables was a primary goal of this study.

### **Retention risk instrument.**

Retention research literature references a number of instruments used to predict student success and persistence in colleges and universities. One such instrument called the College Survey Inventory (CSI) by Ruffalo Noel-Levitz, has gained prevalence and validation in retention literature over the last three decades (Noel-Levitz Inc, 2007; Schreiner, 1991; Stratil, 1988). The CSI is currently used by over 300 higher education institutions. Built on prevalent theoretical principles, the CSI is an early-intervention and early-detection system used to improve retention (Cairns, 1992; Schreiner, 1991). The CSI is a user-friendly, survey-based assessment to identify information on academic motivation, general coping skills, and receptivity to support services (Cairns, 1992; Schreiner, 1991). The CSI survey analysis includes demographic information and scores for the following areas: dropout proneness, predicted academic difficulty, educational stress, receptivity to institutional help, academic motivation, general coping, and requests for support services. These sections are scored on a 5-point stanine scale.

A ten-year longitudinal study was conducted at a public land grant institution in the Midwest to assess the CSI as a predictor of retention in their student population. This

study concluded that the CSI was largely effective in monitoring global changes in factors related to college student success (Slanger, Berg, Fisk, & Hanson, 2015). An earlier study analyzed CSI data from 324 freshman who had withdrawn early, in an attempt to identify predictors of attrition. This study found that while factors such as GPA were predictive, no model from CSI data could account for more than 80% of student attrition (McGrath, 1997). This implies that although the CSI is a valuable tool for identifying students with risk factors, it is incomplete and further research needs to be conducted to learn more about the process underlying retention behavior, as well as to increase the accuracy of the predictions. This present study used the CSI as a tool for demographic collection and classic retention risk assessment, but seeks to enhance this data with potential correlations between this psychological and/or biological indicators of health in an Idaho-specific freshmen population.

### **Theoretical summary.**

Decades of research have been invested into theoretical models that can be used to reduce the problem of student attrition (Berger & Lyons, 2005). Both cognitive and non-cognitive strategies have been employed as a result. However, theories such as integration and academic preparation continue to predominate. Despite excellent advances in this area, the problems associated with attrition remain prominent. Researchers and higher education administrators remain concerned with variables related to student persistence. Advanced theories involving the psychological well-being of students are emerging (Berger & Lyons, 2005). However, the physiological components that are irremovably interconnected with these variables remain largely untouched in retention research. While the seminal theories of Tinto, Astin, and Bean endure in the



field, additional applications are needed to bring new and interesting perspectives to retention study and practice. This study aims to contribute novel information to better integrate strategical approaches already implemented from past theoretical models, particularly involving the physical and mental well-being of the student.

### **From theory to health.**

The retention theories of Tinto (1975, 1993), Bean (1980), and Astin (1997) included non-cognitive factors such as Tinto's (1993) pre-college characteristics and Astin's (1997) cognitive-psychological or cognitive-behavioral dimensions. However, there is a gap in the theory about specific actions taken by campus personnel to effectively assess strategies being used to reverse current retention trends. As one researcher stated, "Surprisingly, there is little empirical research that examines the relationship between student risk, resource and service utilization, and college outcomes. Further, we have limited information on the effectiveness of postsecondary intervention programs" (Robbins et al, 2008, p.103). In 2004, the ACT Policy Report published extensive research covering two decades of retention data, a meta-analysis of three national retention studies, and six national studies surrounding academic advising. This report published findings are listed in Table 2.1, which outlines the correlation between retention measures and risk variables. A glaring oversight in the retention measures listed below (see Table 2.1) is the pervasive role of the student's health (both mental and physical), which arguably intercalates into every cognitive and non-cognitive retention factor yet presented.

Table 2.1

*Factors related to retention: Relative connection*

Categories	Factors	Correlation Coefficient
Factors with strong correlation to retention	Academic-related skills	0.37
	Academic self-confidence	0.36
	Academic goals	0.34
	Institutional commitment	0.26
	Social support	0.26
	High school GPA	0.25
Factors with moderate correlation to retention	Institutional selectivity	0.24
	Socioeconomic status	0.23
	Social involvement	0.22
	Financial support	0.19
	ACT assessment scores	0.12
Factors with weak correlation to retention	Achievement motivation	0.07
	General self-commitment	0.05

*Note.* Adapted from “The role of academic and non-academic factors in improving college retention” by V. A. Lotkowski, S. B. Robbins, and R. J. Noeth., 2004, *ACT Policy Report*, retrieved from [http://www.act.org/research/policymakers/pdf/college\\_retention.pdf](http://www.act.org/research/policymakers/pdf/college_retention.pdf).

Data from this ACHA-NCHA II indicated that only 47.5% of surveyed college students indicated they were in “very good or excellent” health. More than half (54.6%) of surveyed students identified they had been diagnosed or treated in the past 12 months for the various health conditions including, but not limited to, mononucleosis, high cholesterol, diabetes, allergies, sinus infections, and sexually transmitted diseases (American College Health Association, 2018). Additionally, students reported that health behaviors such as alcohol use (3.1%), anxiety (26.5%), depression (18.7%), eating disorders (1.5%), sleep difficulties (21.8%), stress (33.2%) and homesickness (4.3%) had affected their academic performance. Academic performance here is defined as “receiving a lower grade on an exam, or an important project; receiving a lower grade in the course; receiving an incomplete or dropped the course” (American College Health

Association, 2018). The study further reports that 9% of students report regular tobacco use, and 61.7% reported regular alcohol drinking. A staggering 19.8% of college students surveyed admitted to driving under the influence of alcohol in the month prior to taking the survey. Less than half (46.2%) of participants met the recommended guidelines for healthy aerobic exercise, and 40% identified their Body Mass Index in the Overweight or Obese categories (American College Health Association, 2018).

The second National College Health Assessment by the American College Health Association (ACHA-NCHA II) provided staggering data about the physical and mental health status of higher education students. The overwhelmingly message in this report was that student health is at risk during their higher education tenure. As valuable as these data are, it stops short of directly assessing the correlation between health conditions and retention. Additionally, the ACHA-NCHA II does not break down the data into class cohorts, so it is impossible to parse the percentage of this data experienced directly by freshmen, where most attrition is occurring. And finally, this is self-disclosed, survey-based data, so it does not give a picture of the clinical data behind these conditions. This current study sought to enhance this data set by employing survey data similar to the ACHA-NCHA II, specifically within the Idaho-resident freshmen population, in correlation with retention data and biological health markers with the goal of identifying risky health behaviors and/or conditions potentially leading to attrition.

### **Abnormal Psychology**

Diagnosing and defining mental illness is a complex, dynamic process that regularly undergoes revision and scrutiny. This process is complicated by defining what constitutes normal versus abnormal behavior, taking societal and cultural relativism into account

(Addis, 2008). For example, when does the expected sadness after the loss of a loved one cross over into an abnormal psychology depression diagnosis? Currently abnormal behavior is based on the following factors:

- professional diagnostic criteria
- distress
- deviance
- dangerousness
- dysfunctional (Nolen-Hoeksema, 2017)

The fifth edition of the Diagnostic and Statistical Manual of Mental Health Disorders (DSM-5) published by the American Psychiatric Association (APA (2013)) is currently the country's gold standard for the taxonomy and diagnosis of mental illness (Nolen-Hoeksema, 2017). The DSM-5 outlines the criteria that must be determined by professionals in order to diagnose a patient with a specific mental disorder. The DSM-5 considers other factors, such as distress and impaired functioning within their criterion. Distress is defined as the feelings of discomfort or distress that accompanies the behavior of an individual. Deviance is the departure from emotions, thoughts, or behaviors that are considered normal psychological functioning. Dangerous behaviors and feelings that pose threats to the individual or others are also often regarded as abnormal behavior. If behaviors, thoughts, and emotions interfere with a person's ability to function in their everyday life (such as communication, mobility, self-care, relationships, work or school activities, or participation in society), they are considered dysfunctional behaviors (Nolen-Hoeksema, 2017).

There are several categories of physiological theories used to approach, understand, and treat mental disorders and abnormality. These categories include Biological theories, Psychodynamic theories, Behavioral theories, Cognitive theories, Humanistic/Existential theories and Social Structure theories (Nolen-Hoeksema, 2017). Biological theories emphasize the role of biological processes (genes, biochemical, brain structure, etc.) in mental health or abnormality (Duffy, 1995). Psychodynamic theories focus on the mental events, desires, or thoughts, which often unconsciously conflict causing symptoms of abnormality. Behavioral theories focus on the role of environment on mental abnormality, primarily through reinforcement and punishment experiences. Cognitive theories primarily concentrate on the mental processes, thoughts, and belief patterns that shape behavior. Humanistic theories focus on the innate capacity of goodness of the individual, where the therapist has an unconditional positive regard towards the client. And the Social Structure theories focus on integrating the societal pressures, stresses, judgements, or relationships that may influence a person's mental state (Nolen-Hoeksema, 2017). Each theory has its own strengths and weaknesses. As such, a more contemporary theory is to integrate the Biological, Psychological, and Social (even cultural) theories together into the Biopsychosocial approach in an attempt to better explain and treat mental disorders and abnormalities. According to the Biopsychosocial model, it is a combination of factors and potentially triggers of these integrated areas that creates the vulnerabilities that leads to mental disorders. The Biopsychosocial approach to assessing physical health includes looking at biological factors, psychological factors, social and environmental factors, and the reciprocity with physical health (Nolen-Hoeksema, 2017).

Therapy, or intervention and treatment, for mental illness varies widely based on the diagnosis and prevalent theoretical framework of the professional (see Table 2.2).

Table 2.2

*Treatment methods for different theoretical frameworks of abnormal psychology.*

Biological	Behavioral	Cognitive	Humanist
Antipsychotic Drugs	Relaxation Therapy	Psychotherapy	Psychotherapy
Antidepressant Drugs	Systematic Desensitization		
Anticonvulsant Drugs	Flooding/Impulsive Therapy		
Antianxiety Drugs	Response shaping		
Electroconvulsive Therapy	Modeling/Observational Learning		

*Note.* Adapted from *Abnormal psychology*. (7<sup>th</sup> ed., p. 137-143) by S. Nolen-Hoeksema, 2017, Boston, MA: McGraw-Hill.

A number of studies have been conducted to assess the efficacy of therapies in abnormal psychology. In the 1950s one publication reviewed 24 studies on the efficacy of psychotherapy, often referred to as counseling, or talk-therapy (Eysenck, 1952). The surprising conclusion was that 72% of subjects demonstrated greater improvement when they received no therapy. However, a meta-analysis 30 years later reviewed 25,000 subjects in 375 different efficacy studies. This analysis contrastingly found that 75% of subjects receiving psychotherapy had better outcomes than subjects receiving no treatment (Smith, Glass, & Miller, 1980). A more recent 2004 study demonstrated the combination of drugs (biological) and psychotherapy generally worked better than either type of individual therapy alone (Consumer Reports, 2017). This data corroborates with the general consensus of modern abnormal psychologists, indicating mental illnesses are complex and often involve both biological and psychological components that need to be addressed for treatment to be effective (Nolen-Hoeksema, 2017; Young, 2003). Despite

this understanding, there are currently few clear biological tests or markers that definitely can be used in mental healthcare diagnoses.

The 2016 National Survey on Drug Use and Health recognized that in adults over 18-years old, nearly six million people perceived they had unmet needs in mental health services (Park-Lee, Lipari, & Hedden, 2016). These individuals identified a number of reasons that they did not seek treatment. The most prevalent inhibitions included: could not afford cost (37.2%); thought they could handle problems without treatment (31%); did not know where to go for services (26%); did not have time (21.7%); worried about negative opinions of others (12.6%); poor health insurance coverage for mental health services (11.6%); and (9%) did not want others to find out (Park-Lee, Lipari, & Hedden, 2016).

Assessment, or the process of gathering information about behaviors and symptoms, is necessary for an accurate diagnosis of a patient. Numerous clinical assessment tools have been developed for gathering information about various mental health diagnoses (Nolen-Hoeksema, 2017). The validity and reliability of these assessment tools is paramount in determining their quality and usefulness. Validity is defined as an assessment tool's ability to accurately assess what it is supposed to be assessing (Cronbach & Meehl, 1955). For example, a depression assessment should identify individuals with depression, and not anxiety. Reliability, on the other hand, is the consistency of that assessment tool in identifying what you are supposed to be identifying. The standardization of these assessment tools and their interpretation has increased both their validity and reliability (Nolen-Hoeksema, 2017). Assessments can take various form, including interviews, symptom questionnaires, personality inventories,

behavioral observation, self-monitoring, imaging (CT, PET, MRI, etc.), projective tests, psychophysiological tests, and intelligence tests (Groth-Marnat, 2003). Each assessment tool has benefits and limitations, and efforts to remove biases need to be considered and implemented. The following section briefly addresses some of the abnormal psychology disorders that are most prevalent in the higher education student community.

### **Anxiety and panic disorders.**

The prevalence of social fears indicates that some level of anxiety is common in our country (Watson, 2009). Respondent from a national survey acknowledged that public speaking is a common (30.2%) social fear. Another 15.2% admitted they had fear talking in front of a small group, 13.7% talking with others, 6.6% using the toilet away from home, 6.4% writing while someone watches, and 2.7% had fears of eating or drinking in public (Watson, 2009). Nearly half of college students identified themselves as shy and admitted to being nervous in unfamiliar social settings or meeting new people (Heiser, Turner, & Beidel, 2003). While some degree of social anxiety may be “normal,” extreme anxiety, preoccupation with social fears, and impaired functioning may indicate a social anxiety disorder. Social anxiety disorders are common, with a 12% lifetime prevalence rate in the United States, and 3-7% internationally (Lang & Stein, 2001).

Twin studies suggest there is a biological component in social anxiety disorder (Bogels et al., 2010). Cognitive theorists believe people with social anxiety disorders have excessively high standards for themselves and their social performance, and tend to over-focus on the negative aspects of social interactions (Morrison & Heimberg, 2013). Current treatment for social anxiety disorders typically involves a combination of antidepressant drugs and cognitive-behavioral therapy (Morrison & Heimberg, 2013.)



In addition to social anxiety, panic disorders can be debilitating. According to the first diagnostic criteria in the DSM-5, a panic attack is “an abrupt surge of intense fear or intense discomfort that reaches a peak within minutes” (Cameron, 2008, p.214).

Symptoms that may accompany a panic attack include heart racing/palpitations, sweating, shaking, difficulty breathing, chest pain, nausea, dizziness, numbness, and overwhelming fear of dying (Nolen-Hoeksema, 2017). As many as 28% of adults will experience at least one panic attack in their life, and these situations are usually stress-induced, and isolated events. If they become debilitating and recurrent, then a panic disorder may be diagnosed. Up to 5% of people in the United States will develop a panic disorder in their life (Craske & Waters, 2005).

There is a clear biological propensity to panic disorders, and they run in families, with a heritability factor of 48% (Wittchen, Gloster, Beesdo-Baum, Fava, & Craske, 2010). Despite the strong evidence of biological heritability from family history and twin studies, no specific biological factors have been causally identified. However, neuroimaging studies have shown difference in the limbic system (fear center of the brain) of those affected with panic disorders (Craske & Barlow, 2001). Cognitive theorists argue that catastrophic thinking patterns exacerbate panic attacks greatly. Antidepressants, benzodiazepines, and cognitive behavioral therapies are most often utilized to help these patients. However, relapse is common if these individuals discontinue their therapy (Barlow, 2011).

### **Mood disorders.**

The two major types of mood disorders include bipolar disorder and depressive disorders. While there is a spectrum of depressive disorders, they are characterized by

symptoms that negatively affect emotions, bodily functions, thoughts, behavior, and depressed mood out of proportion to any cause (Nolen-Hoeksema, 2017). According to the DSM-5 criteria, a severe incidence of debilitating depression lasting more than two weeks with five additional symptoms (including but not limited to anhedonia, psychomotor changes, suicidal ideation, sleeping, and eating changes), may be classified as major depressive disorder. More chronic forms of depression may be classified as persistent depressive disorder if the symptoms persist for most days for at least two years in adults (Horowitz et al., 1997).

As many as 16% of adults in the US will experience major depression at some point in their lifetime, with adults 18-29-years old being most often affected (Kessler et al., 2007). Women are twice as likely to experience depressive symptoms as men. Some studies suggest this is due to the physical health impairments that accompany depression, those with depressive histories die at earlier ages (Kessing, Hansen, & Anderson, 2004). Additionally, Kessler, Merikangas and Wang (2007) reported that people with major depressive disorders lose on average 27 work days a year, due to related symptoms. This resulted in an employer's loss of \$37 billion annually in productivity alone, implying that depression is something that significantly affects both society and the individuals (Kessler et al., 2007). Despite its prevalence, many people never seek or delay treatment for anxiety disorders.

There is evidence for strong biological contributions to depression, including involvement from genetic factors, neurotransmitters, brain abnormalities, and the neuroendocrine system (Pittenger & Dunman, 2008; Saveanu & Nemeroff, 2012). First degree relatives of those with a depressive disorder are 2-3 times more likely to also have

depression than those without affected relatives (Pittenger & Dunman, 2008). Twin studies also demonstrated higher concordance rates among monozygotic twins than among dizygotic twins (Saveanu & Nemeroff, 2012). Furthermore, serotonin, norepinephrine and dopamine neurotransmitters have all been implicated in depression. For example, several studies have demonstrated that dysfunction in the serotonin transporter gene leads to increased depression vulnerability and prediction (Saveanu & Nemeroff, 2012).

Neuroimaging has found consistencies in abnormal function or brain structure, particularly in the prefrontal cortex, hippocampus, anterior cingulate, and the amygdala (Brown, 2016). Hormones and the neuroendocrine system have been known to play a significant role in depression, affecting the basic functions of sleep, appetite, sexual drive, and pleasure. The hypothalamic-pituitary-adrenal (HPA) axis is typically involved in the body's fight or flight response. Typically, the hypothalamus will release corticotropin-releasing hormone (CRH) in response to a stressor, releasing corticotropin into the bloodstream and stimulating the production of cortisol by the adrenal cortex. Increased cortisol levels act in a negative feedback loop to decrease CRH levels, helping calm the body when stress is over. People with depression show abnormal cortisol levels (generally elevated), and HPA dysregulation (Saveanu & Nemeroff, 2012). The role of cortisol will be addressed in more detail later in this review.

As with most mental illnesses we have discussed, depression has psychological components in addition to the biological aspects addressed above. Behavioral theorists believe that reduced positive reinforcement in combination with increased punishment mentalities lead to depression. Additionally, they believe that those with depression may

develop learned helplessness, or they believe that nothing is within control, which further exacerbates depression (Hamman, 2005). Cognitive theorists believe that people with depression may have biased thinking patterns that promote negative views about the world, themselves, and the future (Joorman, 2010). Interpersonal theorists argue the depressed people are sensitive to rejection and seek excessive external reassurance (Liu, 2013). And sociocultural theorists seek to identify contributors to depression among different demographic groups (gender, cohorts, race, etc.) in terms of cultural and societal contexts (Kim & Lopez, 2014).

It is estimated that annually only 60% of people within the United States seek treatment for depressive disorders, despite the many forms of treatment now available (Kessler et al., 2003). Most biological treatments for mood disorders include drugs (ex. antidepressants, lithium, anticonvulsants), or even electric shock therapy in extreme scenarios. Additional treatment includes some kind of therapy, behavioral, cognitive, or combination (Rim & Gitlin, 2010). Many studies have been conducted to determine the most effective therapy for depressive disorders, with mixed results (Nolen-Hoeksema, 2017). Some studies found that cognitive-behavioral therapy alone was equally effective as antidepressant therapy alone (Thase & Denko, 2008). Other studies found that cognitive-behavioral therapy alone was more effective than drug therapy alone (Rehm, 1977). Still other studies found the most effective treatment for depressive disorders was a combination of both drug and cognitive-behavioral therapy (Bockting, Hollom, Jarrett, Kuyken, & Dobson, 2015). It is clear that there is a need for more research to better identify and treat patients with depressive disorder.

### **Suicide.**

According to the Center for Disease Control (CDC) (2018), suicide is defined as “death from injury poisoning, or suffocation where there is evidence (explicit or implicit) that the injury was self-inflicted and the decedent intended to kill himself/herself.” Suicide is a major global issue, being the third leading cause of death among people ages 15-44, with nearly one million deaths each year (Kessler et al., 2003). This is equivalent to one suicide every 40 seconds. In the United States, nearly 33,000 people commit suicide every year, with nearly 3% of the entire population making a suicide attempt at some point in their lives (Hamman, 2005). Perhaps unsurprisingly, suicide and suicide attempts have strong links to mental illness, particularly depressive disorder, anxiety disorders, substance abuse, and schizophrenia (Nock & Kessler, 2006). As previously highlighted, many of these disorders are common among students in higher education, so it is appropriate to include suicide in this discussion of mental illness.

Despite the global presence, suicide and suicide attempts have significant demographic differences. For example, women are 2-3 times more likely to attempt suicide than men, however men are four times more likely to complete suicide. The difference is often attributed to the gender differences in methodology chosen (Nock & Kessler, 2006). Suicide among young children is uncommon, but by adolescence 17% of teenagers in the United States have seriously considered suicide, and 2% make a serious attempt. Additionally, 9% of college students have seriously contemplated suicide, and 1% say they have attempted suicide while in college (Ross, Neibling, & Heckert, 1999). A 2001 study showed that student with depression were more likely to have contemplated or attempted suicide. Shockingly, this study also reported that only 20% of students that

contemplate suicide sought for any type or professional help (Furr, Westefeld, McConnell, & Jenkins, 2001).

As stated, suicide may be tied to mental illnesses. Feelings of hopelessness and impulsivity have been shown as predictors of suicide or suicide attempts (Nock & Kessler, 2006). Increased suicide risks include serious illnesses, economic hardships, loss, abuse, or other negative life events and circumstances. Biological studies of families, twins, and adoptions have shown there is a genetic vulnerability towards suicide (Nock & Kessler, 2006). Furthermore, several studies have shown that low serotonin levels correlate with suicide (Asberg & Forslund, 2000; Mann, Brent & Arango, 2001). Treatment and intervention for suicide are needed immediately. Suicide hotline and crises intervention programs are available to provide immediate support. Lithium and antidepressants are the most common drug therapies for suicidal patients. Psychotherapy treatment is similar to that for depressive disorders (Furr et al., 2001).

### **Mental health in higher education.**

Mental illness is a common condition defined as changes to a person's thinking, emotions, and/or behavior. Mental illnesses are detrimental as they often disrupt effective functioning in daily activities, such as work, school, relationships, or the ability to cope with adversity (Parekh, 2015). According to the American Psychiatric Association (2013), one out of every five Americans will experience some form of mental illness in their lifetime, with more than 60 million people suffering in any given year. One in 24 will suffer a serious mental illness, and one in 12 will experience substance abuse problems (Kerr, 2017). Mental health is an increasing concern among college-aged student. In fact, suicide is the second leading cause of death in the 15-34 college-aged

demographic (Kerr, 2017). Chickering (1969) claimed that the transition to college raises tremendous inner turmoil as students begin questioning their relationships, values, direction and self-worth. This college experience can lead to personal crises for many, often contributing to the anxiety that can lead to attrition (Pappas & Loring, 1985). The American College Health Association (2017) found that over 30% of college students in America reported students having difficulties in their day-to-day functions due to feelings of depression (American College, 2017).

The American College Health Association (ACHA) is a diverse leadership organization with the mission to “assist college health service providers, health educators, counselors, and administrators in collecting data about their students' habits, behaviors, and perceptions on the most prevalent health topics” (American College Health Association, 2018). In 2000, the ACHA initiated their first survey called the National College Health Assessment (NCHA) which collected higher education student health data for eight years, which was published in 2008. This report included data from over one million students at 624 college campuses across the country, becoming the largest known data set regarding the physical and mental health of higher education students. A revised survey was initiated after its' publication. The ACHA-NCHA II was recently published in 2018, presenting data from the previous decade, from the time the original report was published (American College Health Association, 2018).

The mental health data from the ACHA-NCHA II is concerning. Surveyed students reported that 53.4% had felt hopeless, 87.4% had felt overwhelmed, 84.3% felt exhausted, and 62.8% felt lonely, 68.7% felt very sad, 41.9% had experienced debilitating depression, 63.4% experience overwhelming anxiety, and 12.1% had

seriously considered suicide in the past 12 months. Only 1.7% of students surveyed had attempted suicide, but 7.8% reported bruising, cutting, or otherwise harming themselves. Other studies have identified suicidal ideation among college students as high as 16.1% (Kerr, 2017). Despite the prevalence of mental health issues reported, only 9.3% of survey respondents had sought treatment from a professional in the past year (American College Health Association, 2018).

The Association for University and College Counseling Centers Directors (AUCCCD, 2012) conducted a survey of over 400 directors of higher education mental health and counseling clinics. This report indicated that 57.7% of directors perceived increased number of students with severe psychological issues, when compared with the previous year. A full 95.6% of directors felt these students posed a growing concern on their respective campuses (AUCCCD, 2012). Anxiety and depression were reported as the primary presenting concerns by students visiting these clinics, comprising 41.6% and 35.4% of cases, respectively (AUCCCD, 2012).

Twenge (2000) performed a meta-analysis of four decades (1952-1993) of college-aged mental health data and found that levels of anxiety in young adults have escalated significantly. What had once been considered severe anxiety in the 1950s, is now considered average anxiety. Additionally, the use of psychotropic medications has increased from 18.6 to 59.1 per every 1000 young adults during this same time period (Zito et al., 2003).

Factors that lead to these mental health challenges in young adults are as complex as they are diverse. Socioeconomic status, living situations, personal burden, and intelligence levels are just a few of the factors identified (Kerr, 2017). Duffett and



Johnson (2004) indicated that 22% of students claimed their schedule was too hectic. Similarly, Sharkin (2006) claimed that students were victims of a culture where self-worth and identity are derived from their accomplishments, resulting in disappointment, shame, anxiety, and depression if their expectations and reality did not align.

Universities recognize the challenges faced by first-year students, however, despite best attempts to provide positive transitions into higher education, the freshman year has proved to be hazardous to a student's mental and physical health (Kerr, 2017). Routine college habits such as lack of sleep, poor diet, lack of exercise, and stress are a recipe for depression among college students (Ross, Neibling, & Heckert, 1999). The financial strain of tuition and fees further exacerbates the mental anxiety of students, particularly freshman (Sharkin, 2006).

Not surprisingly, college success is directly affected by common collegiate psychopathologies (Jones, 2008). Grades, attendance, and course persistence are all negatively affected by mental illness, often leading to attrition (Sharkin, 2006). While 35% of all college students suffers from some form of mental illness, 75% of affected college students decline to seek help for their mental health problems, many (34%) failing to recognize they even need help ("Mental illness facts", 2013). The American College Health Association (2018) cited depression and anxiety as one of the top obstructions to academic performance, with 64% of college attrition resulting from mental health concerns. Nearly half (45%) of these students who dropped out due to mental health concerns never sought support or accommodations for their condition while enrolled (Sharkin, 2006). This data undoubtedly makes the case for the importance of addressing the mental health support needed by all students on college campuses.

### **Psychological disorders and physical health.**

The literature is clear that the mental health disorders have strong biological components. Therefore, it comes as no surprise that those persons with psychological disorder have more physical health problems than those without psychological disorders (Chen et al., 2009). For example, depression specifically has been correlated to increased incidences of cancer, heart disease, diabetes, arthritis, and asthma (Everson-Rose & Lewis, 2005; Katon, 2003). The correlation between psychopathology and medical conditions may be causative, genetically linked, or be a result of poor coping and health-related behaviors. Conditions such as chronic stress can suppress the immune system, causing cortisol abnormalities, sickness, and coronary artery disease. Stress is also a frequent contributor to poor sleep. Mortality rates for those sleeping less than seven hours a night is 70% higher than their counterpart (Nolen-Hoeksema, 2017). Sleep deprivation also impairs memory, learning, and decision-making, all of which are critical skills for higher education students.

Endocrine and neurological conditions can be assessed with clinical lab results to see if they are contributing to mental health symptoms (“Mental illness”, 2018). Hypothyroidism, or an underactive thyroid, is the most common medical condition associated with symptoms of depression (Goldberg, 2016). The most definitive lab test of thyroid function is called the thyroid-stimulating hormone (TSH). High levels of TSH indicate an underactive thyroid, and results in symptoms of fatigue, irritability, weight gain, and depression (Vellanki, 2014). Fortunately, if diagnosed, treatment with synthetic hormones is safe and effective for countering thyroid problems (Goldberg, 2016).

Another common test in mental illness monitoring and detection is cortisol.

Cortisol is a hormone that helps control blood sugar, regulate metabolism, and assist with memory formation (“What is cortisol,” 2018). Chronic stress leads to elevated cortisol levels, giving it the nickname the stress hormone (Goldberg, 2016). Abnormal cortisol levels have been linked to depression, decreasing serotonin in the brain, irritability, inability to handle stress, and fatigue (Goldberg, 2016). While many other tests exist to help aid identification of depression and stress, TSH and cortisol are universally accepted as the best tests for initial monitoring and detection of clinical health issues related to depression and stress. Collectively, the literature suggests there are correlating influences in social factors, biological factors, and psychological factors.

### **Mental health assessment and screening tools.**

Mental health illness is a term collectively used to describe over 200 diverse disorders, including anxiety or panic disorders, bipolar disorders, depression, eating disorders, schizophrenia, and substance abuse (Parekh, 2015). Despite being widespread, there is both public and self-imposed stigmas associated with mental illnesses, resulting in very few affected individuals seeking or retaining treatment. Stigmas against mental health can be classified into three categories: stereotypes, prejudice, and discrimination (Corrigan & Watson, 2002). In fact, studies suggest that most U.S. citizens hold some form of negative stigma against mental health illnesses (Corrigan & Watson, 2002). Education, communication, and more research is required to combat these stigmas.

There is a myriad of symptoms that act as mental health warning signs and symptoms. They generally occur as a persistent cluster of symptoms. Some of the warning signs in young adults include:

- Substance abuse;
- Inability to cope with problems and daily activities;
- Changes in sleeping and/or eating habits;
- Excessive complaints of physical ailments;
- Defiance of authority, truancy, theft, and/or vandalism;
- Intense fear of weight gain;
- Prolonged negative mood, often accompanied by poor appetite or thoughts of death;
- Frequent outbursts of anger;

Symptoms and signs are not adequate by themselves to diagnose a mental illness. A medical professional, or licensed mental health professional will diagnose a mental illness through a physical examination, family history, and other diagnostic tests (“What is mental illness,” n.d.).

There are a number of validated screening tools available to assist in the diagnosis and monitoring of mental health symptoms. Most screening tools are checklists or questionnaires acting as informal symptom checkers. However, assessment tools can also include observation, interviews, rating scales, and standardized tests (“Mental health screening tools”, 2018) The delivery of the screening tools can vary widely, depending on the preference and motivations of the provider. Screening tests can be formal, informal, self-administered, therapist-administered, and conducted at any time in the therapy/counseling process. These screening tools assist professionals in creating treatment plans, examining progress, and measuring the achievement of goal (“What is mental illness,” n.d.).

Screening tools are commonly used in health centers and counseling offices as a means to ascertain information to aid in mental health assessments. Professionals most often choose from the validated and endorsed screening tools when initially assessing mental health illnesses. The three most highly-endorsed methods are the Patient Health Questionnaire (PHQ-9), the Hospital Anxiety and Depression subscale (HAD-D); and the Beck Depression Inventory, Second Edition (BDI-II) (Cameron, 2008). Of these, the PHQ-9 is the most widely used tool in the diagnosis and monitoring of depression (Cameron, 2008). The PHQ-9 is especially beneficial in its ability to measure the severity of depression, due to the frequency of symptoms being reported. The PHQ-9 is advantageous in a clinical setting because it can be quickly self-administered by patients, taking only three minutes to complete. Furthermore, the repetition of the PHQ-9 survey allows for clinicians to monitor the depressive state of the patient to assess whether they are improving or regressing over the course of treatment (Kroenke, Spitzwer, & William, 2001).

As indicated by its name, the PHQ-9 is a 9-item self-administered questionnaire designed to evaluate depressive symptoms experienced by participants over the previous two-week period. The prompts follow the diagnostic criteria guidelines for major depressive disorder published in the 4<sup>th</sup> edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), written by the American Psychiatric Association (Cameron, 2008):

1. Little interest or pleasure in doing things;
2. Feeling down, depressed, or hopeless;
3. Trouble falling asleep, staying asleep, or sleeping too much;

4. Feeling tired or having little energy;
5. Poor appetite or overeating;
6. Feeling bad about yourself, feeling that you are a failure, or feeling that you have let yourself or your family down;
7. Trouble concentrating on things such as reading the newspaper or watching television;
8. Moving or speaking so slowly that other people could have noticed. Or being so fidgety or restless that you have been moving around a lot more than usual;
9. Thinking that you would be better off dead or that you want to hurt yourself in some way.

Each of the nine questions is scored individually from 0 to 3, to determine frequency of thoughts or symptoms, with 0 indicating never, 1 indicating every several days, 2 indicating more than half the days, and 3 indicating nearly every day. Major depression is diagnosed if five or more of the nine depressive symptom questions have been present with a score of 2, indicating more than half the days, during the past two weeks, and if one of the symptoms is depressed mood or lack of interest (Kroenke, Spitzwer, & William, 2001). Scoring of the PHQ-9 questionnaire ranges from 0 to 27 points to determine the severity of depressive symptoms in participants. A score of 0 indicates an absence of depressive symptoms, while a score of 27 indicates the most severe depressive symptoms. In general, total scores of 5, 10, 15, and 20 on the PHQ-9 survey represent mild, moderate, moderately severe, and severe depression, respectively (Kroenke, Spitzwer, & William, 2001).

Urasaki (2009) used the PHQ-9 survey to examine depression in 260 college students, particularly looking at the correlation between lifestyle and depressive symptoms. This study found that PHQ-9 scores were significantly higher in first-year students, as opposed to fourth-year students (Urasaki, 2009). Furthermore, students who self-reported feeling stressed, had significantly higher PHQ-9 scores than those who did not report feeling chronic stress in college. Students who had poor sleeping habits, as defined by less than five hours of sleep a night, also had significantly higher PHQ-9 scores than those receiving six or more hours of sleep (Urasaki, 2009). This study not only indicated the strong correlation between depressive symptoms and the typical college lifestyle, but it also confirmed the validity of using the PHQ-9 study to monitor depressive symptoms in the collegiate population.

Counseling services for mental illness are widely available in higher education institutions. There are many questionnaires available which vary based on the type of mental illness in question (Mental health, 2018). The Patient Health Questionnaire (PHQ-9) is a well-validated, commonly-used diagnostic instrument used for assessing, monitoring, and diagnosing mental illness, particularly depression (Kroenke, Spitzwer, & William, 2001). As such, the PHQ-9 was used in this study to gain information on depressive symptoms among Idaho-resident freshmen. However, a psychological exam is limited in its scope. Ideally, lab testing should be used in connection with questionnaires to determine physiological elements that may indicate or contribute to depression or other mental illnesses (“Mental illness,” 2018).

**Abnormal psychology summary.**

Mental illness is a common condition resulting in changes to a person's thinking, emotions, and/or behavior (Nolen-Hoeksema, 2017). This condition often disrupts effective functioning in daily activities, such as work, school, relationships, or the ability to cope with adversity (Parekh, 2015). Mental health illness is a term collectively used to describe over 200 diverse disorders, including anxiety or panic disorders, bipolar disorders, depression, eating disorders, schizophrenia, and substance abuse (Parekh, 2015.). Despite the social stigmas associated with mental illness, it is widespread. According to the American Psychiatric Association, one out of every five Americans will experience some form of mental illness in their lifetime, one in twenty-four will suffer a serious mental illness, and one in twelve will experience substance abuse problems (Parekh, 2015). Additionally, one out of every four college students suffer from some form of mental illness, with 44% of American college students reporting various forms of depression (Kerr, 2017). Additionally, college students have been shown to possess a unique set of stressors, which can negatively affect their academic success and lead to attrition. These stressors include academic stress, financial stress, personal stress, and stress about the future (Hansen, n.d.). Despite these concerns, 75% of affected college students decline to seek help for their mental health problems ("Mental illness facts," 2013). The use of a predictive analysis model may be used to identify these students and offer services and systems that may help alleviate these concerns and contribute to academic success ("Predictive analytics," 2016). In order to develop such a model, accurate detection and intervention is critical.



The pathologies listed in this review are in no way exhaustive of the disorders that plague students in higher education. They may be as broad and diverse as the student body that they represent. Other disorders of note include eating disorders, substance abuse disorders, sexual disorders, and conduct disorders, all of which have both biological and psychological factors. Conclusively, there is strong biological evidence contributing to abnormal psychologies that contribute to poor academic performance and potentially retention. There is currently no predictive model looking at the biological contributions to psychological maladies that plague higher education.

### **Laboratory Biomarkers**

Clinical laboratory testing is an essential element in gathering information for health assessment. Anomalies in results can become biomarkers for the diagnosis, prevention, or treatment of disease (Rohr et al., 2016). Laboratory testing can also be predictive of certain diseases states, for example elevated blood sugar may indicate pre-diabetic conditions (Burtis & Bruns, 2015). There are more than 6000 laboratory tests available, and more than 10 billion tests are performed annually in the United States (Ngo, Ghandi, & Miller, 2017). While laboratory tests guide more than 70% of medical decisions, only 1% of funds allocated to healthcare around the world are dedicated to diagnostic tests (Hallworth, 2011). One study from an outpatient clinic demonstrated that 45% of patients who returned to the clinic with lab results had their diagnosis or treatment plans changed (Carter et al., 2012).

Laboratory testing typically begins with a physician or other clinician ordering lab tests to diagnose, treat, manage, or monitor a patient's condition. The process begins with the collection of a sample of blood, tissue, or other biological specimen from the patient,

which is then sent to the laboratory where it analyzed by trained, certified laboratory professionals. Once the testing is complete, the lab issues a report with the findings. Subsequently, informed decisions can be made as to most appropriate treatment for the patient (Burtis & Bruns, 2015).

An additional benefit of laboratory testing is its ability to keep medical costs contained. For example, one report compared the medical costs of two patients over 20 years, one with laboratory monitored and contained diabetes, and the other with unmonitored and uncontrolled diabetes. Treatment and intervention guided by laboratory tests resulted in the first patient paying only \$1,684 in medical expenses, while the uncontrolled patient paid \$80,553, with most costs incurred by resulting dialysis and limb amputation (Strack et al., 2014). This example shows how laboratory tests can help avoid serious complications and save individuals thousands in medical costs through early detection and intervention.

In the previous section, the literature demonstrated the inability to separate mental and physical well-being. In fact, psychiatry has been cited as having a disease-related burden greater than any other single medical diagnostic category (Prince et al., 2007). However, there is still a gap in connecting physical and mental health research funding and publication (Kingdon & Wykes, 2013; Vivekanantham et al., 2016). There is a need to improve diagnostic criteria and associated treatments. The evidence for depression, for example, shows biomarkers reflecting activity in inflammatory, neuroendocrine, and metabolic systems, and may be predictive of physical health outcomes (Strawbridge, Young, and Cleare, 2017).

An extensive meta-analysis was published in 2017 regarding biomarkers for depression, and reported strong significance for inflammation activity involved in the disease process (Strawbridge, Young, & Cleare, 2017). Proinflammatory markers were higher in depressed patients compared to their counterparts, and anti-inflammatory treatments were shown to decrease depression severity (Haapakoski, Mathieu, Ebmeirer, & Kivimaki, 2015; Kohler, 2014). C-Reactive Protein (CRP), a marker of inflammation, was found significantly elevated ( $P, 0.001$ ) in over 20 depression studies (Strawbridge, Young, & Cleare, 2017). Due to the strength of the literature, this study will look at C-Reactive Protein (CRP) as a marker for inflammation in correlation to the PHQ-9 depression data and student success indices.

The Strawbridge, Young and Cleare (2017) meta-analysis demonstrated that the neuroendocrine system is also significantly predictive of depression, reporting higher cortisol levels and abnormal thyroid tests in patients with poorer therapy responses. Additionally, hypothyroidism is well-established as being a cause of depressed mood (Hage & Azar, 2011). Cortisol and thyroid stimulating hormone (TSH), as the most common markers to initially evaluate stress and depression will also be utilized in this study.

Finally, there has been strong evidence linking the metabolic system with depression. Specifically, lipid profiles, glucose, and albumin have been shown significantly altered in depression research (Strawbridge, Young, & Cleare, 2017). Lipid profiles, including HDL-cholesterol, appear increased in many patients with depression, even when accounting for comorbidities (Liu et al., 2016). Additionally, hyperglycemia, and hypoalbuminemia have been significantly reported in depressed patients (Kan et al.,

2013; Maes, 1995). To assess these results in this study, I utilize the comprehensive metabolic panel (CMP), which includes albumin and glucose testing, in addition to running lipid panels and coronary risk assessment.

In addition to the CRP, cortisol, TSH, CMP, lipid panel testing, this study will assay the complete blood count (CBC) of participants. While the CBC has not been known to be predictive of stress or depression, it is the single most commonly ordered laboratory test which is used as a general indicator of health and blood measurements (Burtis & Bruns, 2015). The following sections in this chapter will review the comprehensive laboratory testing utilized in this study.

### **C-reactive protein (CRP)**

The CRP assay is an acute phase reactant that is produced by the liver. It increases in response to infection and helps to clear the infection by binding to nucleic acids (viruses), bacteria, fungi, and protozoans; this activates the classic complement pathway and results in lysis of the infecting organism (Burtis & Bruns, 2015). CRP is also used as a marker of inflammation, and it increases in response to myocardial infarction, stress, trauma, and surgery. CRP can also be an indicator of atherosclerosis. Levels of CRP that are above the reference range (but not as high as those seen in infection) correlate with a higher risk of developing coronary heart disease (Burtis & Bruns, 2015).

### **Cortisol and depression**

Cortisol is a glucocorticoid class steroid hormone produced by the adrenal gland on top of the kidneys. The hypothalamus and pituitary gland in the brain act via negative feedback inhibition pathways to monitor the levels of cortisol hormone in the blood (“What is cortisol,” 2018). Cortisol plays a critical role in maintaining health and homeostasis in

the human body in numerous capacities. Cortisol has roles in lowering inflammation, regulating blood pressure, establishing sleep cycles, increasing blood glucose, boosting energy, and managing the body's use of carbohydrates, fats, and proteins. Cortisol also acts as an internal alarm system, working to control mood, motivation, and fear through the fight or flight sympathetic nervous system mechanism (Bergland, 2013). Chronic stress prompts the adrenal glands to produce increased amounts of cortisol, which can result in a myriad of clinical manifestations ("What is cortisol," 2018). Elevated levels of cortisol cause impaired immune responses, inhibited memory formation, decreased ability to learn, and increased risk for heart disease (Hansen, 2017). These symptoms have given cortisol the nickname of stress hormone (Bergland, 2013). Abnormal cortisol levels have been linked to depression, decreasing serotonin in the brain, causing irritability, inability to handle stress, and fatigue (Goldberg, 2016).

Cortisol levels exhibit a phenomenon known as diurnal variation, meaning that levels are naturally elevated in the morning, and decrease throughout the course of the day. Therefore, to accurately analyze cortisol levels, both a morning and evening samples are needed, often around 8am and 4pm, respectively (Goldberg, 2016). Cortisol can be analyzed from saliva, urine, or blood samples. While bloodwork is typically more accurate and sensitive, saliva has proven to have strong enough correlation to be validated as a less invasive option of monitoring cortisol (Lee, n.d).

Cortisol levels are influenced by both chronic and acute stress. Acute stress will result in spikes of cortisol that rapidly return to normal, and often would be underreported by clinical cortisol testing (Hansen, 2017). Chronic stress, however, results in higher levels of cortisol throughout the day, more easily measurable in cortisol bloodwork (Hansen,

2017). In 2016, a study of saliva cortisol samples demonstrated increased cortisol levels among first-year college students who reported feeling stressed (Sladek, Dohne, & Eisenberg, 2016). Furthermore, chronic stress can lead to an adrenal fatigue, resulting in a dramatic decrease in both cortisol and other key hormones like aldosterone, testosterone, and epinephrine (Goldberg, 2016). The resulting clinical symptoms include insomnia, fatigue, depression, and lack of vitality. Certain behaviors such as physical activity, meditation, laughter, social connectivity, and listening to music have been shown to naturally lower cortisol levels (Goldberg, 2016).

### **Thyroid stimulating hormone (TSH) and anxiety.**

The thyroid is a butterfly-shaped endocrine organ located on the front of the neck. The primary purpose of the thyroid is to produce hormones that regulate metabolism in the human body (Brady, 2017). These thyroid hormones are responsible for controlling vital functions, including:

- Breathing
- Heart rate
- Central and peripheral nervous systems
- Body weight
- Muscle strength
- Menstrual cycles
- Body temperature
- Cholesterol levels (Brady, 2017)

The thyroid uses iodine from food to make Triiodothyronine (T3) and Thyroxine (T4) hormones. T3 and T4 levels must be carefully regulated by the hypothalamus and

pituitary to maintain proper hormonal balance. The hypothalamus regulates this balance by creating thyroid releasing hormone (TRH) which regulates the level of thyroid stimulating hormone (TSH) (“What is a TSH test,” 2017). The levels of TSH are directly responsible for stimulating the pituitary to increase or decrease the level of T3 and T4. Low levels of T3 and T4 cause the pituitary to release more TSH, which will signal the thyroid to create more T3 and T4 (“TSH,” 2017). Alternatively, if T3 and T4 levels are elevated, less TSH is produced by the pituitary (Orenstein, 2017). Deregulation of these hormone levels results in problems with metabolism.

The TSH blood test is the standard screening assay to determine thyroid function. Due to TSH fluctuations, blood samples should be collected in the morning. The normal TSH blood reference range is 0.4 to 5 milli-international units per liter (mIU/L) (“What is a TSH test,” 2017). TSH levels higher than this range indicate an underactive thyroid. However, pregnancy and steroid medications can also cause elevated TSH levels. Hypothyroidism is the condition of an underactive thyroid (Orenstein, 2017). Hypothyroidism (low levels of T3 & T4) can cause depression, difficulty concentrating, tiredness and fatigue, and trouble sleeping. Alternatively, TSH level under the reference range indicate an overactive thyroid. An overactive thyroid is termed hyperthyroidism (Brady, 2017). Hyperthyroidism (elevated levels of T3 & T4) can cause anxiety, irritability, nervousness, and hair loss. T3, and T4 blood assays would generally be ordered if an abnormal TSH result occurred.

The American Thyroid Association estimates that as many as 20 million Americans suffer from some kind of thyroid disease, with up to 60% of them being unaware of their condition (Prevalence, n.d.). One out every eight women will develop a

thyroid disease, and women are eight times more likely to have a thyroid condition than men (Prevalence, n.d.). In 2015, a study of nearly 1300 college students in India confirmed one out of every eight participants had a thyroid dysfunction, demonstrated by mildly elevated TSH levels (Velayuthum, Selvan, & Unnikrishnan, 2015). Although India is known to have increased thyroid conditions due to iodine deficiencies, it stands to reason that many American college students may be suffering from undiagnosed thyroid dysfunctions. This is further supported by the 20% of college students that are being affected by anxiety or depression. In fact, anxiety among college students has risen sharply by 30% since 2014, and is now the most common mental health diagnosis in college students (Brown, 2016). Nevertheless, there has been little data collected in connection with the clinical evaluation of the thyroid in U.S. higher education students.

### **Comprehensive metabolic panel (CMP).**

The comprehensive metabolic panel (CMP) is a group of 14 tests that assess overall health and organ function. Included tests are glucose and calcium. Kidney function is assessed by blood urea nitrogen (BUN) and creatinine. Levels of albumin, total protein, bilirubin, alkaline phosphatase (ALP), alanine aminotransferase (ALT), and aspartate aminotransferase (AST) assess liver status. Sodium, potassium, chloride, and carbon dioxide levels assess electrolyte balance. Information for this section was summarized from Burtis and Bruns (2015).

- Glucose is the body's main energy source. The brain can only use glucose. Blood glucose levels outside of the reference range can indicate a disorder of carbohydrate metabolism. High blood sugar, hyperglycemia, is a symptom of diabetes mellitus. The majority of diabetes mellitus is type 2, in which insulin



action is impaired. In contrast, type 1 diabetes mellitus is characterized by an insulin deficiency due to loss of pancreatic islet beta cells. A small percentage of diabetes mellitus cases is due to another disease or condition such as infection, Cushing syndrome, administration of certain hormones or drugs, or some genetic conditions. Low blood sugar, hypoglycemia, in people other than those with diabetes mellitus is rare. It can be caused by septicemia, end-stage renal failure, certain drugs, tumors, antibodies to insulin or the insulin receptor, and inborn errors of metabolism.

- Calcium is important for muscle contraction, bone mineralization, and blood coagulation, as well as many other functions. It also affects cell permeability and excitability. Hypocalcemia (low total serum calcium) can be caused by chronic renal failure, hypoparathyroidism, and vitamin D deficiency. Primary hyperparathyroidism and malignancy are the main causes of hypercalcemia.
- Blood urea nitrogen is a waste product made by the liver as a result of protein metabolism. It is normally cleared by the kidneys and excreted in the urine. Elevation of blood urea nitrogen (BUN) results when there is kidney damage. A decreased BUN can occur with liver damage.
- Creatinine is also a waste product; it is formed from creatine and phosphocreatine breakdown in muscle. It is cleared by the kidney and is used in calculating the glomerular filtration rate (GFR). Elevations in creatinine indicate kidney dysfunction, because creatinine cannot be cleared by the kidneys.

- Albumin is the most abundant protein found in plasma and is a major contributor to colloidal oncotic pressure in the vascular space. It also acts as a carrier of other compounds in the blood (free fatty acids, calcium, & hormones). It is produced by the liver. Increased levels of albumin occur with dehydration. Decreased levels of albumin occur with inflammation, burns, edema, chronic liver disease, and kidney disease.
- Total protein is comprised of a diverse group of proteins found in the plasma. Albumin comprises approximately half of the total protein. Total protein is decreased in chronic renal disease and nephrotic syndrome, and may be decreased in acute inflammation and chronic hepatic disease. It is increased in multiple myeloma and may be increased in dehydration.
- Bilirubin is a pigment that results from the breakdown of red blood cells. It binds to albumin in the blood and is transported to the liver for processing and excretion. Elevated bilirubin occurs with hepatitis and cholestasis. If only bilirubin is elevated and other liver enzymes are normal, an inherited disorder of bilirubin metabolism (such as Gilbert syndrome, Crigler-Najjar Syndrome, or Dubin-Johnson syndrome) or increased breakdown of red blood cells (hemolysis) are indicated.
- Alkaline phosphatase (ALP) is an enzyme that is associated with bile duct obstruction caused by a tumor or gallstone. Elevation of ALP is also associated with primary biliary cirrhosis and primary sclerosing cholangitis.
- Alanine aminotransferase (ALT) is a liver-associated enzyme that is released from injured cells; it is more specific to liver disease than AST. It is elevated

in acute hepatitis (viral, alcoholic, toxic) and chronic hepatitis (viral, autoimmune).

- Aspartate aminotransferase (AST) is a liver-associated enzyme that is released from injured cells; it is elevated in liver disease. An AST level greater than ALT occurs in alcoholic disease and cirrhosis. Muscle or heart injury can also cause an elevated AST.
- Sodium ( $\text{Na}^+$ ) is the main extracellular cation, and it is a major contributor to the osmotic strength of plasma. It is also important in water distribution and membrane excitability. A decreased sodium concentration (hyponatremia) can occur as a result of the loss of sodium ions (prolonged vomiting, burns, hypothyroidism, diuretics) or a dilutional effect of excess water (renal failure, congestive heart failure, cirrhosis). An increased sodium concentration (hypernatremia) can be caused by dehydration or diabetes insipidus.
- Potassium ( $\text{K}^+$ ) is the main intracellular cation. It contributes to the membrane potential of excitable cells (neurons and cardiac cells). Low potassium levels (hypokalemia) can occur with kidney dysfunction, diarrhea, and Cushing syndrome. High potassium levels (hyperkalemia) occur with diabetic ketoacidosis, acute renal disease and end-stage renal failure, Addison disease, and the use of certain diuretics.
- Chloride ( $\text{Cl}^-$ ) is the main extracellular anion. It is involved in the maintenance of osmotic pressure, water balance, and anion-cation balance. The chloride concentration usually parallels that of sodium. Decreased chloride concentrations (hypochloremia) have the same causes as

hyponatremia, and increased chloride concentrations (hyperchloremia) have the same causes as hypernatremia.

- Carbon dioxide (CO<sub>2</sub>) is involved in the buffer system that maintains a steady pH. Low levels can be caused by diabetic ketoacidosis, shock, kidney disease, and shock. High levels can be caused by vomiting and/or diarrhea, chronic obstructive pulmonary disease, Cushing syndrome, and metabolic alkalosis

### **Lipid panel and coronary risk profile.**

The lipid panel is a measure of a patient's triglyceride, cholesterol, and lipoprotein content. Triglycerides are the main fat energy source in the body, and elevated triglycerides are a risk factor for coronary heart disease ("Cholesterol test," 2019). Cholesterol is a sterol lipid found in all cells of the body. Cholesterol tests are broken down into total cholesterol, high-density lipoprotein (HDL) cholesterol, and low-density lipoprotein (LDL) cholesterol levels (Cholesterol panel, 2019). Like triglycerides, elevated total cholesterol levels put patients at high risk for cardiovascular disease. HDL is considered "good" cholesterol, while LDL cholesterol is considered "bad" cholesterol. LDL cholesterol can deposit in vessels and cause atherosclerosis ("Cholesterol test," 2019). The ratio of dividing total cholesterol by HDL cholesterol is known as the coronary risk profile. Any ratio above a 5 is considered high risk for heart disease. Elevated triglycerides, total cholesterol and LDL may be effectively treated by diet, exercise and medication ("Cholesterol test," 2019).

### **Complete blood count (CBC).**

The complete blood count (CBC) is a panel consisting of measures of the cellular components of the blood (red blood cells, white blood cells, and platelets.)

Information for this section was summarized from Keohane, Smith and Welenga (2016).

- White blood cell (WBC) count – This is the count of all WBCs. A high WBC count is relatively nonspecific, and this can occur due to infection or leukemia. WBCs can be further differentiated into five types: neutrophils, lymphocytes, monocytes, eosinophils, and basophils. A high neutrophil count is associated with bacterial infections, and a low count can be due to viral infections or certain medications. A high lymphocyte count is associated with viral infections, and a low count can occur with immunodeficiency. A high monocyte count may occur with certain viral infections and leukemia. An elevated eosinophil count is associated with allergic reactions or parasitic infections. An elevated basophil count can occur with allergic reactions, chronic infections, and leukemia.
- Red blood cell (RBC) count – The RBC count will be low in some types of anemia. It will also be low in other disorders, such as iron deficiency, kidney disease, autoimmune disorders, and certain infections.
- Hemoglobin – Hemoglobin is a molecule associated with RBCs that is responsible for the transport of oxygen and carbon dioxide between the lungs and organs. A low hemoglobin level points to an anemia of some kind.
- Hematocrit – Hematocrit is the volume occupied by packed RBCs compared to the total volume of whole blood. It is low in anemia, but it is a less reliable indicator of anemia than hemoglobin.
- Mean cell volume (MCV)– This is the average RBC volume. This can assist in the determination of the type of anemia that is present. Some anemias, such as

iron-deficiency anemia, present as microcytic (smaller than average RBC volume). Other anemias, such as folate-deficiency anemia, present as macrocytic (larger than average RBC volume).

- Mean cell hemoglobin – This is the average mass of hemoglobin per RBC.
- Mean cell hemoglobin concentration (MCHC) – This is the average relative hemoglobin concentration per RBC. This is one of the RBC indices that can help classify an anemia. A low MCHC is seen in iron-deficiency anemia and anemia of inflammation. A high MCHC occurs when RBCs become spherical; this occurs in a specific genetic disorder (hereditary spherocytosis) and in an autoimmune disease (immune hemolytic anemia).
- Red cell distribution width (RDW) – This is a measure of the variation of red blood cell volumes. An increased RDW means that there is a large variation in RBC sizes. An elevated RDW is often seen in certain anemias. It can be the first sign of iron-deficiency anemia. In contrast, other types of anemias are associated with a normal RDW.
- Platelet count – This is a count of platelets, which are cells that assist in clotting. There are many causes of a low platelet count, including certain medications, autoimmune diseases, genetic disorders, and certain infections. High platelet counts are associated with chronic inflammation, infection, kidney disease, and certain cancers.
- Mean platelet volume – This is a measure of the size (volume) of the platelets. Platelets that are larger than normal are seen in a number of genetic disorders.

Platelets that are smaller than normal are seen in certain other genetic disorders and certain viral infections.

### **Biomarker summary.**

Laboratory testing is a critical part of effectively monitoring and treating health anomalies. For this study, CRP, cortisol, TSH, CMP, lipid panels, and CBC assays have been utilized for their significance as biomarkers in assessing both physical and mental health conditions commonly found in higher education student populations. There are certainly numerous additional laboratory biomarkers that may have proved significant and relevant, however, additional assays were cost-prohibitive for the scope of this study. Establishing significance changes in the ISU freshmen health status via longitudinal biomarker analysis, and consequently looking at their correlations to retention indices may identify novel variables and strategies for reducing attrition in the ISU freshmen population, or college populations in general

### **Chapter Summary**

Attrition in higher education is a pervasive problem, and freshmen are predominantly at-risk. The state of Idaho is particularly affected, with abysmal higher education go-on and graduation rates. Retention theory establishes that there is no single cause for attrition, and that campus-wide efforts are needed to reverse the troubling retention trends. Both mental and physical health conditions of students in higher education are also troubling, and this study hypothesized that these health conditions are contributing to the retention crises. A novel combination of survey-based data and biomarker analysis was used to assess the health trends of Idaho-resident freshman, and their correlation to retention and academic success.

## **Chapter 3: Methodology**

### **Purpose of the Study**

The purpose of this study is to assess clinical factor contributions in Idaho's higher education crises. Specifically, this study aims to see if clinical health markers correlate with Idaho State University's freshman retention and health status.

### **Research Questions**

1. Are biological markers of health significantly changing in Idaho freshman during their first semester of higher education? Are these changes, if any, positive or negative?
2. Are quantitative measures of stress and depression significantly changing in Idaho freshman during their first semester of higher education? Do biological markers of stress and depression correlate with validated assessment tools?
3. To what extent do clinical bloodwork assays and the assessment tools from the second research question correlate with the first semester metrics of freshman academic success at ISU (Fall semester GPA, & Fall-to-Spring retention)? Can these factors function as predictors of academic success or risk?

### **Research Design Overview**

My project is quantitative research, comprised of a survey to identify demographics, health risks, mental health status, and other pertinent factors that may contribute to academic success and/or attrition, combined with a quantitative analysis of bloodwork assays.



## **Study Approval**

All methodologies, communications, and forms employed in this study were approved and authorized by the ISU Institution Review Board (IRB) prior to utilization.

## **General Procedure**

Each study participant was de-identified and assigned a study identification number ranging from 1-50, in the order they were scheduled. All study data (both clinical and survey) was collected and analyzed under the participant's assigned study ID. To account for diurnal variation levels of cortisol testing, participants were scheduled to be tested twice during the same day. The first scheduled morning session occurred between 7am and 10am, and the afternoon session was scheduled between the hours of 4pm and 7pm. Informed consent, all survey data, and blood collections were collected during the morning period, with the exception of the PM cortisol, which was the only data collected in the afternoon period. In an attempt to collect data under similar academic settings, all participants were scheduled in the first two weeks of the semester for the first session, and the last two weeks of the semester before final's week. The ISU Fall semester ran from August 20<sup>th</sup> through December 7<sup>th</sup>, with final's week occurring December 10-14<sup>th</sup>. The concluding pieces of data, including retention statistics, from the ISU Office of Institutional Research were collected after the ISU Spring 2019 semester add/drop deadline of January 18, 2019.

## **Participant Criteria**

A total of 50 participants were selected under the following criteria:

- Idaho State University (ISU) student
- Registered for a minimum of 12 credits

- Freshman class status
- Minimum of 18-years old
- Resident of the state of Idaho
- Planning on attending ISU for both Fall 2018 and Spring 2019 semesters

### **Participation Selection and Sampling Methods**

The researcher's study utilized purposive, non-probability, convenience sampling. Non-probability sampling does not rely on randomization in order to obtain a representative sample (Vogt, Gardner, & Haeffele, 2012). Purposive sampling is when members of a particular group are sought after deliberately selecting participants from a population defined by experimental parameters (Vogt, Vogt, Gardner, & Haeffele, 2014). Convenience sampling is a type of non-probability sampling that utilizes participants that are nearby, or easy to reach (Vogt, Vogt, Gardner, & Haeffele, 2014). This study employed convenience sampling, only allowing participants from ISU, to eliminate confounding variables, and for ease of conducting study methodology (Bean, 1980). Purposive sampling was chosen for the ability to focus on a specific population, in this case, Idaho-resident freshmen.

Study solicitation occurred by three methods: freshmen orientation fair, flyer, and social media. The first method involved a booth at the annual freshmen orientation fair where interested participants were pre-screened for study criteria, and contact information was collected. Follow-up emails were sent to participants with study information, the consent form, and scheduling information. Tear-away flyers were produced and approved by the ISU Marketing and Communication department (see Appendix A). Flyers provided a phone number, where interested participants could call

for pre-screening. The same informative email was sent to these candidates after criteria were confirmed. And finally, a targeted, paid Facebook advertisement was created and approved by the ISU Marketing and Communication department. This advertisement contained information about the study and provided a link to a secure document that collected contact information for interested candidates. These candidates were forwarded the same informative email that the first two recruitment methods employed. Once 50 interested participants had met the criteria for the study, no more solicitations were accepted. Confirmation of participant criteria was obtained by the ISU Office of Institutional Research (OIR) prior to scheduling.

### **Participant Informed Consent**

According to IRB guidelines, informed consent was obtained from each participant. Informed consent is the basic legal and ethical obligation of any researcher to ensure that each participant understands the nature of the research and their rights to voluntarily participate or discontinue participation in the study. Participants were given a copy of the informed consent form in the informative email described in the sampling section above. Participants were scheduled, as outlined in the procedures section, and a copy of the IRB approved informed consent form was presented and explained by the primary investigator at the commencement of the participant's first appointment. Participation was voluntary, and participants could decline or withdraw their participation at any time during the study. The informed consent form contained the following sections: study purpose, procedure, risks, study information, incentive schedule, confidentiality and data security, contact information, and signature sections (see Appendix B). Participant and witness signatures were collected prior to any data

collection. The signed consent forms were kept in the participants' secured study files, locked in Bengal Lab. A degree of attrition was expected among the participants over the course of the study. The sample size was chosen to account for this attrition, while retaining statistical significance for data analysis. Larger sample sizes would be cost prohibitive.

### **Participant Incentive**

Grant money from the American Society of Clinical Pathologist (ASCP) Foundation allowed this study to offer monetary compensation for the participant's time in contributing to this study. Grant monies were distributed and documented in accordance with ISU's grants and contracts policies. As an incentive to participate in the project, each subject was offered up to \$30/session (to include two blood collections & one survey collection). Participants were able to participate in a total of two sessions. See Appendix B for a complete schedule of monetary incentive.

### **Facilities and Resources**

Bengal Lab is Idaho State University's CLIA-certified, HIPAA approved laboratory located in Pocatello, ID. Bengal Lab was used to conduct testing, collect data, and store data consistent with all state and federal guidelines. Bengal Lab has the instrumentation and resources necessary to run all clinical testing for this project. The researcher also collaborated with ISU's Education faculty, Institutional Research personnel, and Counseling Department faculty for internal resource support of this project. Study participant data and analysis was stored in Bengal Lab's encrypted computers and double-locked secure laboratory storage.

## **Materials and Supplies**

Phlebotomy supplies were ordered from Fisher Scientific: BD vacutainer venous blood collection tubes: ethylenediaminetetraacetic acid (EDTA) tubes: Hemogard (Catalog number 02-697-107); SST serum separation tubes: Hemogard (Catalog number 02-684-45); BD 21G Eclipse needle for luer lock system (Catalog number 14-821-23); BD vacutainer push button blood collection set (Catalog number BD367336); Cen-Med Enterprises latex-free tourniquets (Catalog number 21-520-130); McKesson general medical 2in coban latex free tape (Catalog number NC9261065); Medique Medi-First Alcohol prep-pad wipes (Catalog number 19-090-834); Bound Tree Medical 4x4 sterile gauze pads (Catalog number NC0180433); Microflex Supreno SE powder-free nitrile exam gloves (Catalog number 19-048-723B); Fisherbrand Sharps-A-Gator sharps containers (Catalog number 22-037-959).

## **Blood Collection**

Blood samples were collected and performed by Bengal Lab, ISU's on-campus Clinical Laboratory Improvement Amendment (CLIA)-certified clinical laboratory. Blood was collected via venipuncture by a trained phlebotomist. Complete blood count (CBC) samples were collected in ethylenediaminetetraacetic acid (EDTA) BD® vacutainer tubes. All other laboratory blood tests were collected in serum separator (SST) BD® vacutainer blood collection tubes containing clot activator and serum separator gel. In general, 1 SST and 1 EDTA tube was collected during the morning period, and 1 SST tube was collected during the evening period. Collected samples were gently inverted 8-10 times. SST tubes were allowed to clot in the upright position between 30-60 minutes. Once clotted, the SST samples will be centrifuged at 2200-2500

RPM for 15 minutes. Blood samples were assayed immediately or refrigerated at 4 degrees Celsius until testing. All samples were assayed between 0-24 hours after collection. After testing, blood samples were saved for one week and then disposed of properly as biohazardous waste.

### **Clinical Laboratory Instrumentation**

All laboratory testing was performed by an ASCP certified Medical Laboratory Scientist (MLS) in accordance with CLIA regulations. CBC assays were performed on a validated Sysmex® XN-Series hematology analyzer. All other clinical laboratory testing was performed on validated Advia® Chemistry XPT and Advia® Centaur XP system analyzers. Laboratory results were reported and interpreted according to CLIA standard reference ranges for the participant's age and sex, as compared to the standard validated Idaho population.

### **Survey Instrumentation**

Two surveys were used in this study, one in the initial session, and another in the mid-year, or end of semester session. Survey data was collected electronically on encrypted computers in Bengal Lab. The initial survey was 134-questions long. This survey contained two parts. The first part (100 questions) utilized Form B of the Ruffalo Noel Levitz College Student Inventory (CSI). The remaining 34 questions contained the 9 question Patient Health Questionnaire-9, and 25 additional customized questions designed to collect demographic and additional health-related behaviors such as sleep patterns and alcohol usage (see Appendix C). The end of semester survey contained 104 questions, also broken down into two parts. The first part (70 questions) was the Ruffalo Noel Levitz Mid-Year Student Assessment (MYSA) survey. The remaining 34 questions

were identical part two in the initial survey administration, containing PHQ-9 questions in addition to customized survey questions (see Appendix D).

The CSI survey is a broadly used instrument designed to identify non-cognitive risk factors and indications of college success. The CSI survey analysis includes demographic information and scores for the following: dropout proneness, predicted academic difficulty, educational stress, receptivity to institutional help, academic motivation, general coping, and requests for support services. These sections are scored on a 5-point stanine scale, with mean of 5 and a standard deviation of 1.96. The larger the stanine score, the larger the corresponding raw score. Data distribution to the stanine score for the CSI is 4%, 7%, 12%, 17%, 20%, 17%, 12%, 7%, and 4% for scores 1 through 9, respectively. In other words, a participant stanine score of a 9 is scoring in the top 4% of normative sampling.

The MYSA survey is designed to be the companion follow-up study for the CSI survey. It assesses changes in motivation, coping, and academic confidence as well as evaluates the participant's perception of their university and retention or transfer plans. Scoring is either descriptive, or stanine scored the same as the CSI inventory (see Appendix C).

The PHQ-9 section of the survey has nine questions scored individually from 0 to 3, to determine frequency of thoughts or symptoms, with 0 indicating never, 1 indicating every several days, 2 indicating more than half the days, and 3 indicating nearly every day. Major depression is indicated if five or more of the nine depressive symptom questions have been present with a score of 2 (more than half the days), during the past two weeks, and if one of the symptoms is depressed mood or lack of interest (Kroenke,

Spitzwer, & William, 2001). Scoring of the PHQ-9 questionnaire ranges from 0 to 27 points to determine the severity of depressive symptoms in participants. A score of 0 indicates a complete absence of depressive symptoms, while a score of 27 indicates the most severe depressive symptoms. In general, total scores of 5, 10, 15, and 20 on the PHQ-9 survey represent mild, moderate, moderately severe, and severe depression, respectively (see Appendix E). The remaining customized survey questions were scored and analyzed categorically.

### **Office of Research Data**

With IRB approval and informed consent, the following information was provided for each participant by the ISU Office of Institutional Research (OIR) after the Spring 2019 semester drop deadline on January 18<sup>th</sup>, 2019: Fall 2018 semester GPA, Spring 2019 semester registration confirmation, Spring 2019 semester credit load, ACT scores (composite, English, math, reading & science) and/or SAT scores (composite, evidence-based reading/writing, math, reading, & writing/language).

### **Data Analysis**

Quantitative analysis involved converting data to numerical forms and subjecting them to statistical analysis for the purpose of describing and explaining the phenomena the observations were reflecting (Vogt, Vogt, Gardner, & Haeffele, 2014). Statistical analysis for this study was generated using SPSS, version 25.0 (IBM Corp. Released 2018. IBM SPSS Statistics for Windows, Version 25.0., Armonk, NY: IBM Corp).

This SPSS software was used to conduct descriptive, comparative, and correlative statistics. The encompassing goal of the first research question was to determine significant differences in participant health, as indicated by biological laboratory tests. In



order to determine this, first continuous laboratory data employed distribution and frequency analysis to determine the normality of the data set. T-tests and nonparametric testing (specifically Wilcoxon Signed-Ranks) were run based on the distribution and frequency of data (Kirby, 2014). Primarily, due to the large number of outliers and skewed data, nonparametric testing was primarily employed. Wilcoxon Signed-Ranks tests that compare the pretest to posttest scores for each measure. The Wilcoxon Signed-Ranks test is sensitive to the number of ties such that too many ties from pretest to posttest can invalidate the results (Kirby, 2014), therefore, effect sizes were also run. An appropriate effect size measure when reporting Wilcoxon's T values (or z if the sample size is large) is the Rank Biserial Correlation for matched pairs.

For the second research question, this study aimed to assess the correlation between biological markers of stress and depression the PHQ-9 survey results. The third research question was interested in determining the correlations between laboratory or survey data, and participant retention and Fall GPA, as markers of academic success. Analysis for both of these research questions employed SPSS testing. Spearman correlation testing was used for ranked data, and Pearson correlations for continuous variables (Kirby, 2014). Wilcoxon nonparametric analysis was run to determine differences between matched, dependent samples. Mann Whitney U-test, nonparametric analysis was run to determine differences between unmatched, independent samples. Then, Spearman correlation testing was used for ranked data, and Pearson correlations for continuous variables to investigate significant correlations between variables (Kirby, 2014). The alpha value for analyses was set at 0.05 for analysis.

Finally, in addition to SPSS data, there was descriptive summaries and analyses created in Office Excel (2016) to contribute relevant data not otherwise presented above. For example, demographic data, trends, and other relevant survey information will be summarized in tables and figures. Missing values have been excluded from analysis and only valid percentages are included in this document.

### **Validity and Reliability**

Clinical laboratory testing is held to high federal and state regulatory standards. Each assay must meet rigorous scientific criteria in reliability, replication, specificity and sensitivity, before it is ever put into clinical practice. Once a test is adopted clinically, it must continue to meet daily quality control measures to ensure each test is performing to established standards. Personnel who run these assays must also be trained, and pass external agency proficiency testing. These requirements ensure that reported laboratory values have high levels of validity, reliability and reducibility.

The survey section of this study has internal validity measures built in to assess the participant's conscientiousness in completing the survey. Specifically, there were seven survey questions distributed throughout the survey that asked the participant to insert a specific numerical score for that answer. For example, a sample internal validity question is "Enter '4' for this question" (see Appendix C & D). Internal validity scores under five are considered questionable, while scores under three are considered unsatisfactory. Low survey validity may represent distraction, low academic commitment, or language difficulties.

This study uses participants only from ISU, increasing the internal validity by sampling a single institution (Ancis, Sedlacek, & Mohr, 2000). Lab testing, in addition to

the CSI and PHQ-9 portions of the survey and standardized, validated, and highly reliable and reproducible (Vogt, Vogt, Gardner, & Haeffele, 2014). The customized survey questions used in and published in this study for future reproducibility (see Appendix C and D).

### **Limitations and Assumptions in Methodology**

1. All participants were tested within a two-week time-frame. It was assumed this would normalize the course and stress-load, however, it is impossible to control the variations in class schedules and course complexity that may be contributing to variations in this study.
2. The surveys had inherent disadvantages, such as question non-responses, certain answer options may have been interpreted differently by subjects, and respondents may have not recall information accurately, known as recall bias (Wyse, 2012). Furthermore, it was assumed that participants answered honestly and thoughtfully, as opposed randomly selecting answers, which can interfere with the validity of the data.
3. The Patient Health Questionnaire-9 (PHQ-9), despite its excellent reliability and validity in primary care, has been cited as being limited in identifying depressed individuals with dysthymia (Eack, 2014). This may have resulted in an under-diagnosis of participants with depressive symptoms.
4. Certain medications, substances and activities have interfering substance on clinical bloodwork. While every attempt was made to identifying these factors in participants, it was impossible to control completely.

### **Special Training**

As the primary investigator in this study, the researcher has been a practicing, ASCP-certified, Medical Laboratory Scientist since 2008- becoming an expert in processing and analyzing clinical laboratory tests. Additionally, the researcher has two research-intensive master's degrees requiring a great deal of statistical coursework and data analysis.

### **Ethical Considerations**

As the researcher has collected patient health information, and clinical laboratory data, this research will need to comply with all Health Insurance Portability and Accountability Act (HIPAA) laws of disclosure, privacy, and confidentiality. Furthermore, as this study may have identified participants with significant health issues and/or other clinical health disease symptoms, it was imperative to conduct due diligence in providing the participants with the proper information about their resources should they need/choose to seek medical guidance in counseling and/or student health.

### **Methodology Summary**

Due to prevalence and concern, there is abundant higher education research concerning the broader topic of institutional retention and student success. The majority of existing studies have focused on the impact of academic success from cognitive or survey-based non-cognitive factors. While research concerning these more specific student experiences has been important, it is also critical that research evaluates additional non-cognitive factors that impact of contributing to a decline in academic success in our freshmen student body. This is increasingly relevant as student success outcomes are progressively scrutinized.

In this quantitative research study, my goal was to determine whether the biological markers of health in Idaho-resident freshmen at ISU contribute to a student's decision to remain enrolled. A key component of this research is first to determine whether biological health markers are declining. A secondary component of this study is to determine if biological laboratory makers are significantly correlated with common, validated mental health assessment tools. And finally, this study seeks to assess if there is any significant correlation between laboratory and survey data collected, as compared to markers of participant academic success, namely Fall 2019 semester GPA and continued Spring semester registration (retention vs. attrition). The ultimate goal is determining whether this data can be used in a way to help alleviate the crisis associated with freshmen retention, specifically in the state of Idaho.

Data was derived from validated survey and laboratory instruments, as described above. SPSS software was utilized for statistical analysis and inference. Chapter 4 contains tables and summary responses of the SPSS data collected in this study.

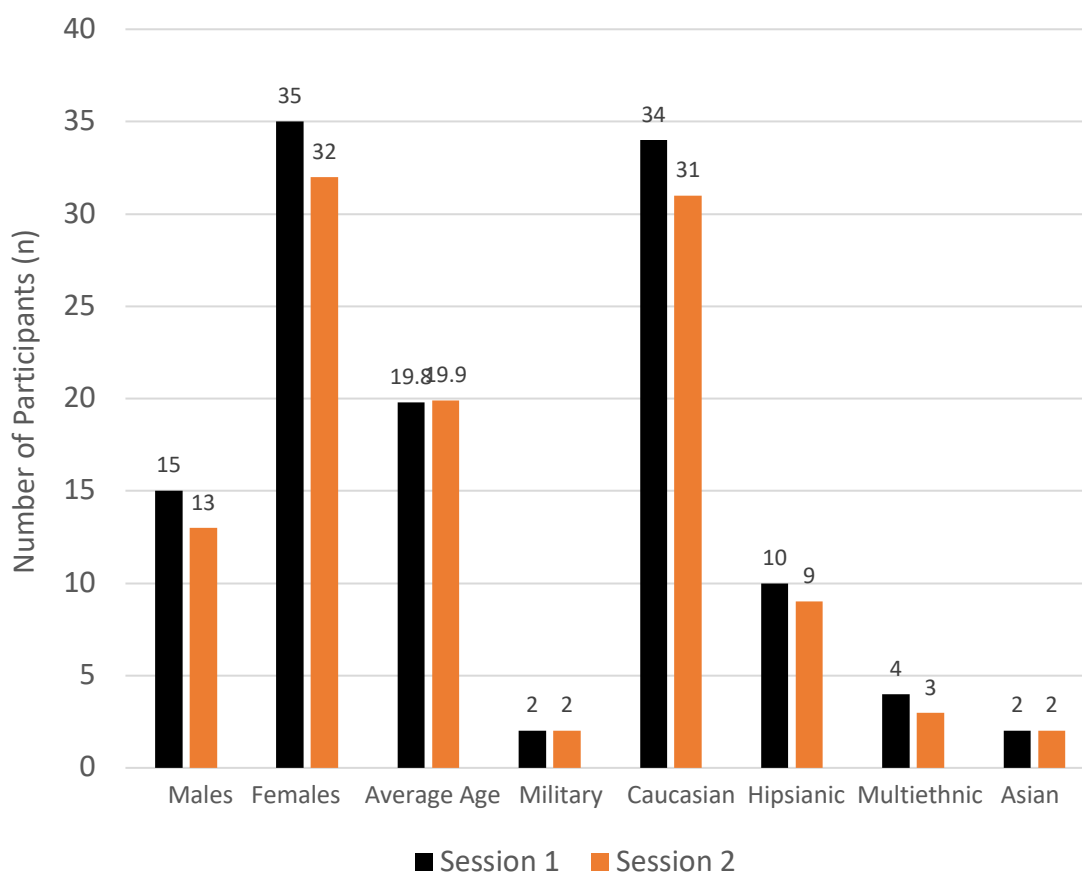
## **Chapter 4: Results and Analysis**

The purpose of this study was to assess the potential contribution of clinical markers as a predictor of attrition in Idaho resident freshman. This study also sought to identify correlations between and among factors that lead to barriers to academic success and retention among freshman at Idaho State University.

### **Participant Demographic and Descriptive Statistics**

A total of  $n = 50$  students participated in this study. Students self-disclosed that they were Idaho-residents and freshmen at Idaho State University. This information was confirmed by the Office of Institutional Research at ISU. During the initial session, 70% ( $n = 35$ ) of participants were female and 30% male ( $n = 15$ ). Military or veteran status was selected by only 4% ( $n = 2$ ) of the participants. The majority of students (68%,  $n = 34$ ) identified their racial/ethnic origin as White/Caucasian, followed by 20% ( $n = 10$ ) Hispanic/Latino, 8% ( $n = 4$ ) multiethnic, and 2% ( $n = 1$ ) Asian/Pacific Islander. Participant ages ranged from 18 to 71 years old (mean=19.8, median=18, mode=18).

During the second session, the same  $n=50$  students were solicited to continue the study. Of those,  $n=45$  students returned to continue the study, resulting in a 90% retention rate between sessions. The participants in the second session were 71.1% ( $n=32$ ) female and 28.9% ( $n=13$ ) male. Military of veteran status remained at  $n=2$ . During this session 68.9% identified their racial/ethnic origin as Caucasian, followed by 20% Hispanic/Latino, 6.7% multiethnic, and 4.4% Asian/Pacific Islander. Participant ages ranged from 18 to 72 years old (mean=19.9, median=18, mode=18; see Figure 4.1).



*Figure 4.1.* Demographic information about participants in this study. Black bars indicate the first session of the study, while orange bars indicate the second session of this study. The numbers on top of the bars are the actual number (n) of participants that fall in each category. The x-axis represents the different demographical categories, while the y-axis represents the number (n) of participants.

### CSI and MYSA Survey Data

The mean statistics reported in this section, with the exception of internal validity, were derived from percentile scores. The national norm for CSI data is the 50<sup>th</sup> percentile, indicating that these scores parallel a level for the described characteristic. For example, a score higher than 50% in dropout proneness would indicate elevated risk over the national norm, and vice-versa. The first reported section in the CSI is the ‘*Summary Observations*’, which provides a preliminary overview of participants levels of risk and receptivity. During this study’s first session representing incoming freshmen, this cohort

ranked 45% in dropout proneness, 34.7% in predicted academic difficulty, 50.4 % in education stress, and 61.7% in receptivity to institutional help, level of risk, and receptivity.

Next, academic motivational assessment identified the students' areas of greatest strength. During the initial session, this cohort scored 58% in study habits, 64.7% in reading interests, 53.8% in verbal and writing confidence, 50.3% in math and science confidence, 47.2% in commitment to college, and 61.6% in interaction with previous teachers. The cohort was then scored on an assessment of their general coping scales, scoring 43.6% in social engagement, 46.4% in family support, 59.1% in capacity for tolerance, 49% in career plans, and 41% in financial security. Finally, receptivity scales represent the participant's willingness or desire to seek external support. This cohort initially scored 55.2% in academic assistance, 65.7% in personal counseling, 57.8% in social engagement, 51% in career guidance, and 60.7% in financial guidance. Internal validity for the respondent's survey answers ranked very high, with a score of 6.98 out of 7. Only one participant out of the cohort of fifty scored a 6 out of 7 on the internal validity, while all others scored a 7 out of 7. The internal recommendation of the CSI system is to discard surveys with an internal validity of 5 or less, therefore, all data was used. See Table 4.1 for a complete list of these results, and the gender breakdown for each category.

As well as identifying cohort data, the CSI also identified individual participants at-risk for dropout proneness. Students were included on the dropout proneness risk-list if their percentile scores for associated questions, as determined by empirical evidence, were 65% or higher. In this study, 28% ( $n = 14$ ) of participants were identified at high-



risk for dropout proneness. Scores for these 14 individuals ranged from 67-99%, with an average score of 83.7%. By those standards, and 32% of the cohort ( $n = 16$ ) was identified as students needing academic assistance to address their specific academic needs, and 40% ( $n = 20$ ) of the cohort were identified as students which would benefit from personal counseling.

Students were also included on specific risk-lists if their percentile scores for associated questions, as determined by empirical evidence, were 35% or lower. For example, 36% ( $n=18$ ) of students scored under 35% on questions associated with lack of career goals, so they were identified as students who might benefit from career guidance. By this same criterion, 48% ( $n = 24$ ) were identified as students needing social engagement, and 50% ( $n = 25$ ) as students with low financial security.

The next section of data analyzes how scores in each of the ‘*Summary Observation*’ categories changed for the study cohort over the course of their first semester, or between the two study sessions (see Table 4.2). Incomplete data sets for the five students who did not return for the second session were omitted from this data set, therefore, the percentages between Table 4.1 and their corresponding ‘Pre’ sections in Table 4.2 are not perfectly aligned. Categories of academic motivation saw both increased and decreased scores. Math and science confidence scores increased by 6.5%, verbal and writing confidence increased by 1.3%, and study habits increased by 0.2%. However, commitment to college decreased by 2.6%, reading interests decreased by 1.6%, and interactions with previous teachers dropped 0.2%.

Changes in general coping categories also demonstrated mixed results. Financial security increased by 3.6%, career plans increased by 1.4%, while social engagement,

family support, and capacity for tolerance decreased by 3.8%, 3.1% and 1.1%, respectively. A complete list of these percentages, and their breakdown by gender are included in Table 4.2.

Table 4.1

*Initial summary observations*

Local Mean on Major Scales	Females	Males	Total
Summary Observation			
Dropout proneness	47.3	39.7	45
Predicted academic difficulty	38	27.2	34.7
Educational stress	49.6	52.1	50.4
Receptivity to institutional help	64.4	55.4	61.7
Academic Motivation Scales			
Study habits	57.3	59.5	58
Reading interests	67.7	57.9	64.7
Verbal and written confidence	53.5	54.7	53.8
Math and science confidence	40.6	72.9	50.3
Commitment to college	48	45.5	47.2
Interactions with previous teachers	62.7	59.2	61.6
General Coping Scales			
Social engagement	42.1	47	43.6
Family support	48.8	40.9	46.4
Capacity for tolerance	57.7	62.5	59.1
Career plans	48.7	49.7	49
Financial security	38.1	47.9	41
Receptivity scales			
Academic assistance	59.1	46.3	55.2
Personal counseling	67	62.5	65.7
Social engagement	58.7	55.6	57.8
Career guidance	51.5	49.9	51
Financial guidance	62	57.9	60.7
Supplemental Scales			
Internal validity	7	6.9	7

*Note.* The means statistics for all scales except internal validity were computed from percentile scores. For all of the scales, the national norm is the 50th percentile. High scores indicated levels of the characteristic described in the scale name (e.g. a high score in Commitment to College means that the group was above the average in Commitment to College). The statistics for internal validity were computed from raw scores (ranging from 0 to 7). The percentages reported for the summary observation scales were calculated based on the percentage of students whose scores are in the 80th percentile or higher. The percentages reported for the receptivity scales are those students whose scores are in the 65th percentile or higher.

Table 4.2

*Comparison of summary observations*

<u>Academic Motivation</u>		Female	Male	Total
Commitment to College	Pre	50.6	46.3	49.3
	Mid-Year	48.4	42.4	46.7
Interactions with previous teachers	Pre	63.3	57.5	61.6
	Mid-Year	63	57.5	61.4
Math and science confidence	Pre	42.1	71.9	50.7
	Mid-Year	49.7	75.5	57.2
Reading interests	Pre	70.3	57.5	66.6
	Mid-Year	68.8	55.9	65
Study habits	Pre	54.9	60.2	56.4
	Mid-Year	56.3	58.1	56.8
Verbal and writing confidence	Pre	53.8	53.8	53.8
	Mid-Year	56.7	51.2	55.1
<u>General Coping</u>				
Capacity for tolerance	Pre	58.1	58.2	5.1
	Mid-Year	56.3	58.9	57
Career plans	Pre	49.2	54.5	50.7
	Mid-Year	52.5	48.8	51.4
Family support	Pre	47.7	40.3	45.6
	Mid-Year	43.3	40.8	42.5
Financial support	Pre	39.2	48.7	41.9
	Mid-Year	45.4	45.5	45.5
Social engagement	Pre	39.5	49.1	42.2
	Mid-Year	36.1	53.9	38.4
<u>Other</u>				
Desire to transfer	Pre	52	49.2	51.2
	Mid-Year	N/A	N/A	N/A

*Note.* The statistics for all scales were computed from percentile scores. For all of the scales, the national norm is the 50th percentile. High scores indicate levels of the characteristic described in the scale name (e.g. a high score in Desire to Finish College means that the group was above the average in Desire to Finish College).

The next section of data contains student background information to provide a context for discussing motivational patterns within the scales. This section, where appropriate, compares data between the first (Pre) session and the second (Mid-Year) session, to assess potential change in motivation and academic performance. The  $n = 5$  incomplete data sets were also omitted from this section, so percentages are reported from a total of  $n = 45$ . This section reports data about work plans, GPA, general academic knowledge, perceived academic knowledge, highest degree sought, study time, and college plans.

When this cohort entered their freshman year, 20% ( $n = 9$ ) had no intentions of working, 64.4% ( $n=29$ ) had intentions of working part-time (20 hours or less), while 15.6% ( $n = 7$ ) planned to work more than 20 hours a week. By the end of their first semester, students with no intention of working increased to 44.4% ( $n = 20$ ). 48.9% ( $n = 22$ ) worked part-time (less than 20 hours), and only 6.7% ( $n = 3$ ) worked more than 20 hours a week.

Self-disclosed GPA differences (from high school GPA to first-semester college GPA) demonstrated a decrease of 17.78% in A-grade GPA averages, a 13.34% increase B-grade averages, and a 4.45% increase in C-grade averages. A self-disclosed feeling of general academic knowledge improved over the semester, as 11.12% more students rated themselves in the top 40% of general academic knowledge than they did at the beginning of the semester. During the initial session, when asked what the highest academic degree the participant intended to pursue, 51.1% ( $n = 23$ ) selected a 4-year college degree, 31.1% ( $n = 14$ ) selected a professional degree, 13.3% ( $n = 6$ ) selected a Master's degree, and 2.2% ( $n = 1$ ) chose a 2-year college degree. In the subsequent section, the only

change was one student who changed their answer from a 4-year degree to a professional degree. In reflecting on the amount of study time needed to succeed in their first semester in higher education, 17.8% (n = 8) found that they needed more study than they expected, while 13.3% (n = 6) needed less. At the conclusion of the semester, 8.9% (n=4) had intentions of transferring, while 2.2% (n = 1) were not sure of their plans. See Table 4.3 for a complete list of numbers and percentages for this data.

The final section from the MYSA data includes the students' impressions of Idaho State University. This section is included to be able to suggest hypotheses about reenrollment plans. Nine questions were rated by participants on a scale of 1 to 7, with a rating of 1 being the lowest and a rating of 7 being the highest. All questions addressing institutional impressions averaged 5.11 to 6.22. The highest average of 6.22 reflected students feeling safe and secure on campus. Lower scores or opportunities for service and interaction with faculty outside of class averaged a 5.11 and 5.16, respectively. The remaining impressions averaged a 5.4 for assistance in selecting a major, 5.47 for availability of financial resources, 5.58 for level of interaction with other students, 5.6 for interaction with faculty in class, 5.33 for interactions with advisors, and 5.31 for a sense of belonging to the ISU college community. A complete list of rankings and percentages for institutional impressions can be found in Table 4.4.

Table 4.3

*Background characteristic data for study participants*

	Session 1 (CSI)		Session 2 (MYSA)	
<u>Work hours (per week)</u>	(n)	%	(n)	%
0 (no plans/do not work)	9	20	20	44.44
1 to 10	13	28.89	13	28.89
11 to 20	16	35.56	9	20
21 to 30	4	8.89	3	6.67
31 to 40	2	4.44	0	0
More than 40	1	2.22	0	0
<u>Average GPA</u>	(n)	%	(n)	%
A	23	51.11	15	33.33
B+	14	31.11	19	42.22
B	2	4.44	3	6.67
C+	5	11.11	5	11.11
C	1	2.22	3	6.67
D+	0	0	0	0
D or less	0	0	0	0
<u>General Academic Knowledge</u>	(n)	%	(n)	%
Highest 20%	11	24.44	10	22.22
Next highest 20%	15	33.33	21	46.67
Middle 20%	17	37.78	14	31.11
Next to lowest 20%	1	2.22	0	0
Lowest 20%	1	2.22	0	0
<u>Highest Degree Sought</u>	(n)	%	(n)	%
None	1	2.22	1	2.22
1-year certificate	0	0	0	0
2-year certificate	1	2.22	1	2.22
4-year certificate	23	51.11	22	48.89
Master's degree	6	13.33	6	13.33
Professional degree	14	31.11	15	33.33
<u>Perceived Academic Ability</u>	(n)	%	(n)	%
Considerably below average	0	0	0	0
Slightly below average	3	6.67	1	2.22
Average	12	26.67	13	28.89
Slightly above average	16	35.56	20	44.44
Considerably above average	13	28.89	11	24.44
Extremely high	1	2.22	0	0
<u>Study time needed</u>	(n)	%	(n)	%
Not as much as I expected	N/A	N/A	6	88.89
About what I expected	N/A	N/A	31	8.89
A lot more than expected	N/A	N/A	8	0
<u>College plans</u>	(n)	%	(n)	%
I plan to complete my degree at ISU	N/A	N/A	40	88.89
I plan to transfer to another institution	N/A	N/A	4	8.89
College is not right for me at this time	N/A	N/A	0	0
I have not yet decided	N/A	N/A	1	2.22

*Note.* The (n) value represents the number of study participants, and the percent is (n) divided by total number of participants.

Table 4.4

*Institutional impressions*

Student's satisfaction after first semester	Number and percent by student rating (1 = low, 7 = high)							Mean
	1	2	3	4	5	6	7	
Assistance in selecting program/major	N=1 2.2	N=0 0	N=2 4.4	N=8 17.8	N=11 24.4	N=12 26.7	N=11 24.4	5.4
Safety and security on campus	N=0 0	N=1 2.2	N=0 0	N=1 2.2	N=3 6.7	N=21 46.7	N=19 42.2	6.22
Availability of financial resources	N=0 0	N=0 0	N=3 6.7	N=8 17.8	N=9 20	N=15 33.3	N=10 22.2	5.47
Level of interaction with other students	N=0 0	N=1 2.2	N=6 13.3	N=6 13.3	N=12 26.7	N=17 37.8	N=9 20	5.58
Opportunities for community service/volunteer work	N=0 0	N=0 0	N=4 8.9	N=12 26.7	N=10 22.2	N=13 28.9	N=6 13.3	5.11
Interaction with faculty in class	N=0 0	N=0 0	N=1 2.2	N=6 13.4	N=12 26.7	N=17 37.8	N=9 20	5.6
Interaction with faculty outside class	N=1 2.2	N=1 2.2	N=4 8.9	N=9 20	N=10 22.2	N=9 20	N=11 24.4	5.16
Interaction with advisor	N=1 6.7	N=1 2.2	N=4 2.2	N=9 8.9	N=10 22.2	N=9 20	N=11 24.4	5.33
Sense of belonging to this college community	N=0 0	N=0 0	N=4 8.9	N=10 22.2	N=7 15.6	N=16 35.6	N=8 17.8	5.31

*Note.* The ‘N’ values represent the total number of student participants in each category. The number below each number is the total percentage for that group. The last column represents the campus mean for that category.

**Office of Institutional Research Data**

After the drop deadline for the Spring 2019 semester, the following data were collected about the 50 study participants from the ISU Office of Institutional Research (OIR): Fall GPA, number of credits registered for Fall 2018, Spring 2019 registration confirmation, ACT entrance exam scores (composite, English, math, reading, science reasoning), and SAT entrance exam scores (composite, evidenced based, math, reading, writing & language). Registration data indicated that six students did not register for Spring semester, indicating a 12% attrition of this cohort from Fall to Spring. Only one of the six students that did not continue their ISU reregistration into Spring semester overlapped with the five-student attrition seen between sessions of this study.

Additionally, none of the participants that indicated they had a desire to transfer on the survey data overlapped with the students that did not continue their registration.

The average Fall GPA for the study cohort was 2.95. The number of registered Fall 2018 credits for the study cohort ranged between 12 and 19 credits, with an average of 15.4 credits. The attrition group, or those that did not register for Spring semester, had an average GPA of 1.3, while those that continued registration had an average GPA of 3.2 (see Table 4.5).

Table 4.5

*GPA and entrance exam scores by group*

Variable	Retention	Attrition	Over 2.5 GPA	Under 2.5 GPA
(n)	44	6	39	11
Average Fall GPA	3.2	1.3	3.5	1.1
ACT Composite	23.9	21.7	24.6	18
ACT English	24.2	20.7	25.5	15.3
ACT Math	24.8	20	22.5	17.3
ACT Reading	22.2	23.3	26.3	21.3
ACT Science Reasoning	26.1	22.3	24.1	16.7
SAT Composite	1168.4	1006.7	1168.4	896.3
SAT Evidence	559.7	523.3	588.3	453.2
SAT Math	562.3	483.3	588.3	442.5
SAT Reading	28.6	27	29.8	23.4
SAT Writing	28.6	25.3	29.5	22

*Note.* The (n) values represent the number of study participants in each category. The entrance exam scores reflect the average score for participants within each category.

As a C-grade average is considered passing by most higher education undergraduate standards, those with a cumulative GPA under 2.5 might be considered at-risk. This study had 22% of participants (n = 11) with a GPA under 2.5 upon completion of their first semester. SAT data was collected from 41 students, and ACT data was collected from 29 students in the cohort. The average ACT composite score for the cohort



was 23.9, while the English, math, reading, and science reasoning sections averaged 24.4, 22, 25.8, and 23.3 respectively. The average SAT composite score for the cohort was 1112.6, while the evidenced based, math, reading, and writing sections averaged 559.2, 546.4, 28.4, and 28, respectively. The average GPA and entrance exam score breakdown for both retention and attrition (not registered) student groups, and GPA risk (under 2.5 GPA) groups are found in Table 4.5.

### **Research Question #1**

1. Are biological markers of health significantly changing in Idaho freshman during their first semester of higher education? Are these changes, if any, positive or negative?

**Hypothesis.** Based primarily on survey data, higher education students (particularly freshman) report adverse health trends during higher education (Pritchard, Wilson, & Yamnitz, 2007). Therefore, this study hypothesizes that there will be significant changes in laboratory assay values toward a negative, or adverse outcome.

**Objective.** CBC, CMP, TSH and cortisol, CRP and lipid panel testing were performed on 50 first-year enrolled Idaho college students during the beginning (baseline), and end of their first Fall semester at ISU. Statistics were run to detect significant changes in biological laboratory values over the course of the semester.

**Analysis.** Incomplete data sets were omitted from this section, leaving n=45, a 90% retention rate. Laboratory data was first analyzed by SPSS statistics for distribution frequency assessment by Shapiro-Wilk and Kolmogorov-Smirnov tests, with an alpha p-value of less than 0.05. Dependent t-tests statistics were performed to assess significant

changes between paired laboratory tests with normal distributions, and Wilcoxon signed-rank tests were performed for non-parametric analysis of matched samples.

Complete blood count (CBC) tests included white blood cell (WBC) count, red blood cell (RBC) count, WBC differential percentages (neutrophils, lymphocytes, monocytes, eosinophils, and basophils), platelet count, hemoglobin and hematocrit levels. The percent of monocytes in the WBC differential was significantly increased at the  $p < 0.05$  level. The only other CBC changes that neared significance were an increase in the total WBC count, basophil percentage, and eosinophil percentage between sessions, and a decrease in Hematocrit and RBC count at the  $p < 0.30$  level.

Complete metabolic panel (CMP) tests include glucose, calcium, albumin, total protein, sodium, potassium, carbon dioxide (CO<sub>2</sub>), chloride, blood urea nitrogen, creatinine, alkaline phosphatase, alanine amino transferase, aspartate amino transferase, and bilirubin levels. Bilirubin, creatinine, and sodium were found significantly increased at the  $p < 0.05$  level. Glucose and alkaline phosphatase were found significantly increased at the  $p < 0.10$  level, and CO<sub>2</sub> and potassium were found significantly increased at the  $p < 0.30$  level. Total protein, albumin, and calcium were found significantly decreased at the  $p < 0.05$  level. Chloride was found to be significantly decreased at the  $p < 0.30$  level.

The lipid panel test includes total cholesterol, triglycerides, high-density lipoprotein (HDL), low-density lipoprotein (LDL) tests, and the Cholesterol/HDL ratio, also known as the coronary risk ratio. The coronary risk ratio was found significantly increased, and HDL was found significantly decreased at the  $p < 0.05$  level. CRP was the only remaining test found significantly increased at the  $p < 0.05$  level. TSH and cortisol

testing were not significantly changed between sessions. A summary of significant laboratory changes can be found in Table 4.6.

Table 4.6

*Summary of significant laboratory changes*

	P-value significance		
	0.05	0.1	<0.3
Session 2 < Session 1 (increase)	% Monocyte	Glucose	WBC count
	Bilirubin	Alkaline phosphatase	% Basophils
	Creatinine		%Eosinophils
	Sodium		CO2
	CRP		Potassium
	Coronary risk		
Session 1 < Session 2 (decrease)	Total protein		Hematocrit
	Albumin		RCB count
	Calcium		Chloride
	HDL		

For purposes of analysis and discussion, significant correlations between lab assays should also be considered. Spearman correlation statistics were run between all significant laboratory variables for both sessions of the study. Table 4.7 contains a complete list of all significant intercorrelation between biological markers. With the exception of C-reactive protein (CRP) and thyroid stimulating hormone (TSH), all significant biological marker intercorrelations became more strongly correlated by the second session of the study.

Of note, the total number of abnormal tests, or assays that fell outside the reference range, increased from 7.2% to 10.6% total abnormal assays for this study cohort. For students with a GPA under 2.5 in the Fall 2018 semester, abnormal tests

increased 3.6% (from 6.6% to 10.2%) while those with a GPA over 2.5 increased 3.3% (from 7.4% to 10.7%) between sessions.

Table 4.7

*Significant intercorrelations among biological markers by session*

Variable 1	Variable 2	Session 1 Significance			Session 2 Significance		
		0.05	0.1	<0.3	0.05	0.1	<0.3
AM cortisol	PM cortisol			X	X		
AM cortisol	Cortisol ratio	X			X		
AM cortisol	TSH		X		X		
AM cortisol	Age						X
PM cortisol	Cortisol ratio	X			X		
PM cortisol	CRP						X
PM cortisol	TSH						X
PHQ-9	CRP		X				
PHQ-9	Age	X			X		
TSH	CRP		X		X		

*Note.* Values marked with an 'X' indicate statistical significance at respective p-values.

## Research Question #2

- Are quantitative measures of stress and depression significantly changing in Idaho freshman during their first semester of higher education? Do biological markers of stress and depression correlate with validated assessment tools?

**Hypothesis.** Stress, anxiety and depression are well-established maladies of higher education students (Garret, 2001; Kerr, 2017; “Mental illness facts”, 2013; Savage, 2006; Zajacova, Lynch, & Epsensshade, 2005). Additionally, abnormal psychology literature stated that symptoms of stress and depression have both psychological and biological components. Therefore, this study hypothesized that validated assessment tools of stress and depression will have significantly adverse trends over the course of participants’ first

semester at ISU. Moreover, it was hypothesized that the biological markers of stress and depression would significantly correlate with their respective assessment responses.

**Objective.** Cortisol and TSH panel testing were performed on 50 first-year enrolled Idaho college students during the beginning (baseline), and end of their first Fall semester at ISU. These students were administered the College Survey Inventory (CSI) and the Patient Healthcare Questionnaire-9 (PHQ-9) assessment surveys, supplemented with customized survey questions for this study. Statistics were run to detect significant changes in assessment responses, across the semester, in addition to looking for correlations to respective biological laboratory values for assessment factors.

**Analysis.** Incomplete data sets were omitted from this section, resulting in  $n = 45$ , or a 90% retention rate. The PHQ-9 survey is a self-administered diagnostic test for depression. PHQ-9 scores range from 0 to 27, with higher scores indicating increased depression severity indices. PHQ-9 scores of 0-4 are categorized for depression severity as 'none', scores of 5-9 as 'mild', 10-14 as 'moderate', and scores over 15 are considered to have 'severe' symptoms of depression. The average PHQ-9 score for the initial survey was 6, and increased to 6.8 by the second session. According to PHQ-9 scoring, both of these averages are categorized as 'mild depression.' Those students with early departure (attrition) actually saw a decrease in the average PHQ-9 scores from 5 to 3.75, indicating a categorical change from 'mild depression' to 'no symptoms'. The retention group increased PHQ-9 scores from 6.13 to 7 between sessions. When the cohort was divided by the 2.5 "at-risk" GPA student, those under 2.5 GPA saw a decrease in average scores from 10.5 to 9.7, while those with GPAs over 2.5 saw increase in scores from 4.6 to 5.9

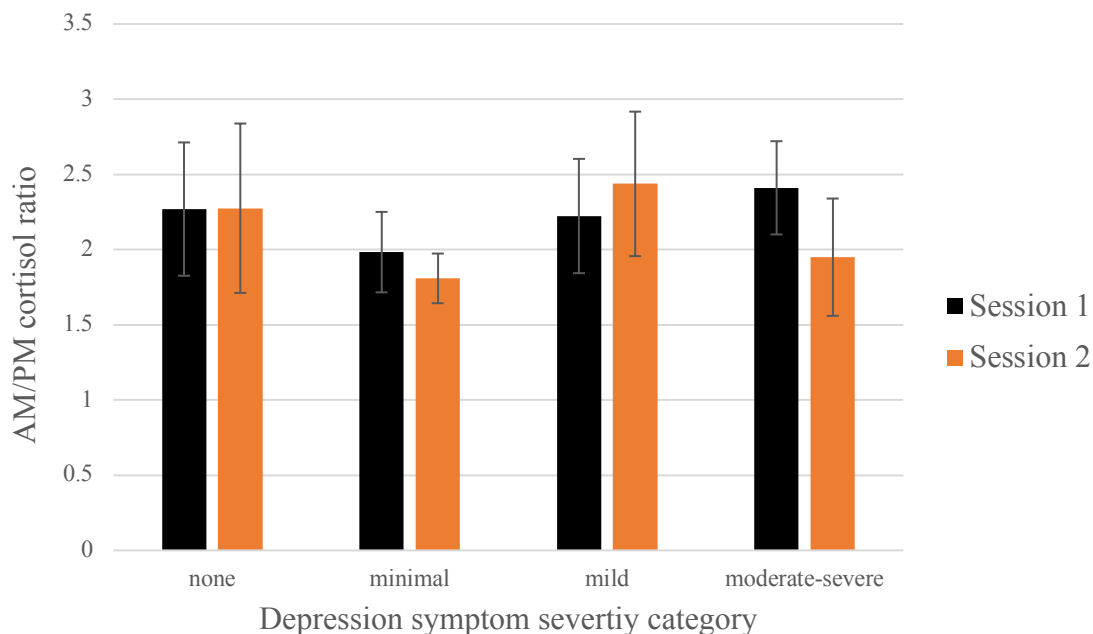
between sessions (see table 4.8). Wilcoxon analysis of paired PHQ-9 scores demonstrated that changes in scores over the semester were significant at  $p=0.149$ .

Table 4.8

*PHQ-9 average cohort scores by group*

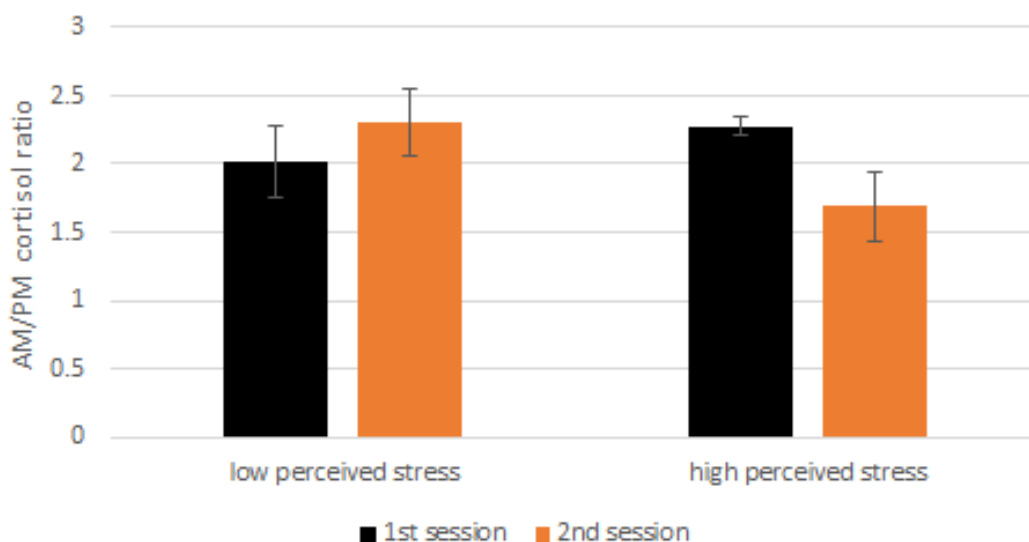
	Total	Retention	Attrition	Over 2.5 GPA	Under 2.5 GPA
Session 1	6	6.13	5	4.6	10.5
Session 2	6.8	7	3.75	5.9	9.7

Cortisol and TSH were tested as measures of stress and depression. As reported in the first research question, neither the participants' TSH nor cortisol levels significantly changed between sessions. Furthermore, when this study cohorts' PHQ-9 data was scored and divided into ranked depression level categories, cortisol ratios did not differ significantly between categories, or between sessions (see Figure 4.2)



*Figure 4.2.* Cortisol ratio comparison between PHQ-9 depression categories. The x-axis represents the different depression categories as determined by participant's PHQ-9 scores, while the y-axis represents the cortisol ratio (AM cortisol/PM cortisol) of participants.

Cortisol is also known as the stress hormone, therefore, it is prudent to assess student's cortisol levels in relation to their stress-level, as well as PHQ-9 depression indices. Study participants were surveyed during both sessions regarding their perceived level of stress over the past year, with the option to pick from the following answers: 'no stress,' 'little stress,' 'average stress,' 'more than average stress,' and 'tremendous stress.' These categorical answers were then converted numerically 1-5, with 1 indicating no stress, and 5 indicating tremendous stress. The average cohort score was 3.6 for level of perceived stress during the first session, and raised minimally to 3.7 for the second session. Cortisol ratios did not differ significantly between student who scores 3 or below (low perceived stress) and those who scored 4 or 5 (high perceived stress; see Figure 4.3).



*Figure 4.3.* Cortisol ratio comparison by perceived stress categories. The x-axis represents the different levels of perceived stress as determined by participant's survey scores, while the y-axis represents the cortisol ratio (AM cortisol/PM cortisol) of participants.

SPSS exploration and frequency analysis demonstrated that the data sets for this section did not have normal distribution, therefore nonparametric testing was used for statistical correlation analyses. Mann-Whitney U tests were performed to compare two independent samples, while Spearman rank correlation coefficient testing was executed

to assess linear association between two variables. The variables analyzed for each session to test for significant correlations were: cortisol am, cortisol pm, cortisol ratio, TSH, CRP, PQH-9 score, sex, and age. Table 4.9 presents a complete list of results that contain at least one session correlation score of  $p > 0.30$ .

Most notably for the Mann-Whitney U test statistics, PHQ-9 scores strongly correlated with participant's self-disclosed history of depression with  $p = 0.017$  for session one and  $p = .005$  for session two. A total of  $n = 14$  (28%) of respondents reported having a past history of a depression diagnosis. As both AM and PM cortisol levels were used to determine cortisol ratio, one would expect strong correlations between these variables in the Spearman rank correlations, which was confirmed by this study. TSH with am cortisol, and TSH with CRP demonstrated significant correlation for both session at the  $p > 0.10$  level. Age and PHQ-9 scores were significantly correlated at the  $p > 0.05$  level. Finally, TSH and CRP were strongly correlated at the  $p > 0.05$  level during the second session and the  $p > 0.10$  session during the first session (see Table 4.9). Notably, TSH showed no correlation with PHQ-9 scores.



Table 4.9

*Depression variable correlation outcomes*

Mann-Whitney U Test			
Variable 1	Variable 2	Session 1	Session 2
		P-value	P-value
Depressions history	PHQ-9 score	0.017	0.005
Depressions history	PM cortisol	0.218	0.336
Sex	PHQ-9 score	0.293	0.615
Sex	PM cortisol	0.745	0.136

Spearman rank correlation			
Variable 1	Variable 2	Session 1	Session 2
		P-value	P-value
AM cortisol	Cortisol ratio	0	0
PM cortisol	Cortisol ratio	0.003	0.002
AM cortisol	PM cortisol	0.263	0.023
AM cortisol	TSH	0.065	0.033
TSH	CRP	0.051	0.002
PHQ-9 score	CRP	0.099	0.651
PHQ-9 score	Age	0.003	0.005

*Note.* Correlations that did not have at least one session value of  $p > 0.30$  were not included in this summary.

**Research Question #3**

3. To what extent do clinical bloodwork assays and the assessment tools from the second research question correlate with the first semester metrics of freshman academic success at ISU, measured by Fall semester GPA, and Fall-to Spring retention? Can these factors be used as predictors of academic success or risk?

**Hypothesis.** The PHQ-9 and CSI assessments have been validated across multiple populations and have proved reliable and repeatable (DeBerard et al., 2004; Kroenke, Spitzwer, & William, 2001). Therefore, this study predicts that risk factors and depression results from the assessment tools will significantly correlate with student

success metrics. Furthermore, this study predicts that biological markers will parallel academic outcomes, with more adverse health conditions significantly correlating with adverse outcomes of student success.

**Objective.** Fall semester GPA, and Fall-to-Spring retention and entrance exam scores were collected from the ISU Office of Institutional Research after the Spring semester drop deadline. Correlation studies were performed on this data in relation to significant changes in clinical laboratory assays between sessions. The researcher also looked for correlations of academic success combined with PHQ-9 survey, CSI survey, and other health survey responses to assess relationships between identified risk factors, mental health, and academic success.

**Analysis.** Incomplete data sets were omitted from this section, resulting in  $n = 45$ , or a 90% retention rate. In order to best organize and analyze this research question, the researcher defined retention (continued Spring registration), and Fall GPA as measures of retention and academic success. Therefore, the researcher treated Fall GPA and Spring registration as dependent variables, to determine which other independent variables, or potential risk factors, may be contributing to attrition or declines in academic success (GPA).

SPSS correlation analysis was first executed to determine significant relationships between the dependent variables and high school GPA and entrance exam scores (both ACT & SAT). Next the dependent variables were analyzed to assess correlations with the laboratory tests identified as significantly changing between sessions in the first research question. Finally, the dependent variables were analyzed to identify significant

correlations with other health-associated conditions and behaviors identified in the survey-portion of the study.

Retention, defined by continued Spring 2019 registration, was the first variable analyzed for entrance exam correlations. Fall GPA and retention were significantly correlated ( $p < 0.05$ ). High school GPA was also significantly correlated with retention ( $p < 0.10$ ). SAT composite scores and SAT Math scores were the only entrance exam scores loosely correlated ( $p < 0.30$ ) with retention. Fall GPA, however, was strongly correlated ( $p < 0.05$ ) with all aspects of both the ACT (composite, English, math, science, reading), and the SAT (composite, evidence, math, reading, writing) exams.

Fall GPA and Spring retention were assessed for significant correlations with biological markers. Those clinical tests found significantly changed between sessions (see Table 4.6) were used as independent variables for correlation analysis. Fall GPA was strongly correlated with changes in potassium ( $p < 0.05$ ), bilirubin, and sodium (both  $p < 0.10$ ). Changes in white blood cell count, percent monocytes, calcium, and carbon dioxide were only loosely correlated ( $p < 0.30$ ) with Fall GPA. Retention had no strong correlation with any biological makers tested. However, there were some loose correlations ( $p < 0.30$ ) with changes in white blood cell count, percent monocytes, percent eosinophils, bilirubin, and creatinine.

PHQ-9 analysis was included in research question 2. However, there were a number of other survey-based questions included in this study to assess the contribution of health-related or risk-factor behaviors to retention and Fall GPA. These survey questions included background questions and health-related questions. Background questions were designed to assess common factors (non-health related) that have been

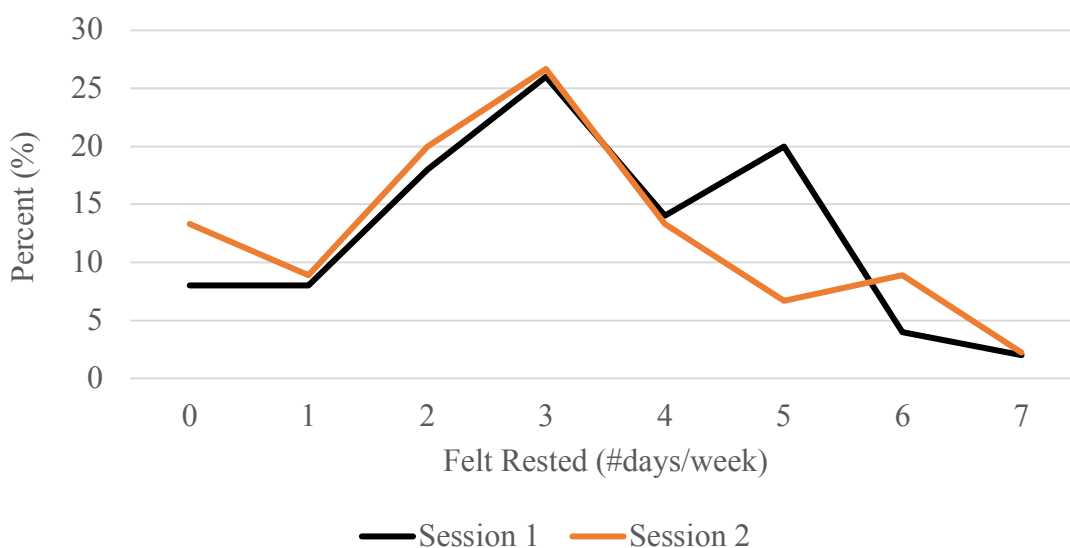
documented to effect retention. These background question included: number of hours worked during the semester, sexual orientation, relationship status, living situation satisfaction, and the highest education level of the participant's mother and father. Health related survey questions include questions about: participants perceived overall health, cigarette use, alcohol use, weight, exercise habits, sleep patterns, and feelings of sleepiness during the day. Statistical correlation analysis was performed between these aforementioned independent variables and the dependent variables of retention and Fall GPA.

The background survey questions had little correlation with retention or Fall GPA. The first risk factors assessed was the number of hours the student participants chose to work over the course of the semester. This variable had no significant correlation with either retention or Fall GPA. Satisfaction with living situation had no significant correlation either. Those in stable relationships and those with parents who had higher levels of education were loosely ( $p < 0.30$ ), but positively correlated with Fall GPA, but not retention. Changes in sexual orientation had a slight negative ( $p < 0.30$ ) correlation with both GPA and retention.

Health-related survey questions had additional correlation to Fall GPA and retention. The most notable correlation was that levels of sleepiness during the day had strongly significant negative correlation ( $p < 0.05$ ) with GPA. The only other correlation at the  $p < 0.05$  level was the negative correlation between cigarette use and retention. All other significant health-related survey data only loosely correlated to Fall GPA and retention, as follows. Participants level of perceived health and weight had loose negative correlation ( $p < 0.30$ ) with Fall GPA, but not retention. The amount of regular exercise

had positive correlation ( $p < 0.30$ ) with GPA. The amount of sleep and alcohol use had negative correlation ( $p < 0.30$ ) with retention.

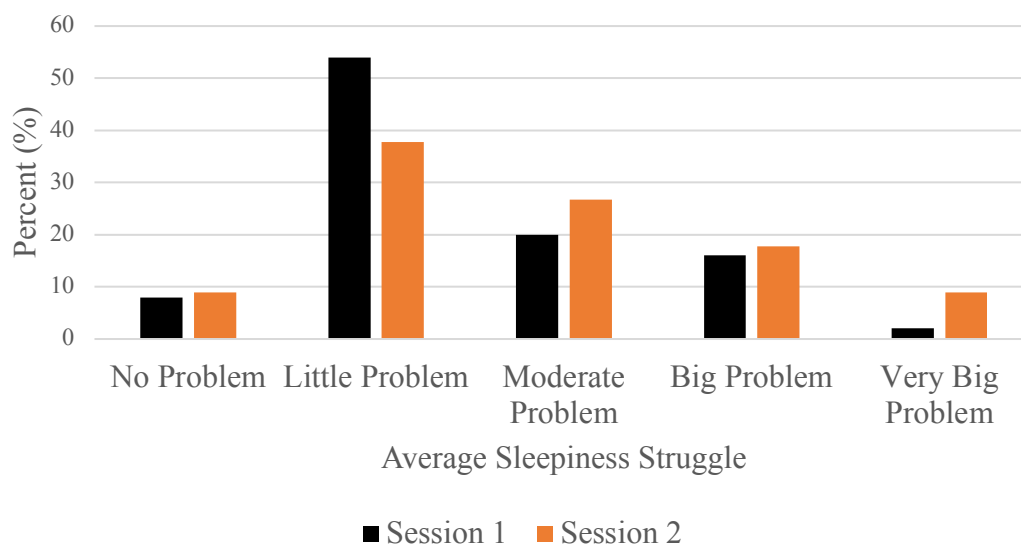
Two survey questions were designed to assess sleep behavior among study participants during both study sessions. The first question asked how many of the past 7 days participants felt they got enough sleep, so that they felt rested when they woke up in the morning. Answer options ranged from 0 to 7 days. The average response was 3.2 days for session 1, and 2.8 days for session 2. The percentage of respondents selecting each category remained relatively consistent between sessions, with the exception of a 13.3% difference on the day-5 answers (see Figure 4.4).



*Figure 4.4.* Days rested in the past week. Black lines indicate session one responses, and orange lines represent session 2 responses. The x-axis represents the total number of days participants work up feeling rested in the past 7 days, while the y-axis represents the total percentage of participants selecting each category.

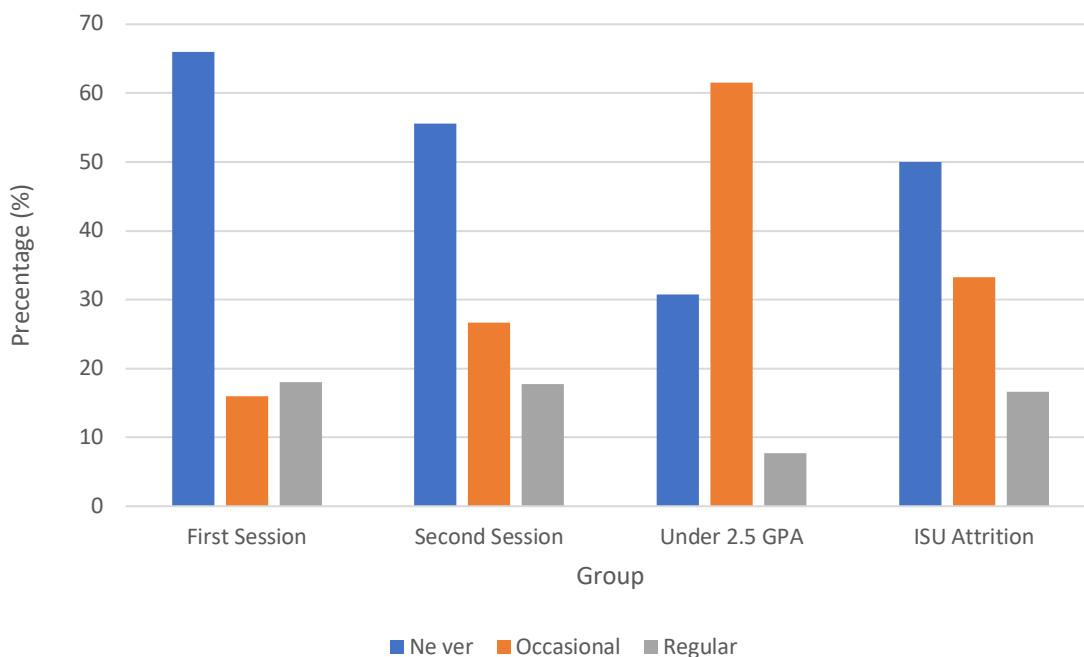
The next sleep-based question asked participants how much of a problem they had with sleepiness (feeling sleepy, struggling to stay awake) during your daytime activities in the past 7 days. Answer options for this question included ‘no problem,’ ‘little problem,’ ‘moderate problem,’ ‘big problem,’ or ‘very big problem.’ Response differences between sessions increased 0.9% for ‘no problem,’ decreased 16.2% for ‘little

problem,’ increased 6.7% for ‘moderate problem,’ increased 1.8% for ‘big problem,’ and increased 6.9 for ‘very big problem’ (see Figure 4.5).



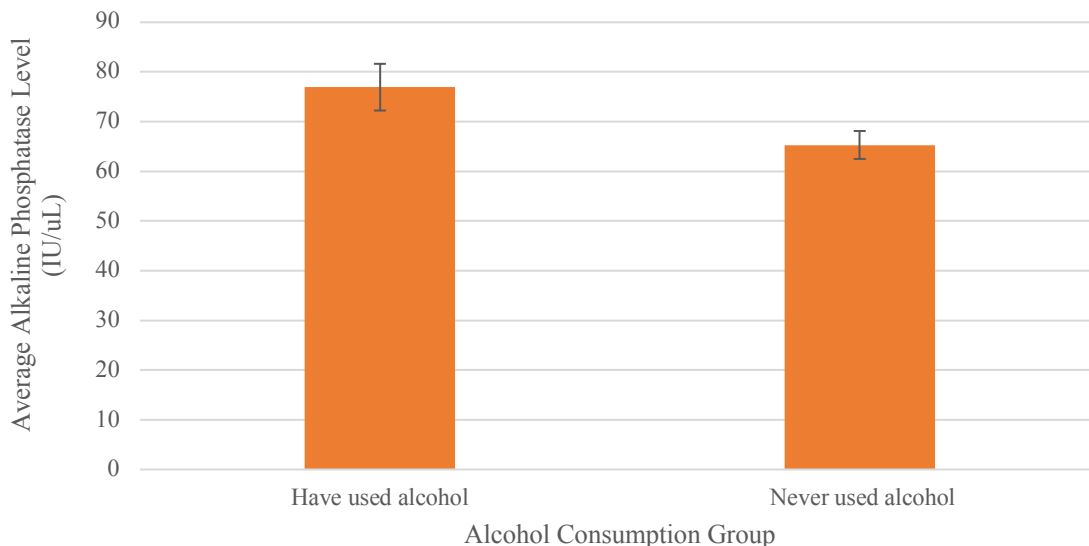
*Figure 4.5.* Sleep loss struggles over past week. Black bars indicate session one responses, and orange bars represent session 2 responses. The x-axis represents the different category levels of sleepiness in the past 7 days, while the y-axis represents the total percentage of participants selecting each category.

The federal legal age to buy and drink alcohol is 21 years of age. However, despite the average age of the cohort being under 19-years old, the percentage of students that have never consumed alcohol dropped from 66% to 55.6% between sessions. Occasional drinking, defined as consuming alcohol 1-2 days a month, rose from 16.6% to 24.4% of the cohort between sessions. Regular drinking, defined as drinking on 6 or more days during the month, stayed relatively constant, changing from 18% to 17.8% between sessions. For the student participants that had below a 2.5 Fall GPA, 61.5% reported occasionally drinking, and 7.7% reported regular drinking. Only 30.8% of this group did not report any drinking behavior. For the attrition group (those that did not return to ISU for the Spring semester), 50% reported never drinking, 33.3% reported occasional drinking, and 16.7% reported regular drinking (see Figure 4.6).



*Figure 4.6.* Percent alcohol consumption by group. Blue bars indicate those who indicated they have never consumed alcohol, orange bars indicate the participants who reported occasional alcohol-drinking behavior, and the gray bars indicated those participants that reported regular alcohol consumption. The x-axis represents the classification group, while the y-axis represents the total percentage of participants engaging in each category.

A number of tests were identified to have significantly changed between sessions may have connections with alcohol consumption. These tests include total protein, albumin, alkaline phosphatase, and bilirubin. Of these, only alkaline phosphatase demonstrated significant differences between those participant's reporting occasional or regular alcohol consumption (averaging 77 IU/uL) and those reporting to never have used alcohol (averaging 65.3 IU/uL; see Figure 4.7).



*Figure 4.7.* Alkaline phosphatase levels by alcohol consumption. The orange bars represent the average level of alkaline phosphatase between those who consume alcohol, and those in the study who do not. The x-axis represents the classification group, while the y-axis represents the blood serum alkaline phosphatase level in IU/uL.

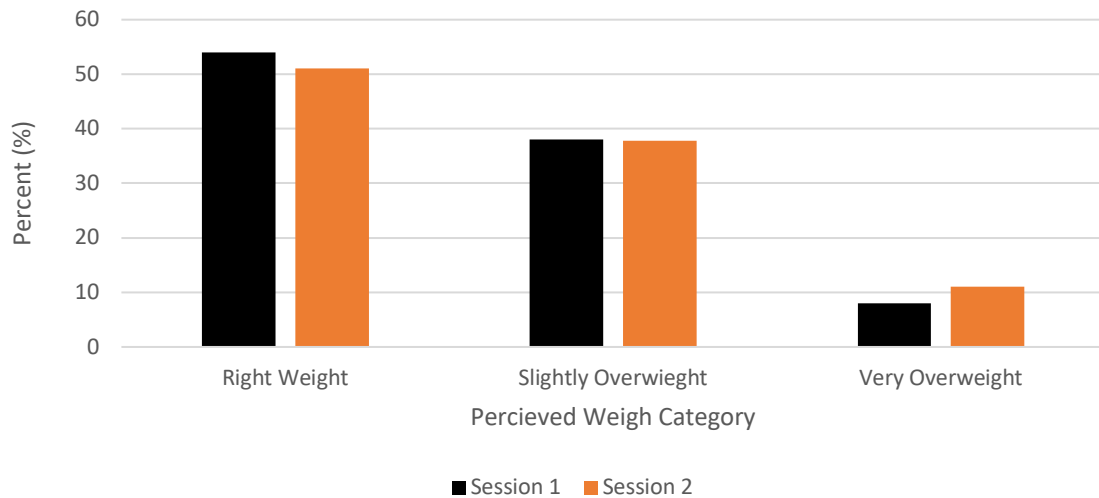
Cigarette use, weight, and exercise behavior were the last health variables analyzed. Cigarette use was found to not significantly change between sessions. However, it is notable that 28% of respondents indicated some form of cigarette or tobacco use over the past month.

Participants were asked their perception on their current weight status. All respondents either felt they were at the right weight, slightly overweight or very overweight. No participant indicated being underweight. Those indicating they felt they were at the right weight dropped from 54% to 51.1% between sessions. Those indicating that they were slightly overweight remained consistent with 38% selecting this response during session 1 and 37.8% during session 2. Those that perceived they were overweight increased from 8% to 11.1% between sessions (see Figure 4.8).

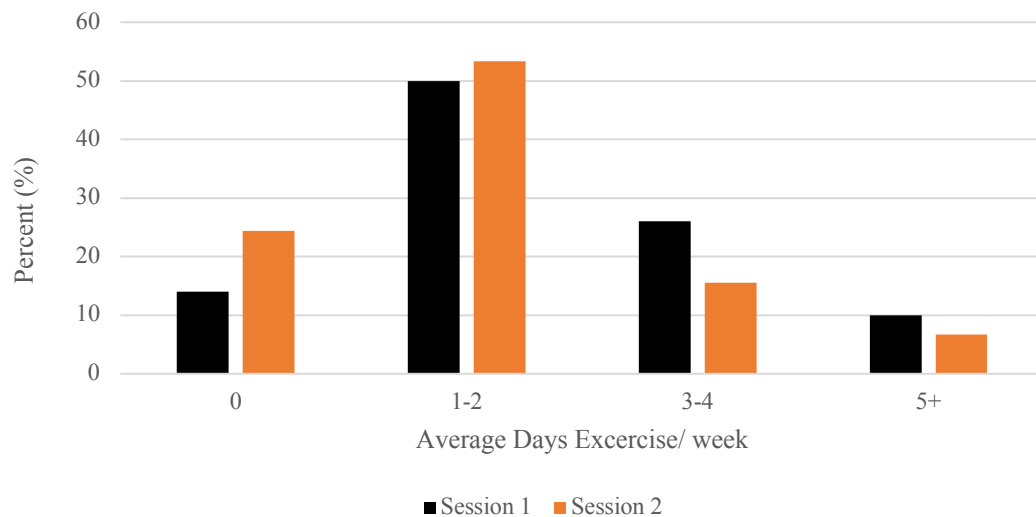
Finally, students were asked the average numbers of day per week that they exercised at least 30 minutes. Those indicating no regular exercise increased from 10% to



24.4% between sessions. Participants exercising 1-2 days per week increased from 50% to 53.3% between sessions. Those indicating exercise 3-4 days per week decreased from 26% to 15.6%, and those working out 5 or more days a week decreased from 10% to 6.7% (see Figure 4.9)



*Figure 4.8.* Average sleepiness over past week. Black bars indicate session one responses, and orange bars represent session 2 responses. The x-axis represents the category or perceived weight, while the y-axis represents the total percentage of participants selecting each category.



*Figure 4.9.* Average exercise per week. Black bars indicate session one responses, and orange bars represent session 2 responses. The x-axis represents the average number of days per week the participant exercises at least 30 minutes, while the y-axis represents the total percentage of participants selecting each category.

## **Chapter Summary**

The purpose of this study was to assess the potential contribution of clinical markers as potential contributors to attrition predictions among Idaho resident freshman. This study also sought to identify correlations between and among factors that lead to barriers in the academic success and retention among freshman at Idaho State University.

First, demographic and descriptive data was presented. SPSS statistical analyses were executed and significant changes and correlations were reported in this chapter to address the three research questions guiding this study. Clinical biological markers were analyzed for significant changes between study sessions, and a number of assays were found to have been significantly changed. PHQ-9 and stress data were compared and correlated with cortisol and TSH as biological markers to identify any significant correlations between biological markers of stress and depression and self-disclosed survey levels of stress and depression.

Finally, survey-based health analysis was performed descriptively on factors such as sleep behavior, weight, exercise, cigarette and alcohol consumption, then SPSS statistics were executed to identify correlations between these health factors and Fall GPA and retention. Chapter 5 will discuss these results.

## **Chapter 5: Discussion, Implications, and Conclusion**

This chapter provides a summary of the study, including the problem, the methodology, and a discussion of the findings from the study. The chapter will conclude by discussing the significance of this study, and its contribution to the field, as well as providing some recommendations for future research.

### **Statement of the Problem**

Student retention in higher education is not only a pervasive problem worldwide, it is of considerable concern in the state of Idaho. While the majority of Idaho students will graduate high school, only four in ten will advance their education by enrolling in college (Walters, 2015). Of those, 75% college attrition rate results in only one out of every ten Idaho high school graduates advancing to earn a college degree (Idaho Business, 2015). Since 61% of the new jobs being created in Idaho now require some form of postsecondary education, it is clear that the Idaho education system is underprepared to meet the state's needs (Idaho Business, 2014). Therefore, increasing college enrollment and reducing the soaring college attrition rates are vital for the health and economic welfare of the state.

Nation-wide studies have sought to target the root of attrition in an effort to identify students at higher risk for attrition and improve retention. Collectively the studies have found there is no single factor leading to attrition, rather, student attrition has been found to be multidimensional, encompassing common themes such as student demographics, educational background, and financial status (Johnson, 2012; Kerr, 2017). Research indicates that the majority of students who drop out of college will do so in their first year (Noel, Levitz, Saluri, & Associates, 1985). During the 2016-2017 academic year, ISU

saw a 38% freshmen attrition rate over the course of their first academic year, 8% above the national average (“Undergraduate retention,” 2017). These data indicated a significant problem with freshmen retention nationally; it indicated additional factors exacerbating early departure choices for freshmen at ISU.

Retention theory establishes that there is no single cause for attrition, and that campus-wide efforts are needed to reverse the troubling retention trends. Both mental and physical health conditions of students in higher education are troubling, and this study believes that these health conditions are contributing to the retention issue at ISU. A novel combination of survey-based data and biomarker analysis was used to assess the health trends of Idaho-resident freshman, and their correlation to retention and academic success.

### **Review of Hypotheses and Methodology**

The purpose of this study was to assess clinical factor contributions in Idaho's higher education student retention. Specifically, this study aims to see if clinical health markers correlative to Idaho State University's freshmen retention and health status. This project was quantitative research, and comprised of a survey to identify demographics, health risks, mental health status, and other pertinent factors that may contribute to academic success and/or attrition, combined with a quantitative analysis of bloodwork assays.

Based primarily on survey data, higher education students, particularly freshman, report adverse health trends during their time as higher education students (Pritchard, Wilson, & Yamnitz, 2007). Therefore, this study hypothesized that there were significant changes in laboratory assay values contributing to or caused by psychological factors

which, in tandem, indicated higher attrition. Additionally, stress, anxiety and depression are well-established maladies of higher education students (Garret, 2001; Kerr, 2017; Savage, 2006; Zajacova, Lynch, & Epsenshade, 2005). Abnormal psychology literature states that symptoms of stress and depression have both psychological and biological components. Therefore, this study hypothesized that validated assessment tools of stress and depression, such as the PHQ-9 survey would reveal significantly adverse trends over the course of participants' first semester at ISU. Moreover, it was hypothesized that the biological markers of stress and depression would significantly correlate with their respective assessment responses. Finally, the PHQ-9 and CSI assessments have been validated across multiple populations, and have proved both reliable and repeatable (DeBerard et al., 2004; Kroenke, Spitzwer, & William, 2001). Therefore, this study predicted biological risk factors and stress/depression results from the assessment tools would significantly correlate with student success metrics. Furthermore, it was predicted that biological markers would parallel academic outcomes, with more adverse health conditions significantly correlating with adverse outcomes of student success.

## **Discussion of Results**

### **Participant discussion.**

Student background information was important to provide context for discussing motivational patterns within the scales of this study. Demographic analysis determined that the freshmen participant's in this study were 70% female and 30% males, compared to the 54.1% female to the 45.9% male ratio of total undergraduate students at ISU ("Idaho State University student population", n.d.). Therefore, this study was slightly skewed to include more female participants than reflected by university averages. The

average age of participants in this study was 19.8-years old, while the average age for the ISU freshmen body for this time frame was similarly 20-years old (“Idaho State University student population,” n.d.). The diversity of study participants was 68% White/Caucasian, 20% Hispanic/Latino, 8% multiethnic, and 2% Asian/Pacific Islander. The ISU total student body diversity is currently 71.9% White/Caucasian, 11.21% Hispanic/Latino, 6% multiethnic and 1.6% Asian/Pacific Islander. Furthermore, 92% of freshmen body at ISU are Idaho-residents (“Idaho State University student population,” n.d.). Based on this comparison, the ethnic diversity composition and ages of the study’s participants accurately reflects the population which they more broadly represent.

The average high school GPA for the study cohort was 3.3 while the average high school GPA of degree-seeking, full-time freshmen entering ISU is 3.2 (ISU Institutional Research, 2018b). The average GPA for participant’s first semester at ISU (Fall 2019 GPA) was 3.1. The average composite ACT for the study participants was 23.9, while the average full-time incoming freshmen ACT score was 22 (ISU Institutional Research, 2018b). The average composite SAT score for the study participants was 1112.6, while the average full-time incoming freshmen SAT score was 1015.5 (ISU Institutional Research, 2018b). Based on GPA and entrance exam scores, this cohort may reflect a slightly higher performing group than their ISU freshmen class average. This was likely a result of the study’s recruiting methods, particularly the booth at the ISU New Student Orientation fair, which may have drawn more females, and a higher-achieving crowd than other recruitment methods. However, generally speaking, the participants in this study closely reflect the Idaho-resident freshmen class at ISU.

**Retention discussion.**

There were two types of retention mentioned in this study: study retention and ISU retention. Study retention was defined as student participants that completed both sessions of the study. In this study,  $n=45$  of the original  $n=50$  students completed both sessions, indicating a 90% study retention rate. Research literature suggested that strong longitudinal clinical study retention rates are 85% or higher, indicating that this study had a strong return rate (Abshire et al., 2017). ISU retention, on the other hand, was defined as those who remained registered for classes after the drop deadline for the Spring 2019 semester.

In this study,  $n = 44$  of the  $n = 50$  students remained registered for Spring classes, indicating an 88% ISU retention rate for the study cohort. Only one study participant fell into both categories of study and institutional attrition. The ISU Office of Institutional Research reported that the fall-to-spring retention factor for full-time freshmen was 80.7% in 2017 (ISU Institutional Research, 2018b). Therefore, the retention rate for the study cohort was 7.3% higher than this class average, and I would have expected an attrition of up to four more study participants.

The ISU Office of Institutional Research further advised that freshmen fall-to-fall retention was 62% in 2017, suggesting the value in increasing the duration of future studies to account for larger groups susceptible to attrition (ISU Institutional Research, 2018b). While the greater retention rate of the study cohort over the ISU freshmen body may be accounted for by participants being academically higher-performing students, applications of Tinto's theory of integration cannot be excluded. In other words, it cannot

be determined if the cohort's participation and monitoring provided by this study contributed positively to retention choices.

### **CSI and MYSA survey discussion.**

The internal validity of survey data was very strong (6.98 out of 7), indicating that participants were actively engaged in the survey process. However, as with most survey data, it is assumed that students answered questions thoughtfully and honestly. The CSI survey identified 28% (n = 14) students at risk for attrition, with percentages of dropout proneness between 65-99%, as compared to the national average of 50%. This is significantly higher than the 12% (n = 6) ISU student attrition that was experienced in this study. However, had this study been extended fall-to-fall, rather than fall-to-spring, there likely would have been numbers closer to ISU's fall-to-fall freshmen attrition rate of 38%. Notably, the CSI survey cautions that even though dropout proneness scales were determined empirically, the nature of retention choices are complex. Therefore, the dropout proneness scale should be considered as a pattern of intellectual and motivational traits that are loosely associated with dropping out, and not entirely predictive. This is evidenced by the fact that only three of the 14 students identified at-risk for dropout proneness, actually did experience early departure from ISU.

Despite 14 participants being identified by the CSI survey as at-risk for attrition, the total study cohort average for dropout proneness was reported as 45%, which is 5% under the national average (see Table 4.1). However, when the study cohort was ranked by at-risk GPAs, 24% (n = 12) of study participants earned a 2.5 GPA or less for the Fall 2018 semester. Eight of the fourteen (57%) students included on the dropout proneness list had GPAs under 2.5. This suggests that Fall GPA correlates better with CSI data than



retention data. It also indicates that CSI data might be a better indicator of attrition if studies were to include the entire freshman year, rather than just the first semester.

Primarily due to their incoming GPAs, the CSI's predicted academic difficulty for the study cohort was only 34.7% (see Table 4.1). In fact, all initial CSI academic motivational scales, except one, were above national averages. Study habits rated 58.0%, reading interests 64.8%, verbal and writing confidence 53.8% and math and science confidence 50.3% on the CSI scale. The level of commitment to college was the only academic motivational scale below the national average and reported at 49.3%.

Interestingly, by the end of their first semester at ISU, commitment to college decreased to 46.7%. Reading interest and verbal and writing confidence changed very little, but math confidence increased by 6.5% (see Table 4.2). Extrapolating this data to larger populations, the evidence suggests that the primary problems with ISU freshmen attrition is not based on cognitive ability nor their academic motivation. The decrease in college commitment does not seem to be associated with academic motivation.

Furthermore, the degree plans for the cohort imply increased motivation, with 51.1% ( $n = 23$ ) pursuing a 4-year college degree, 31.1% ( $n = 14$ ) a professional degree, and 13.3% ( $n = 6$ ) with plans to pursue a Master's degree (see Table 4.3). These numbers changed very little between the CSI initial survey, and the MYSA second session survey, suggesting that the study cohort has ambitious goals for their careers. Furthermore, this implies that the academic degree targets remained consistent, even among those with suffering GPAs and retention challenges.

While the study cohort's capacity for opinion tolerance is above national CSI/MYSA averages, this scale decreased from 58.1% to 57% between sessions. Family

support, financial security and social engagement were all well below national averages. However, family support decreased 3.1% while financial security increased 3.6% between sessions (see Table 4.2). This may be due to 25 of the 45 participants working at least part-time. Social engagement decreased 3.8% to a 38.4% average. This data indicates that there is a surprisingly low desire for companionship and social entertainment in this freshmen cohort. While high levels of sociability may be detrimental for students with poor study skills, a lack of sociability as seen here, limits student's ability to integrate into the university culture and mission and cause general dissatisfaction or discouragement in the experience (Stoecker, Pascarella, & Wolfle, 1988). According to Tinto (1987, 1993) and Bean's (1980) theories of retention, trends of decreased sociability may result in increased attrition.

The data indicated that this freshmen cohort was highly receptive to institutional aid in the form of academic assistance, personal counseling, career guidance, and financial guidance, with all CSI metrics rating above the national average (see Table 4.1). To improve retention, it is incumbent on the institution to provide the needed and requested services to help these students. Without such services, retention will likely be negatively impacted.

The MYSA survey followed-up on these metrics to determine how satisfied the cohort was with their university services. As reported in Table 4.4, institutional impression was rated on a 7-point scales, with 1 being the most negative and 7 being the most positive opinion. Cohort responses were averaged for a campus mean. The highest-ranking student impression suggested that the cohort felt safe and secure on campus, with a campus average of 6.22. Following safety, students rated interaction with faculty inside

class as 5.6, and outside of class as 5.16. This is important since retention literature suggests that interaction with faculty positively influences persistence (Pascarella & Terenzini, 1976; Stoecker, Pascarella, & Wolfle, 1988). Students rated ISU financial resources with a 5.47 campus average score. This correlates with the feelings of financial security reported earlier. Assistance in selecting majors, and interactions with advisors scored 5.4 and 5.33 respectively, indicating a general satisfaction with provided academic advising opportunities. And finally, study participants provided ISU with an average score of 5.31 for creating a sense of belonging and college community. Despite respectable scores for institutional impressions, four students reported that they planned to transfer to another higher education institution. All four students who reported this currently remain registered at ISU. There may be many reasons for transfer potential, despite institutional satisfaction, such as program cost, degree availability, class schedule, or family reasons.

Summarily, CSI and MYSA data suggested that this study cohort accurately represents the larger ISU freshmen population in terms of demographics and academic preparation. The data revealed that student participants are academically motivated and have positive impressions of ISU. Interestingly, this data did not indicate that financial strain was a major concern for this cohort. Instead, the most concerning scores, those furthest from national averages, involved general coping measures, relating to the student's capacity to manage the non-academic aspects of college life that may interfere with their ability to be successful in college. This gives further credibility to the premise of this study involving health factors, stress, and depression.

### **Research question #1.**

The purpose of the first research question was to evaluate whether there was a general decline in the physical health status of the study cohort during the course of this study. This was accomplished by monitoring changes in clinical biomarkers over their first semester in higher education and executing statistical analysis to determine the significance of those changes. Chapter 4 outlined a number of clinical assays that were found to be significantly changed between sessions. The purpose of this section is to discuss the relevance behind those changes, and suggest possible causes for those results.

Distribution analysis performed on the clinical assays demonstrated the majority of blood work values for the study cohort did not have normal distributions. This is primarily due to the relatively small sample size of the study and some significant violations in normality assumptions, such as extreme outliers. Therefore, non-parametric testing was performed to account for these distributions. Wilcoxon-Mann Whitney statistical nonparametric testing was used to determine significant changes in blood work between paired samples from the first and second sessions. It should be mentioned that few assays could reasonably be considered to have a normal distribution in this study. In these instances, both parametric t-testing and nonparametric Wilcoxon-Mann Whitney testing were performed, with no meaningful changes resulting between these statistical comparisons. In other words, the significance reported in this study remained consistent. Traditional statistical significance is typically reported at the  $p=0.001$ ,  $p=0.05$ , and  $p=0.1$  levels. There were a number of assays in this study that nearly missed the  $p=0.1$  significance cutoff. However, I believe that had more testing been accomplished in larger volumes, these tests would continue trending towards statistical significance. Therefore,

in this dissertation, I report all significant p-values under  $p=0.3$  primarily for discussion purposes and reflection for future research.

Understanding the difference between abnormal laboratory testing and critical values is necessary when discussing bloodwork results. Abnormal laboratory values are those that fall above or below the designated reference range for each specific assay. Reference ranges are determined by the age, race, and population of the area in which they are being tested, with little variation worldwide. Critical values are not only abnormal, they are laboratory values that are considered clinical emergencies that require immediate intervention. This study experienced one critical value for a low total white blood cell count during the first session. This student participant was sent immediately to ISU student health services for evaluation. Due to HIPAA regulations, this study was not able to ascertain the treatment plan presented for this student. However, by the second session this student was no longer in critical range. The student did not know of their critical condition prior to participation in this study.

Reference ranges are determined empirically by every lab, using thousands of samples to determine the normal distribution. Generally, the reference range reflects a 95% confidence interval, or two standard deviations from the mean. In other words, 95% of results in the given population should fall between the reference ranges for any given assay (Burtis & Bruns, 2015). This is important to consider, as this implies that as many as 5% of results may be flagged as abnormal when, in reality, they may be just outside the 95% confidence interval. With this in mind, it is still concerning to find that in the course of this study 7.2% of assays in the first session and 10.6% of assays in the second session were flagged as abnormal. While some of these tests may not be considered

critical in nature, there are more values outside of statistical significance than we would predict from reference ranges of an age-appropriate, healthy population. Additionally, the number of abnormal tests is increasing over time. More testing is needed to determine if this trend will continue to increase over the course of the student's academic career, or if there are other causes, such as seasonal illnesses. Future testing may consider running a baseline blood value prior to the beginning of the semester, to better determine if students are entering with a similar level of lab abnormalities, or if these results are a condition of the stress or other experiential conditions leading up to beginning their first semester in higher education.

Several values in the complete blood count (CBC) were found to be significantly changed between sessions. First, the researcher will discuss aspects of the white blood count (WBC). The total WBC was found to increase ( $p < 0.30$ ) over the course of the semester. Elevated WBC counts typically indicates that the immune system is working to protect or heal the body. However, there is no positive health condition that would elicit such a response. Therefore, significantly elevated WBC counts across the cohort indicated a decline in general health.

There are a number of conditions that may result in an elevated WBC count, including infection, cancer, stress, inflammation, trauma, or allergy. One possible explanation for WBC increase in this study may be due to an escalation in seasonal illnesses, often associated with the winter season when the second session bloodwork was drawn. Illnesses may also cause internal inflammation that can lead to increased WBC counts (Strawbridge, Young, & Cleare, 2017). Additionally, both physical and emotional stress have been linked to increases in WBC counts (Keohane, Smith, & Welenga, 2016).

The levels of stress and depression will be analyzed in greater detail in the second research question of this study, but persistent levels of stress and depression may account for this WBC increase.

It is impossible to determine the exact cause of the increased WBCs reported in this study by analyzing it as an isolated value. To better understand WBC increase, examining the WBC differential is prudent. The WBC differential is the breakdown, by percentage, of the five different types of white blood cells: neutrophils, lymphocytes, monocytes, basophils, and eosinophils. Lymphocytes and neutrophils are primarily increased during bacterial and viral infection; however, they were not increased significantly in this study (Keohane, Smith, & Welenga, 2016). This suggests that seasonal-related disorders were not primarily contributing to the significant increase in WBC reported. Contrastingly, the monocyte percentages were significantly ( $p < 0.05$ ) increased between sessions. Monocytes are commonly elevated by stress and inflammation (Keohane, Smith, & Welenga, 2016). Both eosinophil and basophil percentages were less significantly ( $p < 0.30$ ) increased between sessions. Elevations in basophils and eosinophils is primarily caused by allergies. Monocytes and basophils can also be increased in diseases such as infectious mononucleosis (mono), however, we would also expect to see an increased level of lymphocytes if this condition was driving increases in these value (Keohane, Smith, & Welenga, 2016). Anecdotally, one study participant was diagnosed with active mono during the second session of this study. Summarily, the total WBC count, and three of the five differential WBC cell lines were found to be increased over the course of the session, indicating a general decline in health and accompanying immune response.

In addition to the WBC count, the red blood cell (RBC) count also presented significant differences between study sessions. However, in this instance, the RBC count declined. Both RBC count and hematocrit levels decreased ( $p < 0.30$ ) in the course of this study. RBC values typically mirror changes in hematocrit or hemoglobin. Hematocrit measures the proportion of RBCs in the blood. Low hematocrit counts may indicate anemia, vitamin and mineral deficiencies, long-term infections and illnesses, or blood loss (Burtis & Bruns, 2015). In this population, long-term illness or blood loss seemed unlikely. Diet changes, and vitamin and mineral deficiency are suspected to be the likely culprit for the low RBC and hematocrit levels seen in this study. These decreases, like WBC, also indicate negative health conditions developing among the study cohort.

C-reactive protein (CRP) is a general marker of inflammation in the body. CRP was found to be significantly increased ( $p < 0.05$ ) between study sessions. CRP is a nonspecific assay with numerous causes for increase. CRP and WBC are often elevated together, as is the case in this study. CRP is also elevated in conditions of stress and depression (Strawbridge, Young, & Cleare, 2017). While discussion of causation for elevated CRP may be futile, the ultimate risk of elevated CRP is heart disease. Elevated CRP is never an indication of health; therefore, it can be concluded that the students' health is being negatively affected.

The lipid profile testing done in this study showed clinically significant changes in high density lipoprotein (HDL) and the coronary risk profile, also known as the cholesterol/HDL ratio. HDL is known as "good" cholesterol. Therefore, the decrease ( $p < 0.05$ ) in HDL in this study is concerning. Fatty food, alcohol consumption, and smoking can all decrease HDL levels. Metabolic syndromes may also account for decreased HDL



(Burtis & Bruns, 2015). The third research question in this study looked more closely at weight gain and alcohol consumption as health markers, however, decreases in HDL is likely due to poor lifestyle changes in diet and exercise across the semester. The “freshmen 15” is a common phrase used to describe weight gain by freshmen during their first year at college, primarily due to substantial lifestyle changes.

Because HDL is the denominator in the coronary risk ratio, one would expect coronary risk to increase to the same degree of significance as HDL is increasing. This was true for this study. Increases in coronary risk ratios indicated increased danger of atherosclerosis and heart disease. Stress has been linked directly to poor diet choices and increased coronary risk. This study included a larger percentage of females, consequently, it should be mentioned that birth control has been connected to increases in cholesterol, decreases in HDL, and abnormal thyroid tests (Burtis & Bruns, 2015). However, TSH values did not significantly change in this study, and neither did total cholesterol. Analysis of these variables comparing males and females was insignificant, suggesting that birth control is not the cause of decreased HDL in this study. The evidence suggests that poor diet and lifestyle changes are the primary contributors to significantly increased coronary risk and decreased HDL in this study.

The comprehensive metabolic panel (CMP) was the final assay that reported significant changes between study sessions. Changes in bilirubin, creatinine, sodium, total protein, albumin, and calcium were strongly significant ( $p > 0.05$ ), and changes in alkaline phosphatase and glucose were moderately significant ( $p < 0.10$ ). Carbon dioxide, potassium, and chloride showed trends toward significance ( $p < 0.30$ ). Interestingly, the combination of increased bilirubin, decreased total protein, decreased albumin, and

increased alkaline phosphatase are a combination that exists in liver damage from those consuming too much alcohol (Vellanki, 2014). The third research question demonstrated that self-reported alcohol consumption may not be overly concerning, however, the participants' honesty of answering alcohol-related questions must be considered due to the illegal age of those answering the questions. Laboratory testing in this study indicated that it may be a more concerning problem than the survey data portrayed. Changes in creatinine and sodium indicate that kidney function might be altered. Increased sodium, increased glucose, and decreased calcium give additional evidence of poor diet among study participants.

The evidence for this research question clearly demonstrated that a large number of clinical biomarkers were significantly changed among the study cohort. The overwhelming trend of these changes indicates a decline in student health over the course of their first semester. Therefore, the researcher concluded that my hypothesis for this research question was correct. Student laboratory tests are changing towards an unfavorable outcome. The overall discoveries and potential implications of this study are noteworthy. This study unmistakably demonstrates that there is a biological decline in freshmen health. It contributes clinical evidence to support the survey data that currently describes adverse health outcomes in higher education students. Equally as remarkable is the degree and speed in which that these outcomes became evident. Clinically significant changes in health are able to be detected in a matter of weeks. This potentially allows for early prevention strategies through student health services. Health problems have the potential to intercalate and interfere with every aspect of life, and, therefore, undoubtedly play a pivotal role in academic success. This research question not only supports the

current literature in the field, but provides compelling evidence that more needs to be done to holistically care for, and potentially intervene on behalf of the students on campuses, particularly freshmen.

### **Research question #2.**

Stress, anxiety, and depression are well-established maladies of higher education students (Garret, 2001; Kerr, 2017; Savage, 2006; Zajacova, Lynch, & Epsenshade, 2005). Abnormal psychology literature readily states that symptoms of stress and depression have both psychological and biological components. Therefore, this study hypothesized that validated assessment tools of stress and depression will have demonstrated significantly adverse trends over the course of participants' first semester at ISU. Moreover, it is hypothesized that the biological markers of stress and depression will significantly correlate with their respective assessment responses.

In order to accomplish this analysis, cortisol and TSH panel testing was performed on the freshmen study cohort during the first two weeks of the Fall 2019 semester. In addition to this, the students were administered the College Survey Inventory (CSI) and Patient Healthcare Questionnaire-9 (PHQ-9) assessment surveys supplemented with customized survey questions for this study. Statistics were executed to detect significant changes in assessment responses across the semester, in addition to looking for correlations to respective biological laboratory values.

The PHQ-9 survey is a self-administered diagnostic tool for depression diagnosis and monitoring. PHQ-9 scores range from 0 to 27, with higher scores indicating increased depression severity indices. PHQ-9 scores of 0-4 are categorized for depression severity as 'none', scores of 5-9 as 'mild', 10-14 as 'moderate', and scores over 15 are considered

to indicate “severe” symptoms of depression. It should be explained that PHQ-9 results would not be considered diagnostic by themselves, and an official diagnosis of depression would need to be made by a qualified health-care professional.

This study does not claim that the scores represent depression, nor does this study claim to diagnose depression from these results. Rather, students are self-identifying that they have symptoms of depression and this study seeks to identify changes that maybe be occurring in these symptoms. Mann-Whitney U Tests demonstrated that PHQ-9 scores were strongly correlated ( $p= 0.005$ ) with students with a history of depression, demonstrating an expected relationship. This correlation gives validity to the PHQ-9 assessment tool (see Table 4.9).

Table 4.8 gives an overview of PHQ-9 scores broken down between measures of retention and academic success. Depression scores did increase from a 6-point average to 6.8 between study sessions. Both of these scores represent “mild” depressive symptoms, however there is an increasing trend. The majority of students ( $n=31$  or 69%) reported an increased individual PHQ-9 score between sessions. Notably, the percentage of student reporting no depression symptoms decreased, while the percentage of student in the moderate and severe depression categories increased over the course of the study. Surprisingly, when analyzing PHQ-9 data differences between those who remained registered for Spring 2019 with early departure scores, students who remained at ISU experienced an average score increase from 6.13 to 7, while the attrition group decreased from 5 to 3.75. This may be a result of the small number of student attrition seen in this study. Alternatively, this data may indicate those students who choose early departure may experience a relief from symptoms of depression.

When analyzing GPA as a marker of academic success, the relationship with PHQ-9 scores were remarkable. Those with GPA 2.5 or under reported approximately twice the PHQ-9 scores as those with GPAS over 2.5. PHQ-9 scores for students with higher GPAS increased from 4.6 to 5.9. Those with lower GPAS remained relatively consistent with an average score of 10.5 during the first session and 9.7 during the second session. This results indicated that students with lower GPAs were, on average, experiencing moderate to severe levels of depression symptoms. Interestingly, this group did not show an increase of depression symptoms over the semester. This suggests that students entering higher education with symptoms of depression are at-risk for poor academic performance, and that these symptoms are a persistent challenge throughout their educational experience.

In summary, PHQ-9 scores indicated that those with more severe symptoms of depression at the beginning of the year are at risk for poorer academic performance, and that those levels of depression symptoms remain relatively stable. Additionally, extrapolation of this data implied that there was a general increase in depressive symptoms among freshmen during their first academic year. This study's data revealed that early PHQ-9 monitoring may provide valuable information for student support and intervention, and could be considered as a cost-effective method in monitoring freshman mental health.

With reported increases of depression symptoms, the researcher hypothesized that clinical biomarkers would correlate with significant changes in cortisol and/or TSH levels between sessions. Unexpectedly, as reported in the first research question, there were no significant difference in TSH and cortisol scores between sessions. However, there were

increasingly significant correlations between AM cortisol and TSH ( $p = 0.033$ ), TSH and CRP ( $p = 0.002$ ), and PHQ-9 and CRP ( $p = 0.099$ ) scores, respectively (see Table 4.7). This data indicated that as PHQ-9 scores increased, CRP scores increased as well. This signifies that there is a biological correlation of inflammation with more severe depression symptoms.

CRP and PM cortisol did demonstrate stronger correlation ( $p < 0.30$ ) by the second session of this study than it did during the first session. Therefore, the researcher postulated that this trend would have become more significant had the study extended another semester. Also, CRP was previously reported as significantly increasing in this study population. Consequently, if cortisol levels continued to demonstrate stronger correlations with CRP, then one would expect that cortisol would eventually significantly correlate with PHQ-9 scores. The researcher believes that this testing needs to be conducted over a longer time period in order to adequately assess the true correlations between depression symptoms and biological markers. However, with the data available, the researcher rejected my hypothesis that cortisol and TSH could be used as biological markers for monitoring changes in depression symptoms.

Study participants were also surveyed on their perceived level of stress over the past year, with the option to pick from the following answers: ‘no stress,’ ‘little stress,’ ‘average stress,’ ‘more than average stress,’ and ‘tremendous stress.’ These categorical answers were then converted numerically from 1-5, with 1 indicating no stress, and 5 indicating tremendous stress. The average cohort score was 3.6 for level of perceived stress during the first session, and increased marginally to 3.7 for the second session. Cortisol ratios did not differ significantly between students who scored 3 or below (low

perceived stress) and those who scored 4 or 5 (high perceived stress; see Figure 4.3).

TSH levels did not correlate significantly with perceived stress either. Consequently, this study suggested that without further data, medical evaluation and intervention using these specific biological markers would be inadequate to help students with depression symptoms and high perceived stress. Conversely, this study data does indicate the need for increased resources directed to mental health services on campus. The final research question investigates how these results, and other health variables further influence retention and academic success.

### **Research question #3.**

For the final research question, the researcher wanted to determine how health variables correlated with retention and student success. Consequently, the researcher hypothesized that biological markers will parallel academic outcomes, with more adverse health conditions significantly correlating with adverse outcomes of student success. To accomplish this, the researcher performed correlation studies on the data related to significant health changes as evidenced by clinical laboratory assay changes between sessions. The researcher analyzed correlations of academic success combined with GPA, entrance exam scores, the PHQ-9 survey, CSI survey, and other health survey responses to assess relationships between identified biological risk factors, mental health, and academic success.

First, statistical analysis found that both high school and Fall semester GPA were strongly correlated with retention ( $p < 0.10$ , &  $p < 0.05$  respectively). Interestingly for this study cohort, the only entrance exam scores that were loosely correlated ( $p < 0.30$ ) with retention were the SAT composite and SAT math scores. It is possible that

extending this study to include another semester would result in stronger correlations between entrance exams and the additional attrition that would be expected.

Fall GPA, as a measure of academic success, demonstrated strong correlation ( $p < 0.05$ ) with every subject and composite scores of both the ACT and SAT entrance exam scores. This data suggested that GPA (both high school & Fall) is a stronger indicator of retention, while entrance exams were predictors of academic success. These data correlate well with current retention literature and provide additional validity to the analysis in this study.

Next, both Fall GPA and Spring retention were assessed for significant correlations with biological markers. Those clinical tests that were found to have significant changes between sessions (see Table 4.6) were used as independent variables for correlation analysis. Fall GPA was strongly correlated with changes in potassium ( $p < 0.05$ ), bilirubin, and sodium (both  $p < 0.10$ ).

In the first research question it was determined that a number of CMP analytes were significantly changing, including potassium, sodium, calcium, and chloride. Some of these tests indicated that there may be some level of impaired kidney function among study participants, or movements in that direction. Fascinatingly, stress has been linked with kidney disease. Sustained stress for prolonged periods of time, as might be experienced during initial enrollment in higher education, can lead to increased blood pressure, higher fat and sugar levels in the blood, which can contribute to kidney disease. As already reported, this study found that serum glucose levels and coronary risk ratios were significantly increasing in this study population. Therefore, it is reasonable to



assume that kidney function impairment may also be occurring. This conclusion was further supported by the significant correlations to changes in CMP analytes.

Stress in higher education may be difficult to control, however, guiding physical responses to stress is manageable. Many positive health-related choices such as healthy eating, limiting sodium and sugar intake, adequate sleep, and regular exercise helps improve these stress levels. Despite this, the data generated in this study demonstrated that nearly 25% of participants engaged in no form of regular exercise, in addition to a 10.4% decrease in participants that engaged in regular exercise (see Figure 4.9).

Psychological approaches such as counseling, meditation, prayer, and goal-setting is also effective at reducing stress (Young, 2003). Much like the literature reviewed for this study suggested, this data indicates there is a need for both psychological and physical health assessment and remediation in combatting health issues which correlate to successful academic performance. Regrettably, students often won't know they are suffering from any health conditions that are affecting their daily performance. They may associate any symptoms as side-effects of lifestyle choices. Regular bloodwork monitoring may provide students with knowledge to counteract measures that are detrimental to their academic success.

Like entrance exam scores, bloodwork was more significantly correlated to GPA than it was to retention. However, WBC count, percent monocytes, percent eosinophils, bilirubin, and creatinine were trending towards significance, with  $p < 0.30$ . Again, this may be a result of the limited percentage of attrition, and future studies should extend the timeframe to account for attrition over the entire freshmen academic year. Correlations to increases in total WBC, and monocyte and eosinophil percentages suggest that infections,

illnesses, or general declines in health are correlated with early departure choices.

Interestingly, bilirubin was the only analyte found correlated to both retention and GPA.

Elevated bilirubin may be found in hemolytic anemia, hepatitis, liver dysfunction, and gallstones. The most likely indication of bilirubin increases in this freshmen study cohort was likely due to alcohol consumption.

A number of tests were identified to have significant changes between sessions that may have connections with alcohol consumption. These tests include total protein, albumin, alkaline phosphatase, and bilirubin, all changing in directions that would indicate some level of liver dysfunction. Occasional and regular drinking was reported to increase over the course of the study, with occasional drinking occurring much more frequently among both study participants that had a GPA under 2.5 and early departure participants (see Figure 4.6).

Regular drinking, was defined as alcohol consumption more than 6 days a month, and occasional drinking 1-5 days per month. Occasional drinking increased 7.8% between sessions, while regular drinking remained consistent. Participant survey data determined that for occasional and regular drinkers, the average number of alcohol drinks per session or party averaged 4.5 drinks. However, one student reported drinking as many as 20 alcoholic beverages the last day they chose to drink. This data suggested that alcohol consumption was a concern worth further investigation among our freshmen students. Furthermore, this data suggests that the quantity of drinking may be more harmful than the frequency during the month, assuming participants were honest and accurate in their consumption assessments. More studies are needed to directly assess the relationship between occasional drinking and liver function in higher education students,

and the role of liver impairment on health and academic success. This data presents adverse liver health outcomes over the course of the semester, and these outcomes are correlated with both retention and academic success.

Other health-related survey questions demonstrated significant correlations to decreased academic success. Sleep behavior, for example, was strongly correlated ( $p < 0.05$ ) to lower Fall GPA and retention. Those who experienced high degrees of sleepiness were more likely to have low GPAs. Those with fewer hours of sleep also had negative correlations ( $p < 0.30$ ) with retention. Respondents reported on average they only woke up feeling rested 2.8 days per week at the conclusion of the study. Over 50% of respondents reported they had moderate to severe problems with sleepiness during the past week prior to the survey. Figure 4.5 shows that sleepiness problems only worsened over the course of the study. Lack of sleep is similar to alcohol use, which slows functional capacities necessary for academic success. Furthermore, blood glucose is known to increase with lack of sleep, as was seen in this study. Low HDL and increased coronary risk has also been correlated with poor sleep behaviors. Therefore, increases in blood sugar and coronary risk ratios can be related to both diet and sleep patterns in our study population.

Additionally, bilirubin levels have found to be increased with sleep apnea patients, so it is possible that bilirubin may have a correlation to sleep in this study as well. If that is the case, it provides compelling evidence that sleep a large contributor to academic success. Therefore, identifying causes for poor sleep patterns among students within the control of the university, such as scheduling and course expectation, may help

to alleviate some of these adverse health issues, and consequently, improve academic performance.

Based on the evidence presented, the researcher believes that there are significant correlations between negative health outcome that correlate with adverse GPA or retention outcomes. Therefore, the researcher accepted the hypothesis as correct for this third research question. However, determining the causes for the correlation and adverse health outcomes will require a great deal more research. Additionally, the researcher believes that many more relevant biological markers should be included in future retention studies, particularly those involved with kidney function, liver function, sleep, and exercise.

#### **Results summary.**

The data indicated that the participants in this study closely reflect the Idaho-resident freshmen population at ISU in terms of demographics and academic preparation. With strong internal validity, CSI and MYSA survey demonstrates ISU freshmen were academically motivated and had positive impressions of ISU. Interestingly, these data do not indicate that financial strain was a major concern of this cohort. Rather the most concerning scores related to the student's capacity to manage the non-academic aspects of college life that may interfere with their ability to be successful in college. This gives further credibility to the premise of this study involving health factors, stress, and depression.

The first research question presented compelling biological evidence that freshmen's health was adversely affected over the course of their first semester. Equally as remarkable was the degree and speed in which these outcomes became evident.

Clinically significant changes in health were able to be detected in a relatively few number of weeks.

The second research question demonstrated that symptoms of depression increased among ISU freshmen across their first semester. Remarkably, students with lower academic performance demonstrated 200% more symptoms of depression than their higher performing counterparts, as determined by their PHQ-9 scores. Biological markers of cortisol and TSH did not correlate with these trends, however, markers of inflammation did. The researcher believes that increasing the length of future studies will demonstrate that these markers, particularly cortisol, will become statistically significant.

Finally, the third research question revealed correlations of data in relation to both retention and academic success. The data suggested that there are several health behaviors that may be of great concern in the ISU freshmen population, particularly alcohol use, persistent stress, and poor sleep. Each of these behaviors were correlated with retention and/or Fall GPA, and also with significant changes in appropriate biological markers for these conditions. While causation cannot be determined in the course of this study, this data provides compelling and innovative evidence, that not only supports existing retention literature, but opens doors for future research and scaffolding measures to better assist struggling freshmen.

### **Ties to Theoretical Frameworks of Retention**

Theoretical retention models are numerous, yet the underlying theme of all frameworks seek to answer the question, why do students leave, or why do students stay? Furthermore, it becomes apparent that even in theoretical models, there are multiple complex relationships when identifying factors contributing to retention. The CSI and

MYSA survey data presented in this study are deeply rooted in retention theory. One dominant retention theory is described by Tinto (1975, 1987, & 1993) as institutional integration and goal commitment. Academic integration relates to sharing academic values, as well as grades and intellectual development. Social integration, on the other hand, relates to developing positive relationships with friends, faculty, and staff.

Tinto's (1987, 1993) describes goal commitment as the student's commitment to graduating from college. The CSI data presented in this study demonstrated that all participants had intentions of earning higher education degrees, with 98% of respondents planning on completing a bachelor's degree, or higher. At the end of their first semester, these goals remained unchanged, indicating that goal commitment was not a retention factor in this study population.

This study also collected data about parental education levels, incoming GPAs, perceived academic preparation, and changes in academic confidence levels. Study participants were found to have strong academic preparation, and data indicated increased confidence levels in math, science, and reading. Therefore, there was no strong evidence to support issues of academic integration as a contributor to attrition in this study. Social integration, however, was more concerning. Both family support and social engagement declined, and both variables were below national limits. However, financial security concerns improved over the course of the study.

Positive interactions with both previous teachers and faculty were reported. Decreased social engagement and family support potentially contributed to increased feelings of loneliness or symptoms of depression, as reported in this study. Therefore, the data gives some evidence that social integration may contribute to poor academic

performance and retention choices. Later renditions of Tinto's theme resonate with the premises of this study, as the inability to successfully separate, integrate, and incorporate may lead to additional attrition-related factors such as physical and mental health-related issues. One missing theme is the overarching health factors, both psychological and biological, that are interfering with both academic and social integration, as presented in this study.

One potential confounding variable in this study relates to Tinto's Theory of Integration (1993). It is possible that involvement in this study may have contributed towards feelings of institutional integration. Student participants had some understanding of the nature of the research, and understood that they were being monitored and followed on a personal basis. Study participants were also financially compensated for their participation. Therefore, the researcher cannot disregard the possibility that students felt connected to the study, knowing they were being personally monitored. In other words, retention choices may have been positively affected simply by participating in this study, which may partially account for the high ISU retention rates. Future studies regarding this possibility would be wise.

Astin (1997) published that strains on the students' time, such as being over-committed by work, negatively impact academic integration. Astin's theory suggested the more outside obligations the student had, the less time students had to devote to academic pursuits. All participants in this study were full-time students, indicating that they have little extra time for other commitments. Only three (6.67%) participants reported working more than part-time, and 22 (48.89%) worked 20 hours or less. More than half of the participants in this study did not have external work commitments. Each of the three

students working more than 20 hours per week continued their education, and only one of them had a GPA under a 2.5. Therefore, part-time work commitments did not seem to be a strong negative contributor to academic integration.

The pervasive sleep issues, however, may suggest that these students were overcommitted. Sleep behavior was found to have a strong influence on academic success and retention. There may be other commitments, besides work and school, that were not included in this study. Biological markers associated with sleep deprivation were significant in this study.

Bean's (1980) theory of retention included aspects of student loyalty, institutional views, and commitment (Bean, 1985). Bean believed that student's perception of quality was a key factor in student's retention decisions. The MYSA survey of this study analyzed student impressions of ISU (see Table 4.4). All scores ranged from 5.11 to 6.22 on a 7-point scale, indicating that students were generally satisfied with their experience and resources.

At the end of the study, only four students had plans to transfer. Anecdotally, one student mentioned in conversation that the only reason they were planning on leaving was because their desired major was not available at ISU, but they planned to stay as long as possible before transferring. Therefore, the high numbers of retention in this study support Bean's (1980) theory, that these students had a positive institutional view of ISU. Therefore, institutional impressions or commitment do not seem to be significant variables in retention choices or academic success for the students engaged in this study.



Bean and Eaton (2000) introduced a multi-level theoretical framework of retention to include factors of background and the student's well-being. While acknowledging Tinto's (1993) theory of integration and Summerskill's (1962) theory of cognitive factors, Bean (1980) also included factors such as coping strategies, perceived abilities, and receptivity to institutional support (Bean & Eaton, 2000). CSI data demonstrated that this study cohort had receptivity to institutional support above the national average (see Table 4.1).

Table 4.1 also reports satisfactory levels of perceived ability. While three students entered ISU feeling below average, at the end of the semester, only one student ranked themselves as 'below average' for perceived academic ability. This result suggested that student's receptivity to help and perceived ability were not significant retention variables in this study. Coping strategies, as discussed in Tinto's (1993) model above, were more concerning. Social engagement and family support were the two measures that reported declines in the coping strategy category (see Table 4.2). This study, demonstrated increased symptoms of depression, particularly among those respondents with poor academic performance along with novel biological evidence for a decline in health of ISU freshmen.

As health factors, both physical and mental, have the ability to affect goal commitment, academic and social integration, coping strategies, receptivity to institutional support, perceptions, and commitment. Consequently, it is clear that health should have greater prevalence in retention theory. Not only does the evidence from this study support the current retention theory, but these results strongly suggests that

focusing on physical and mental health as a critical factor in retention would contribute significantly towards reversing current attrition trends.

### **Implications and Recommendations**

This study provided strong evidence that the health of freshmen students was adversely affected during their first semester in higher education at ISU. The data further suggested that health played an important role in academic success, and ultimately retention. Anecdotally, one student participant discovered they had a critical low white blood cell count. Another student developed a severe case of infectious mononucleosis. Yet another participant had clinical hypothyroidism, and one student had concerning high lipid levels. Each of these medical conditions had significant potential to interfere with academic success, and none of these participants knew of their condition prior to laboratory testing. Surprisingly, there was only one study participant out of 45 that did not have at least one abnormal laboratory test result by the end of the study. While not all abnormal laboratory results may be clinically concerning, this study demonstrated that a sizeable portion of our first semester freshman students had or developed serious health concerns, many of which are unknown without proper screening. Additionally, many of these medical conditions are easily treated and corrected with professional assistance. Conclusively, if ISU is serious about improving freshmen retention, ISU must make concerted efforts to include health issues in retention strategies.

ISU currently does have student health and counseling services available to the student population. There is the ISU Wellness Center and other programs directed at student health and wellness issues. From direct personal experience on several ISU committees, the researcher has concluded that many of these resources are underutilized

by the student population. Furthermore, data from this study support that conclusion. It is recommended that an analysis of the efficacy of current marketing and promotion approaches be completed, and a strategy be developed to assist students in better utilizing these programs and resources, particularly freshmen. Additionally, determining causes for the underutilization is as important as targeted marketing. Resource allocation may be needed to adequately assist in these efforts.

The researcher recognizes that this is a controversial recommendation, however, based on the evidence provided in this study, the researcher believes that the ISU student body would benefit greatly from a counseling session and physical exam, including basic bloodwork screens, on an annual basis. While a number of ethical considerations would likely prohibit such a recommendation from becoming policy, the researcher believes there are numerous strategies worth evaluating to promote these opportunities. For example, resources might be allocated to cover the cost of basic bloodwork up to one time a year. Utilizing existing structures, such as the Bengal Lab and ISU Student Health services, would minimize costs, while promoting the services available on campus. With the pervasiveness of mental health issues among college students, and the data generated from this study showing low-performing student are at higher risk for symptoms of depression, it is necessary to evaluate whether we have adequate mental health resources to provide for the volume of professional counseling and psychiatric needs on campus. If ISU, like many campuses, lack sufficient resources, concerted efforts should be made to resolve these concerns. Future cost analysis may determine that resources devoted to improving these holistic experiences of the students on higher education campuses may be recuperated by improved retention.

### **Statistical Considerations**

Primarily due to sample size, statistical analysis should be interpreted with caution. The alpha value for this study was set at  $p=0.05$ , which implied that 5% of the time the presented statistics may be occurring by chance. Replication would be necessary to confirm the findings of this study. With the number of tests run in this study, there is a risk of Type-I error. Bonferroni adjustments were made on family-wise error rate calculations, however, the risk of Type-1 errors from these calculations should be considered. Additionally, Mann-Whitney U tests are sensitive to the number of ties, such that too many ties from pretest to posttest can invalidate the results. Therefore, it is necessary to do further investigation to confidently validate the true significance presented in this study.

### **Future Directions**

As previously mentioned, future replication would be prudent in order to validate the findings of this study. In addition to replication, increasing participant volume and longevity of the study would add tremendous value and statistical strength to the assessment of the research questions presented in this study. There are a number of additional biomarkers that should be analyzed for their potential contributors to attrition, such as neurotransmitters, which were not cost-effective to be included in this dissertation. The researcher would recommend this study be repeated at other colleges and universities to ensure that results can be extrapolated and generalized to larger populations. Ideally, validated results could be assessed among other student populations at-risk for retention besides freshmen, such as part-time or military veteran students.

## **Conclusion**

Attrition in higher education is a pervasive problem, and freshmen are predominantly at-risk. The state of Idaho is particularly affected, with concerning higher education go-on and graduation rates. Retention theory has established that there is no single cause for attrition, and that campus-wide efforts are needed to reverse the troubling retention trends. Both mental and physical health conditions of students in higher education are also troubling, and this study has provided evidence that these health conditions are contributing to the retention problem. A novel combination of survey-based data and biomarker analysis was used to assess the health trends of Idaho-resident freshman, and their correlation to retention and academic success.

## References

- Abshire, M., Dinglas, V. D., Cajita, M. I., Eakin, M. N., Needham, D. M., & Himmelfarb, C. D. (2017). Participant retention practices in longitudinal clinical research studies with high retention rates. *BMC medical research methodology*, 17(1), 30. doi:10.1186/s12874-017-0310-z.
- Addis, M. E. (2008). Gender and depression in men. *Clinical Psychology: Science and Practice*, 15, 153-168.
- American College Health Association (2017). *National College Health Assessment II*. Retrieved from [https://www.acha.org/NCHA/ACHA-NCHA\\_Data/Publications\\_and\\_Reports/NCHA/Data/Reports\\_ACHA-NCHAIIC.aspx](https://www.acha.org/NCHA/ACHA-NCHA_Data/Publications_and_Reports/NCHA/Data/Reports_ACHA-NCHAIIC.aspx)
- American College Health Association. (2018). *American College Health Association-National College Health Assessment II: Reference group executives summary*. Retrieved from: [https://www.acha.org/documents/ncha/NCHAIISpring2018\\_Reference\\_Group\\_Executive\\_Summary.pdf](https://www.acha.org/documents/ncha/NCHAIISpring2018_Reference_Group_Executive_Summary.pdf)
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.
- Ancis, J. R., Sedlacek, W. E., & Mohr, J. J. (2000). Student perceptions of campus cultural climate by race. *Journal of Counseling and Development*, 78, 180-185.
- Asberg, M., & Forslund, K. (2000). Neurobiological aspects of suicidal behavior. *International Review of Psychiatry*, 12(1), 62-74.

- Association for University and College Counseling Center Directors. (2012). *Association for university and college counseling center directors annual survey*. Retrieved from [http://aucccd.org/support/aucccd\\_directors\\_survey\\_monograph\\_2012\\_public.pdf](http://aucccd.org/support/aucccd_directors_survey_monograph_2012_public.pdf)
- Astin, A. W. (1984). Student involvement: A developmental theory for higher education. *Journal of College Student Personnel*, 25(2), 297-308.
- Astin, A. W. (1997). *What matters in college? Four critical years revisited*. San Francisco, CA: Jossey-Bass.
- Baker, R. W., & Siryk, B. (1989). *Student adaption to college questionnaire manual*. Los Angeles, CA: Western Psychological Services.
- Barlow, D. H. (2011). The development and evaluation of physiological treatments for panic disorder. *Psychology and real world: Essays illustrating fundamental contributors to society* (pp. 198-204). New York, NY: Worth Publishers.
- Bean, J. P. (1980). Dropouts and turnover: The synthesis and test of a casual model of student attrition. *Research in Higher Education*, 12(2), 155-187.
- Bean, J. P., & Eaton, S. B. (2000). A psychological model of college student retention. In J. M. Braxton (Ed.), *Rethinking the departure puzzle: New theory and research on college student retention*. Nashville, TN: Vanderbilt University Press.
- Beech, H., & Funk, J. (2012, January 15). Shame: Idaho ranks poorly in many key areas. *Idaho Press Tribune*. Retrieved from [https://www.idahopress.com/news/state/shame-idaho-ranks-poorly-in-many-key-areas/article\\_69e564a4-3f3f-11e1-a84c-0019bb2963f4.html](https://www.idahopress.com/news/state/shame-idaho-ranks-poorly-in-many-key-areas/article_69e564a4-3f3f-11e1-a84c-0019bb2963f4.html)

- Beer, C., & Lawson, C. (2016). The problem of student attrition in higher education: An alternative perspective. *Journal of Further and Higher Education*, 41(6), 773-784.
- Bennett, R. (2003). Determinants of undergraduate student dropout rates in a university business studies department. *Journal of Further and Higher Education*, 27(2), 123-141.
- Berger, J. B., & Lyons, S. (2005). Past to present: A historical look at retention. In A. Siedman (Ed.), *College student retention: Formula of student success*. Westport, CT: Praeger Press.
- Bergland, C. (2013, January 22). Cortisol: Why the “stress hormone” is public enemy no.1. *Psychology Today*. Retrieved from <https://www.psychologytoday.com/blog/the-athletes-way/201301/cortisol-why-the-stress-hormone-is-public-enemy-no-1>
- Bockting, C. L., Hollom S. D., Jarrett, R. B., Kuyken, W., & Dobson, K. (2015). A lifetime approach to major depressive disorder: The contributions of psychological interventions in preventing relapse and recurrence. *Clinical Psychology Review*, 41, 16-26.
- Bogels, S. M., Alden, L., Beidel, D. C., Clark, L. A., Pine, D. S., Stein, M. B., & Voncken M. (2010). Social anxiety disorder in DSM-5. *Clinical Psychology Review*, 33(1), 663-674.
- Brady, B. (2017). Thyroid gland, how it functions, symptoms of hyperthyroidism and hypothyroidism. *Endocrine*. Retrieved from <https://www.endocrineweb.com/>



conditions/thyroid-nodules/thyroid-gland-controls-body's-metabolism-how-it-works- symptoms-hyperthyroidism

- Braxton, J. M. (2000). *Reworking the student departure puzzle*. Nashville, TN: Vanderbilt University Press.
- Braxton, J. M., Milem, J. F., & Sullivan, A. S. (2000). The influence of active learning on the college student departure process. *The Journal of Higher Education*, 71(5), 569-590.
- Brown, J. (2016). Anxiety and depression: Anxiety the most common mental health diagnoses in college students. *BU Today*. Retrieved from <http://www.bu.edu/today/2016/college-students-anxiety-and-depression/>
- Burrell, J. (2017, February 18). Why school retention rates are important to consider. *The Spruce*. Retrieved from <https://www.thespruce.com/what-is-a-retention-rate-3570270>
- Burtis, C. A. & Bruns, D. E. (2015). *Tietz fundamentals of clinical chemistry and molecular diagnostics*. St. Louis, MO: Saunders.
- Cabrera, A. F., Castañeda, M. B., Nora, A., & Hengstler, D. (1992). The convergence between two theories of college persistence. *The Journal of Higher Education*, 63(2), 143-164.
- Cairns, M. A. (1992). An aptitude, attitude interaction study of academically underprepared students. (Doctoral dissertation, Michigan State University). *Dissertation Abstracts International*, 43, 1963B

- Cameron, I. M. (2008). Psychometric comparison of PHQ-9 and HADS for measuring depression severity in primary care. *British Journal of General Practice*, 58(546), 32-36.
- Carter, J., Lema, O., Wangai, M., Munafu, C., Rees, P., & Nyamongo, J. (2012). Laboratory testing improves diagnosis and treatment outcomes in primary health care facilities. *African Journal of Laboratory Medicine*, 1(1), 1-6.
- Chen, H., Cohen, P., Crawford, T. N., Kasen, S., Guan, B., & Gordan K. (2009) Shift-and-persist strategies: Why being low economic status isn't always bad for health. *Perspectives on Psychological Science*, 7(1), 135-138.
- Chickering, A. W. (1969). *Education and Identity*. San Francisco, CA: Jossey-Bass.
- Cholesterol test. (2019, January 11). *Mayo Clinic*. Retrieved from <https://www.mayoclinic.org/tests-procedures/cholesterol-test/about/pac-20384601>
- Consumer Reports. (2017, April). Best antidepressant treatments. Retrieved from <https://www.consumerreports.org/cro/2013/09/best-treatments-for-depression/index.htm>
- Corbin, C. (2016). *Idaho's college go-on rate dips below 50 percent*. Retrieved from: <https://www.idahoednews.org/news/idahos-college-go-rate-drops-50-percent/on-2-10-18>.
- Corrigan, P. W., & Watson, C. (2002). Understanding the impact of stigma on people with mental illness. *World Psychiatry*, 1(1), 6-20.
- Craske, M. G., & Barlow, D. H. (2001). *Panic disorder and agoraphobia: Clinical handbook of psychology disorders: A step-by-step treatment manual* (3<sup>rd</sup> ed., pp. 1-59). New York, NY: Guilford Press.

- Craske M. G., & Waters, A. M. (2005). Panic disorder, phobias, and generalized anxiety disorder. *Annual Review of Clinical Psychology*, 1, 197-226.
- Cronbach, L. J., & Meehl, P. E. (1955). Construct validity in psychological tests. *Psychological Bulletin*, 52, 281-302.
- Crosling, G., Heagney, M., & Thomas, L. (2009). Improving student retention in higher education. *Australian Universities' Review*, 51(2), 9-18.
- Cuseo, J. (n.d). Academic advisement and student retention: Empirical connections & systemic interventions. Retrieved from [http://www.uwc.edu/sites/uwc.edu/files/imce-uploadsemployees/academicresources/esfy/\\_files/academic\\_advisement\\_and\\_student\\_retention.pdf](http://www.uwc.edu/sites/uwc.edu/files/imce-uploadsemployees/academicresources/esfy/_files/academic_advisement_and_student_retention.pdf)
- DeBerard, M. S., Spielmans, S., Glen, I., & Julka, D. L. (2004). Predictors of academic achievement and retention among college freshmen: A longitudinal study. *College Student Journal*, 38(10), 66-82.
- Duarte, R., Ramos-Pires, A., & Gonçalves, H. (2014). Identifying at-risk in higher education. *Total Quality Management and Business Excellence*, 25(7), 944-952.
- Duffy, J. D. (1995). General paralysis of the insane: Neuropsychiatry's first challenge. *Journal of Neuropsychiatry*, 7, 243-249.
- Duffett, A., & Johnson, J. (2004). All work and no play? Listening to what kids and parents really want from out-of-school time. *Public Agenda*. Retrieved from [http://www.publicagenda.org/files/all\\_work\\_no\\_play.pdf](http://www.publicagenda.org/files/all_work_no_play.pdf)
- Eack, S. M. (2014). Limitations of the Patient Health Questionnaire in identifying anxiety and depression: Many cases are undetected. *Research on Social Work Practice*, 16(6), 625-631.

- Ebersole, J. (2015, February 13). A discussion on higher education accountability. *Forbes Leadership*. Retrieved from <https://www.forbes.com/sites/johnebersole/2015/02/23/a-discussion-on-higher-education-accountability/#1711a0707717>
- Elkins, S. A., Braxton, J. M., & James, G. W. (2000). Tinto's separation stage and its influence on first-semester college student persistence. *Research in Higher Education*, 41(2), 251-268.
- Everson-Rose, S. A., & Lewis, T. T. (2005) Psychosocial factors and cardiovascular diseases. *Annual Review of Public Health*, 26(1), 469-500.
- Eysenck, H. J. (1952). The effects of psychotherapy: An evaluation. *Journal of Consulting Psychology*, 16(5), 319-324.
- Furr, S. R., Westefeld, J. S., McConnell, G. N., & Jenkins, J. M. (2001). Suicide and depression among college students: A decade later. *Professional Psychology, Research and Practice*, 32, 97-100.
- Garret, J. B. (2001). Gender differences in college related stress. *Undergraduate Journal of Psychology*, 12(1), 14.
- Goldberg, J. (2016). Tests used to diagnose depression. *WebMD*. Retrieved from <https://www.webmd.com/depression/guide/depression-tests#1>
- GradGuard. (2017). Trends and common practices for managing student withdrawals and tuition refunds. Retrieved from <https://highered.gradguard.com/>
- Green, H., & Greene, M. (2003). Yes, student retention is an admissions issue. *University Business*. Retrieved from <https://www.uccs.edu/Documents/retention/2003%20Yes,%20Student%20Retention%20is%20an%20Admissions%20Issue.pdf>

Groth-Marnat, G. (2003). *Handbook of psychological assessment*. (4<sup>th</sup> ed.). New York, NY: Wiley.

Haapakoski, R., Mathieu, J., Ebmeier, K. P., Alenius, H., & Kivimäki, M. (2015).

Cumulative meta-analysis of interleukins 6 and 1 $\beta$ , tumour necrosis factor  $\alpha$  and C-reactive protein in patients with major depressive disorder. *Brain, behavior, and immunity*, 49, 206-15.

Hage, M. P., & Azar, S. T. (2011). The link between thyroid function and depression. *Journal of Thyroid Research*, 2012, 590648.

Hallworth, M. J. (2011). The ‘70% claim’: What is the evidence base? *Annals of Clinical Biochemistry*, 48(6), 487–488.

Hamman, C. (2005). Stress and depression. *Annual Review of Clinical Psychology*, 1, 293-320.

Hansen, F. (2017, October 17) How do cortisol levels change throughout the day. *Adrenal Fatigue Solution*. Retrieved from <https://adrenalfatiguesolution.com/cortisol-levels-change-throughout-day/>

Hansen, R. S. (n.d.). Top college stressors that affect academic performance. *My College Success*. Retrieved from <http://www.mycollegesuccessstory.com/academic-success-tools/top-college-stressors.html>

Heiser, N. A., Turner, S. M., & Beidel, D. C. (2003). Shyness: Relationships and social phobia and other psychiatric disorders. *Behavior Research and Therapy*, 41, 209-241.

Higher Education Act of 1965, 28 U.S.C. § 1001 (1965).

Horowitz , M. J., Siegel, B., Holen, A., Bonanno, G. A., Mibrath, C., & Stinson, C. H. (1997). Diagnostic criteria for complicated grief disorder. *American Journal of Psychiatry*, 154, 904-910.

Hotchkiss, J. L, Moore, R. E., & Pitts, M. M. (2006). Freshmen learning communities, college performance, and retention. *Journal of Education Economics*, 14(2), 197-201.

Idaho Business for Education. (2014). Educated workforce: The lifeblood of Idaho business. Retrieved from <http://www.idahobe.org/wp-content/uploads/2014/05/workforce-study-final.pdf>

Idaho Business for Education (2015). Idaho education field guide. Retrieved from <http://static1.squarespace.com/static/56733533c647ad862c4e7189/t/567afec81115e03a97296fa9/1450901192362/JKAF-IdahoFieldGuide.pdf>

Idaho State University student population: Who goes here? (n.d.) *College Factual*. Retrieved from <https://www.collegefactual.com/colleges/idaho-state-university/student-life/diversity/#secMaleFemale>

ISU Institutional Research (2018a) Idaho State University freshmen demographic data.

ISU Institutional Research. (2018b). Idaho State University medical withdrawal student data.

Johnson, N. (2012). The institutional costs of student attrition. Retrieved from <https://deltacostproject.org/sites/default/files/products/Delta-Cost-Attrition-Research-Paper.pdf>

- Jones, R. C. (2008). *The effects of depressed mood on academic outcomes in adolescents and young adults* (Unpublished doctoral dissertation). University of South Florida.
- Joorman, J. (2010). Inhibition and emotion regulation in depression. *Current Directions in Psychological Science*, 19, 161-166.
- Kadvany, E. (2018, May 25). Lawsuit: Standard violated students' rights in mental health response. Retrieved from <https://www.paloaltoonline.com/news/2018/05/18/lawsuit-stanford-violated-students-rights-in-mental-health-response>.
- Kan, C., Silva, N., Golden, S. H., Rajala, U., Timonen, M., Stahl, D., & Ismail, K. (2013). A systematic review and meta-analysis of the association between depression and insulin resistance. *Diabetes care*, 36(2), 480-489.
- Katon, W. J. (2003). Clinical and health services relationships between major depressive disorders, and general medical illness. *Biological Psychiatry*, 54, 216-226.
- Keohane, E. M., Smith, L. J., & Walenga, J. M. (2016). *Rodak's hematology: Clinical principles and applications*. St. Louis, MO: Elsevier.
- Kerr, M. (2017). Depression and college students. *Healthline*. Retrieved from <http://www.healthline.com/health/depression/college-students#1>
- Kessing, L. V., Hansen, M. G., & Anderson, P. K. (2004). Course of illness in depressive and bipolar disorders: Naturalistic study. *British Journal of Psychiatry*, 185, 372-377.
- Kessler R. C., Berglund, P., Demler, O., Jin, R., Koretz, D., Merikangas, K. R., Rush, A. J, Walters, E. E, & Wang, P. S. (2003). The epidemiology of major depressive

- disorder: Results from the national comorbidity survey replication. *Journal of the American Medical Association*, 289, 3095-3105.
- Kessler, R. C., Merikangas, K. R., & Wang, P. S. (2007). Prevalence, comorbidity, and service utilization for mood disorders in the United States at the beginning of the twenty-first century. *Annual Review of Clinical Psychology*, 3, 137-158.
- Kim, J. & Lopez, S. R. (2014). The expression of depression in Asian American and European Americans. *Journal of Abnormal Psychology*, 123, 754-763.
- Kingdon D., & Wykes, T. (2013). Increased funding needed for mental health research. *The BMJ*, 346: 402-404.
- Kirby, D. S. (2014). The simple difference formula: An approach to teaching nonparametric correlation. *Innovative Teaching*, 3(1), 1-9. doi:10.2466/11.IT.3.1.
- Köhler, O., Benros, M. E., Nordentoft, M., et al. (2014). Effect of anti-inflammatory treatment on depression, depressive symptoms, and adverse effects: A systematic review and meta-analysis of randomized clinical trials. *JAMA Psychiatry*, 71(12), 1381–1391. doi:10.1001/jamapsychiatry.2014.1611
- Kroenke, K., Spitzwer, R. L., & William, J. B. (2001). The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine*, 16(9), 606-613.
- Lang, A. J., & Stein, M. B. (2001). Social phobia. Prevalence and diagnostic threshold. *Journal of Clinical Psychiatry*, 62, 5-10.
- Lee, J. R. (n.d.). Saliva tests vs, serum test for hormone testing. *Virginia Hopkins*. Retrieved from <http://www.virginiahopkinstestkits.com/salivavsblood.html>



- Liu, R. T. (2013). Stress generation: Future directions and clinical implications. *Clinical Psychology Review, 33*, 406-416.
- Liu, X., Li, J., Zheng, P., Zhao, X., Zhou, C., Hu, C., et al. (2016). Plasma lipidomics reveals 575 potential lipid markers of major depressive disorder. *Analytical and Bioanalytical Chemistry, 408*, 6497– 6507.
- Lotkowski, V. A., Robbins, S. B., & Noeth, R. J. (2004). “The role of academic and non-academic factors in improving college retention.” *ACT Policy Report. ACT 2004*. Retrieved from [http://www.act.org/research/policymakers/pdf/college\\_retention.pdf](http://www.act.org/research/policymakers/pdf/college_retention.pdf)
- Maes, M. (1995). Evidence for an immune response in major depression: a review and hypothesis. *Progress in Neuropsychopharmacology and Biological Psychiatry, 19*, 11-38.
- Mansouri, Z., & Moumine, M. E. A. (2017). Outlook on student retention in higher education university reforms in Morocco. *International Journal of Education and Literacy Studies, 5*(2), 53-60.
- Mann, J. J., Brent, D. A., & Arango, V. (2001). The neurobiology and genetics of suicide and attempted suicide: A focus on the serotonergic system. *Neuropsychopharmacology, 24*(5), 467-477.
- McGrath, M. (1997). The prediction of freshmen attrition: An examination of the importance of certain demographic, academic, financial and social factors. *College Student Journal, 31*(3), 396-408.

- Meilman, P. W., Manley, C., Gaylor, M. S., & Turco, J. H. (1992). Medical withdrawals from college for mental health reasons and their relation to academic performance. *Journal of American College Health*, 40(5), 217-223.
- Mental health screening tools. (2018). *Mental Health America*. Retrieved from <http://www.mentalhealthamerica.net/mental-health-screening-tools>
- Mental illness. (2018). *The Mayo Clinic*. Retrieved from <https://www.mayoclinic.org/diseases-conditions/mental-illness/diagnosis-treatment/drc-20374974>
- Mental illness facts and numbers. (2013) *National Alliance on Mental Illness*. Retrieved from: [http://www2.nami.org/factsheets/mentalillness\\_factsheet.pdf](http://www2.nami.org/factsheets/mentalillness_factsheet.pdf)
- Morrison, A.S., & Heimberg, R.G. (2013). Social anxiety and social anxiety disorder. *Annual Review of Clinical Psychology*, 9(1), 249-272.
- Mulhere, K. (2015, January 10). Illegal mandatory leave? *Inside Higher Ed*. Retrieved from <https://www.insidehighered.com/news/2015/01/20/mandatory-leaves-mental-health-conditions-raise-discrimination-concerns>
- Ngo, A., Ghandi, P., & Miller, W. B. (2017, January). Frequency that laboratory tests influence medical decisions. *American Association for Clinical Chemistry*. Retrieved from <http://jalm.aaccjnls.org/content/jalm/early/2016/11/08/jalm.2016.021634.full.pdf>
- Nock, M. K., & Kessler, R. C. (2006). Prevalence and attempts versus suicide gestures: Analysis of national comorbidity survey. *Journal of Abnormal Psychology*, 115 (3), 616-623.

- Noel, L., Levitz, R., Saluri, D., & Associates (1985). *Increasing student retention: Effective programs and practices for reducing the dropout rate*. San Francisco: Jossey-Bass.
- Noel-Levitz, Inc. (2007). *Student retention practices at four-year institutions*. Retrieved from: [www.noellevitz.com](http://www.noellevitz.com)
- Nolen-Hoeksema, S. (2017). *Abnormal psychology*. (7<sup>th</sup> ed.) Boston, MA: McGraw-Hill.
- Orenstein, B. W. (2017). Understanding your hypothyroidism test results. *Everyday Health*. Retrieved from <https://www.everydayhealth.com/hs/healthy-living-with-hypothyroidism/understanding-test-results/>
- Pascarella, E. T., & Terenzini P. T. (1976). Informal interaction with faculty and freshman ratings of academic and non-academic experience of college. *The Journal of Educational Research*, 70(1), 35-41
- Pascarella, E. T. , & Terenzini, P. T. (1991). *How college affects students*. San Francisco, CA: Jossey-Bass.
- Pappas, J. P. & Loring, R. K. (1985). *Increasing student retention: Effective programs and practices for reducing the dropout rate*. San Francisco, CA: Jossey-Bass.
- Parekh, R. (2015, November). What is mental illness? *American Psychiatric Association*. Retrieved from <https://www.psychiatry.org/patients-families/what-is-mental-illness>
- Park-Lee, E., Lipari, R. N., & Heddon, S. L. (2016). Receipt of services for substance use and mental health issues among adults: *National Survey on Drug Use and Health*. Retrieved from [https://www.samhsa.gov/data/sites/default/files/NSDUH-dr-ffr2-2016/NSDUH-dr-ffr2-2016.htm](https://www.samhsa.gov/data/sites/default/files/NSDUH-drug-ffr2-2016/NSDUH-dr-ffr2-2016.htm)

Pinnelli, K. (2017). 23 College dropout statistics that will surprise you. *Credit Donkey*.

Retrieved from [https://www.creditdonkey.com/college-dropout\\_statistics.html](https://www.creditdonkey.com/college-dropout_statistics.html)

Pittenger, C., & Dunman, R.S. (2008). Stress, depression, and neuroplasticity: A

convergence of mechanisms. *Neuropsychopharmacology Reviews*, 33, 88-109.

Predictive Analytics. (2016). What is predictive modeling? *Pat Research*. Retrieved from

<http://www.predictiveanalyticstoday.com/predictive-modeling/>

Prevalence and Impact of Thyroid Disease, (n.d.). *American Thyroid Association*.

Retrieved from <https://www.thyroid.org/media-main/about-hypothyroidism/>

Prince, M., Patel, V., Saxena, S., et al. (2007). No health without mental health. *Lancet*,

370(9850), 859-877.

Pritchard, M. E., Wilson, G. S., & Yamnitz, B. (2007). What predicts adjustment among

college students? A longitudinal panel study. *Journal of American College*

*Health*. 56(1), 15-21.

Quality Counts (2017). *State Report Cards Map*. Retrieved from

<https://www.edweek.org/ew/marketplace/products/spotlight-on-growth-mindset.html?intc=main-hsadsptfree>

Raisman, N. (2013). The cost of college attrition at four-year colleges and universities:

Policy perspective. *Educational policy Institute*. Retrieved from

<https://files.eric.ed.gov/fulltext/ED562625.pdf>

Rehm, L. P. (1977). A self-control model of depression. *Behavior Therapy*, 8, 787-804.

Rim, C. L., & Gitlin, M. J. (2010). Ziprasidone, monoamine, oxidase inhibitors, and

serotonin syndrome. *Journal of Clinical Psychopharmacology*. 14, 1257-1288.

Robbins, S., Allen, J., Casillas, A., Akamigbo, A., Saltonstall, M., Campbell, R., ...

Gore, P. (2008). Associations of resource and service utilization, risk level, and college outcomes. *Research in Higher Education*, 50(1), 101-118.

Rohr, U. P., Binder, C., Dieterle, T., Giusti, F., Messina, C. G., Toerien, E., Moch, H., ...

Schäfer, H. H. (2016). The value of in vitro diagnostic testing in medical practice: A status report. *PloS one*, 11(3), e0149856.

doi:10.1371/journal.pone.0149856.

Ross, S. E. Neibling, B. C. & Heckert, T. M. (1999). Sources of stress among college students. *College Student Journal*, 33(2), 312- 317.

Rovai, A. P. (2003). In search of higher persistence rates in distance education online programs. *Internet and Higher Education*, 6(1), 1-16.

Savage, S. (2006). The impact of stress on academic success in college students.

*RedOrbit*. Retrieved from: <http://www.redorbit.com/news/health>

/391477/the\_impact\_of\_stress\_on\_academic\_success\_in\_college\_students/

Saveanu R.V., & Nemeroff, C. B. (2012). Etiology of depression: Genetic and environment factors. *Psychiatric Clinics of North America*, 35, 51-71.

Schneider, M. (2010). Finishing the first lap: The cost of first-year student attrition in

America's four-year colleges and universities. *Washington, DC: American*

*Institutes for Research*. Retrieved from [http://www.air.org/files/AIR\\_Schneider\\_](http://www.air.org/files/AIR_Schneider_Finishing_the_First_Lap_Oct10.pdf)

[Finishing\\_the\\_First\\_Lap\\_Oct10.pdf](http://www.air.org/files/AIR_Schneider_Finishing_the_First_Lap_Oct10.pdf)

Schneider, M., & Lin, Y. (2011). The high cost of low graduation rates: How much does dropping out of college really cost? *Washington, DC: American Institutes for*

*Research*. Retrieved from [http://www.air.org/focusarea/education/index.cfm?fa=viewContent&content\\_id=1404](http://www.air.org/focusarea/education/index.cfm?fa=viewContent&content_id=1404)

Schreiner, L.A. (1991). *The college student inventory: Accurately identifying students at risk*. Iowa City, IA: Noel-Levitz Centers, Inc.

Scott, K. (2015). The laboratory workforce shortage demands new solutions. *American Association for Clinical Chemistry*. Retrieved from: <https://www.aacc.org/publications/cln/articles/2015/november/the-laboratory-workforce-shortage-demands-new-solutions>

Sharkin, B.S. (2006). *College students in distress: A resource guide for faculty, staff, and campus community*. New York, New York: Hawthorn Press, Inc.

Sladek, M. R., Dohne, L. D., Eisenberg, N. (2016). Perceived stress, coping, and cortisol reactivity in daily life: A study of adolescents during the first year of college. *Biological Psychology*, 117(1), 1-15.

Slanger, W. D., Berg, E. A., Fisk, P. S., & Hanson, M. G. (2015). A longitudinal cohort study of student motivational factors related to academic success and retention using the College Student Inventory. *Journal of College Student Retention: Research, Theory & Practice*, 17(3), 278–302.

Smith, M. L., Glass, G. V., & Miller, T. I. (1980). *The benefits of psychotherapy*. Baltimore, MD: John Hopkins University Press.

Spady, W. (1971). "Dropouts from higher education: Toward an empirical model." *Interchange*, 2, 38-62.

- Stoecker, J., Pascarella, E. T., & Wolfle, L. M. (1988). Persistence in higher education: A 9-year test of a theoretical model. *Journal of College Student Development*, 2, 196-209.
- Strack, B., DeShazo, J. P., Gennings, C., Olmo, J. L., Ventura, S., Cios, K.J., & Clore, J. N. (2014). Impact of HbA1c measurement on hospital readmission rates: Analysis of 70,000 Clinical Database Patient Records. *BioMed research international*, 2014, 1-11.
- Stratil, M. (1988). College student inventory. Iowa City, IA: Noel-Levitz Centers for Institutional Effectiveness and Innovation, Inc.
- Stratton, L. S., O'Toole, D. M., & Wetzel, J. N. (2005). A multinomial logit model of college stopout and dropout behavior. IZA Discussion Paper No. 1634.
- Strawbridge, R., Young, A. H., & Cleare, A. J. (2017). Biomarkers for depression: recent insights, current challenges and future prospects. *Neuropsychiatric disease and treatment*, 13(1), 1245-1262. doi:10.2147/NDT.S114542.
- Summerskill, J. (1962). In N. Sanford (Ed.), *The American College*. New York: Wiley.
- Thase, M.E., & Denko, T. (2008). Pharmacotherapy of mood disorders. *Annual Review of Clinical Psychology*, 4(1), 53-92.
- Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research*, 45(1), 89-125. doi:10.2307/1170024.
- Tinto, V. (1987). *Leaving college: Rethinking the causes and cures of student attrition*. Chicago and London: The University of Chicago Press.
- Tinto, V. (1993). *Leaving college: rethinking the causes and cures of student attrition*. (2nd ed). Chicago; London: University of Chicago Press.

- Tinto, V., & Pusser, B. (2006). Moving from theory to action: Building a model of institutional action for student success. *National Postsecondary Education Cooperative*, 1-51.
- TSH. (2017). *Sigma Diagnostics*. Retrieved from <http://sigmadiagnosticsinc.com/product/tsh/>
- Twenge, J. M. (2000). The age of anxiety? Birth cohort change in anxiety and neuroticism, 1952-1993. *Journal of Personal and Social Psychology*, 79(6), 1007-1021. doi: 10.1037//0022-3514.79.6.1007.
- Undergraduate retention and graduation rates. (2017, April 1). *National Center for Education Statistics*. Retrieved from. [https://nces.ed.gov/programs/coe/indicator\\_ctr.asp](https://nces.ed.gov/programs/coe/indicator_ctr.asp)
- Upcraft, M. L., Finney, J.E., & Garland, P. (1984). *Orientation: A context in M. L. Upcraft (Ed.), Orienting students to college*. San Francisco: Jossey-Bass.
- Urasaki, M. (2009). The Patient Health Questionnaire (PHQ-9) scores and the lifestyles of nursing students. *The Southern Medicine Journal*, 102(8), 800-804
- U.S. college dropout rates and dropout statistics. (2018). *College Atlas*. Retrieved from <https://www.collegeatlas.org/college-dropout.html>
- Velayuthum, K., Selvan, S., & Unnikrishnan, A. G. (2015.) Prevalence of thyroid dysfunction among young females in a South Indian population. *Indian Journal of Endocrinology and Metabolism*, (19)6, 781-784.
- Vellanki, P. (2014, September 15). How doctors diagnose hypothyroidism. *Endocrineweb*. Retrieved from <https://www.endocrineweb.com/conditions/hypothyroidism/how-doctors-diagnose-hypothyroidism-0>



- Vivekanantham, S., Strawbridge, R., Rampuri, R., Ragunathan, T., & Young, A.H. (2016). Parity of publication for psychiatry. *British Journal of Psychiatry*, 209(3), 257-261. <https://doi.org/10.1192/bjp.bp.115.165118>
- Vogt, W. P., Gardner, D. C., & Haeffle, L. M. (2012). *When to use what research design*. New York, NY: The Guilford Press.
- Vogt, W. P., Vogt, E. R., Gardner, D. C., & Haeffele, L. M. (2014). *Selecting the right analysis for your data*. New York, NY: The Guilford Press.
- Walters, D. (2015, March 04). *Why Idaho kids don't go to college*. Retrieved from <https://www.netflix.com/watch/70085715?trackId=13589554>
- Watson, D. (2009). Differentiating the mood and anxiety disorder: A quadripartite model. *Annual Review of Clinical Psychology*, 5, 221-247.
- What is a TSH test? (2017). *WebMD*. Retrieved from <https://www.webmd.com/a-to-z-guides/what-is-tsh-test#2>
- What is cortisol? (2018, January 2). *Hormone Health Network*. Retrieved from <https://www.hormone.org/hormones-and-health/hormones/cortisol>
- What is mental illness? (n.d.). *Mental Health Association*. Retrieved from <https://www.triadmentalhealth.org/what-is-mental-illness/>
- Willingham, W. W. (1985). Success in college: The role of personal qualities and academic ability. Institute of Education Science. Retrieved from <https://eric.ed.gov/?id=ED263837>

- Wittchem H.U., Gloster, A.T, Beesdo-Baum, K. Fava, G., & Craske, M.G. (2010).  
 Agoraphobia: A review of the diagnostic classificatory position and criteria.  
*Depression and Anxiety*, 27(1), 113-133.
- Wyse, S. E. (2012). Advantages and disadvantages of surveys. *SnapSurveys*. Retrieved  
 from <https://www.snapsurveys.com/blog/advantages-disadvantages-surveys>.
- Xu, D., & Jaggars, S. D. (2014). Performance gaps between online and face-to-face  
 courses: Differences across types of students and academic subject areas.  
*Journal of Higher Education*, 85(5), 633-659. doi: 10.1353/jhe.2014.0028
- Young, J.R. (2003). Prozac campus: More students seek counseling and take psychiatric  
 medication. *The Chronicle of Higher Education*, 49(23), A37-A38.
- Zajacova, A., Lynch, S. M., & Epsensshade, T. J. (2005). Self-efficacy, stress, and  
 academic success in college. *Research in Higher Education*, 46(6), 677-706.
- Zalaznick, M. (2016, December 16). Higher ed enters the age of accountability.  
*University Business*. Retrieved from <https://www.universitybusiness.com/article/higher-ed-enters-age-accountability>
- Zito, J. M., Safer, D. J., Reis, S., Gardner, J. F., Madger, L., & Soeken, K. (2003).  
*Archives of Pediatric and Adolescent Medicine*, 157(1), 17-25.

## Appendix A

## Poster for Recruiting Participants

*discover* OPPORTUNITY



**FRESHMEN WANTED**

Looking for freshmen at ISU to participate in a research study.

The study is looking to identify factors that may be hindering academic success.

Priority given to Idaho residents.

The study involves taking a survey and donating a few tubes of blood, up to 4 times (45-60 minutes per session) over the course of this upcoming Fall and Spring (2018-2019) semesters.

Freshmen will be compensated for their time up to \$120 (\$30 per session) for their voluntary participation in this study.

[bit.ly/ISU\\_Survey](http://bit.ly/ISU_Survey)  
(208) 282-4456

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**Idaho State**  
UNIVERSITY  
Kasiska Division of Health Sciences

If you have any questions, please do not hesitate to contact:  
Rachel Hulse | 208-282-4456 | hulsrach@isu.edu

## Appendix B

### Informed Consent Form for Participants



**Idaho State**  
UNIVERSITY

**IRB #: FY2019-25**

**IRB Approval Date:** August 1, 2018

<b>Study title</b>	Identifying contributions to Idaho's higher education crises
<b>Researcher[s]</b>	Rachel Hulse, M.S., MLS (ASCP)CM

We're inviting you to participate in a research study. Participation is completely voluntary. If you agree to participate now, you can always change your mind later. There are no negative consequences, whatever you decide.

#### What is the purpose of this study?

The purpose of this survey is to gain insight into factors that may be inhibiting academic success and retention. It is our hope that information from this research will contribute to a better understanding of clinical factors, predispositions, experiences, and attributes which may influence freshman retention in Idaho higher education.

#### What will I do?

If you agree to be in this study, you will go to Bengal Lab (Leonard Hall, room 161) and fill out a survey, followed by a blood sample collection, via phlebotomy. This will take between 45-60 minutes. One blood test requires both a morning and an evening draw. There will be no survey administered during the evening draw, and the processed should take between 5-10 minutes. The morning session will collect up to 5 tubes of blood (up to a total of 21 mL), and the evening sample will collect 1 tube of blood (up to 5 mL). This process may be repeated near the beginning and end of both the Fall 2018 and Spring 2019 semesters, up to a total of 4 times (see schedule below). The initial survey given at the beginning of the Fall 2018 semester consists of 140 questions. The subsequent three surveys are identical, and 79 questions in length. These surveys will ask questions about demographics, academic motivation, general coping ability, receptivity to support services, and questions about your perceived health status.

#### Risks

Possible risks	How we're minimizing these risks
Some survey questions may be personal or upsetting	You can skip any questions you don't want to answer.
Breach of confidentiality (your data being seen by someone who shouldn't have access to it)	<ul style="list-style-type: none"> <li>All identifying information is removed and replaced with a study ID.</li> <li>We'll store all electronic data on a password-protected, encrypted computer.</li> </ul>

	<ul style="list-style-type: none"> <li>• We'll store all paper data in a locked filing cabinet in a locked office.</li> </ul> <p>We'll keep your identifying information separate from your research data, but we'll be able to link it to you by using a study ID. We will destroy this link after we finish collecting and analyzing the data.</p>
The needle stick may hurt. There is a small risk of bruising and fainting, and a rare risk of infection.	<ul style="list-style-type: none"> <li>• Venipuncture is completed by a certified phlebotomist in a CLIA certified laboratory.</li> </ul>

We will inform you if we identify any unknown risks in the course of this study that might affect your decision to participate.

### Other Study Information

<b>Possible benefits</b>	There are no benefits from participating in this study.
<b>Estimated number of participants</b>	50 freshmen from ISU will be participating in this study.
<b>How long will it take?</b>	See schedule below
<b>Costs</b>	There are no costs associated with participating in this study
<b>Compensation</b>	See the schedule below for compensation for participating in this study. Payment will be issued directly following the completion of each participation activity listed.
<b>Do I have to participate?</b>	Participation is absolutely voluntary, and you may withdraw at any time.
<b>Future research</b>	De-identified (all identifying information removed) data may be shared with other researchers. You won't be told specific details about these future research studies. Your biospecimens won't be used or shared for any future research studies and will be discarded within 7 days of collection.
<b>Removal from the study</b>	In order for our data to be useful, it is important that you attend all sessions (see schedule). If you miss a session and can't reschedule, we'll have to take you out of the study.

### What if I am harmed because I was in this study?

If you're harmed from being in this study, let us know. If it's an emergency, get help from 911 or your doctor right away and tell us afterward. We can help you find resources. You or your insurance will have to pay for all costs of any treatment you need.

### Participation and compensation schedule

Time	Participation Activity	Estimated time	Compensation
Early Fall 2018 semester			
am	Initial Survey (135 questions)	30-60 minutes	\$10
	Blood collection (5 tubes)	5-10 minutes	\$10
pm	Blood collection (1 tube)	5-10 minutes	\$10
Late Fall 2018 semester			
am	Subsequent Survey (78 questions)	30-60 minutes	\$10
	Blood collection (5 tubes)	5-10 minutes	\$10
pm	Blood collection (1 tube)	5-10 minutes	\$10
Early Spring 2019 semester			
am	Subsequent Survey (78 questions)	30-60 minutes	\$10
	Blood collection (5 tubes)	5-10 minutes	\$10
pm	Blood collection (1 tube)	5-10 minutes	\$10
Late Spring 2019 semester			
am	Subsequent Survey (78 questions)	30-60 minutes	\$10
	Blood collection (5 tubes)	5-10 minutes	\$10
pm	Blood collection (1 tube)	5-10 minutes	\$10
<b>Total Potential Compensation</b>			<b>\$120</b>

### Confidentiality and Data Security

In addition to your surveys and biospecimens, we will collect the following identifying information for the research: your name, Bengal ID, birthday, phone number, and email address. This information is necessary for accurate reference ranges for blood tests, and for scheduling appointments for each data collection session (see schedule). Furthermore, the Bengal ID will be used to solely by the researcher to collect the following data from the Office or Institutional Research: registration confirmation, GPA, and entrance exam (SAT, ACT, etc.) scores. All data will be de-identified with a study code prior to data analysis, and any resulting publications would not contain any personal identification information.

<b>Where will data be stored?</b>	Electronic data will be kept on encrypted computers and/or an encrypted USB drive in Bengal Lab. This USB and all other research documentation or data will be kept in a locked file cabinet in a locked office within Bengal Lab.
<b>How long will it be kept?</b>	3 years

Who can see my data?	Why?	Type of data
The researchers	To analyze the data and conduct the study	Data collected from biospecimens will be deidentified by the primary researcher and provided with a study code matching the survey study code by the same participant. Data analysis will be performed only on coded, deidentified data.

The IRB (Institutional Review Board) at ISU  The Office for Human Research Protections (OHRP) or other federal agencies	To ensure we're following laws and ethical guidelines	All research files as needed- including biospecimen and survey data and analysis.
Public	To share our findings in publications or presentations	<ul style="list-style-type: none"> <li>• Only deidentified data would be included</li> </ul>
ISU Student Health	While not expected, critical laboratory values will be referred to a primary care provider at ISU Student Health for follow-up. Note: This referral and/or visit to ISU Student Health is at no cost to the student.	<ul style="list-style-type: none"> <li>• Critical values in a participant's blood work, as determined by the reference range limits of Bengal Lab's CLIA certified reference laboratory.</li> </ul>

**Contact information:**

<b>For questions about the research</b>	Rachel Hulse	(208) 282-4456 hulsrach@isu.edu
<b>For questions about your rights as a research participant</b>	IRB (Institutional Review Board; provides ethics oversight)	(208) 282-2618 orexpctr@isu.edu
<b>For complaints or problems</b>	Rachel Hulse	(208) 282-4456 hulsrach@isu.edu
	IRB	(208) 282-2618

		orexpctr@isu.edu
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### Signatures

If you have had all your questions answered and would like to participate in this study, sign on the lines below. Remember, your participation is completely voluntary, and you're free to withdraw from the study at any time.

\_\_\_\_\_  
Name of Participant (print)

\_\_\_\_\_  
Signature of Participant

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name of Researcher obtaining consent (print)

\_\_\_\_\_  
Signature of Researcher obtaining consent

\_\_\_\_\_  
Date



## Appendix C

### First Session Survey

#### College Student Inventory Form B

Instructions: The main body of the inventory contains 100 items. Answer each item by selecting the option that best describes you. Click on the radio button that corresponds to the option you have selected.

Begin with the first item and complete items 1 through 9 before moving on to the next section.

1. While enrolled in classes, the amount of time I expect to spend **working at a job** is approximately:
  - ☐ 0 (I have no plans to work)
  - ☐ 1 to 10 hours per week
  - ☐ 11 to 20 hours per week
  - ☐ 21 to 30 hours per week
  - ☐ 31 to 40 hours per week
  - ☐ Over 40 hours per week

\*This item only applies to time frames during which you are actually attending classes. It does not apply to summer employment, school breaks, or other such periods. If your work schedule varies, take a rough average across weeks.

2. The **average** of all my grades during my **senior year in high school** was approximately:
  - ☐ A
  - ☐ Halfway between A and B
  - ☐ B
  - ☐ Halfway between B and C
  - ☐ C
  - ☐ Halfway between C and D
  - ☐ D

\*If your school **did not use letter grades**, do your best to translate your grades into this system. If you completed a GED, try to estimate the grades you think you would have earned for your last ten GED courses if you had been taking them as regular high school courses. It is recognized that making this estimate will be difficult; just try to give your best estimate.

3. **Compared to the average high school graduating senior in this country**, I consider my general academic knowledge to be in the:
  - ☐ highest 20%
  - ☐ next to highest 20%
  - ☐ middle 20%

- next to lowest 20%
- lowest 20%

\*This item is about your **general academic knowledge**. This consists of the ideas and facts you have learned through the core courses designed to prepare you for college (e.g., English, mathematics, science, and social studies).

4. I would describe my racial/ethnic origin as:
  - Black/African-American
  - American Indian or Alaskan Native
  - Asian or Pacific Islander
  - White/Caucasian
  - Hispanic or Latino
  - Multiethnic or other ethnic origin
  - Prefer not to respond
5. What is the highest level of education completed by your mother/guardian?
  - 8 years or less of elementary school
  - Some high school but no diploma
  - A high school diploma or equivalent
  - 1 to 3 years of college (including study at a technical, community, or junior college)
  - A 4-year undergraduate college degree (bachelor's degree)
  - A master's degree
  - A professional degree (medicine, dentistry, law, philosophy, or other similar degree)
6. What is the highest level of education completed by your father/guardian?
  - 8 years or less of elementary school
  - Some high school but no diploma
  - A high school diploma or equivalent
  - 1 to 3 years of college (including study at a technical, community, or junior college)
  - A 4-year undergraduate college degree (bachelor's degree)
  - A master's degree
  - A professional degree (medicine, dentistry, law, philosophy, or other similar degree)
7. The highest degree that I plan to pursue is:
  - None
  - A 1-year certificate
  - A 2-year college degree (associate)
  - A 4-year college degree (bachelor's)
  - A master's degree
  - A professional degree (medicine, dentistry, law, philosophy, or other similar degree)
8. In relation to the **general population** of our society, I consider my academic ability to be:
  - Considerably below average
  - Slightly below average

- Average
- Slightly above average
- Considerably above average (in the top 20%)
- Extremely high (in the top 5%)

\***Academic ability** is the general capacity to understand and remember complex ideas through formal education. It involves learning through such media as books, lectures, written assignments, and computer programs.

9. Which of the following most accurately describes the **timing** of your decision to apply for admission to your college or university?
- My decision was made a few days before classes began.
  - My decision was made a few weeks before classes began.
  - My decision was made many months before classes began.

**Instructions:** Items in this section measure a variety of attitudes toward college. Use the following rating scale to answer each item.

NOT AT ALL TRUE   1   2   3   4   5   6   7   COMPLETELY TRUE

If you agree completely with a statement, you should answer with a “7.” Agreement that is fairly strong but not total is indicated by selecting a “5,” while agreement that is fairly weak is indicated by a “3.” Total disagreement is indicated by selecting “1.”

In answering the items on study habits and teachers, you should draw primarily on your **pre-college experiences**.

Click on the radio button that corresponds to the option you have selected.

	1	2	3	4	5	6	7
10. I have found a potential career that strongly interests me.							
11. My teachers have been very caring and dedicated.							
12. Reading has never gotten me very excited.							
13. My financial problems are very distracting and troublesome.							
14. Enter a “2” for this item.							
15. I get along well with people who disagree with my opinions openly.							
16. I dread the thought of going to college so long and sometimes think about giving up.							
17. I would like help in effective ways to take college exams.							
18. I take clear notes in class and review them carefully before a test.							
19. I would like to talk with a counselor about my general attitude toward school.							

20. My previous teachers were too opinionated and inflexible.							
21. Growing up, my family understood me and treated me in ways that helped me grow.							
22. I would like to talk to someone about getting a part-time job while I'm enrolled.							
23. It is easy for me to pick up new vocabulary words quickly and use them in speaking and writing.							
24. I would like to attend events where I can meet new friends.							
25. Going to college is definitely the most satisfying thing I could do at this point.							
26. I tend to be unfriendly toward those whose opinions differ strongly with mine.							
27. I plan to transfer before completing a degree at this college or university.							
28. I would like help in improving my study habits.							
29. I would like to talk with someone about the qualifications for certain careers.							
30. I have great difficulty concentrating on coursework and often get behind.							

**Instructions:** Items in this section measure a variety of attitudes toward college. Use the following rating scale to answer each item.

NOT AT ALL TRUE   1   2   3   4   5   6   7   COMPLETELY TRUE

If you agree completely with a statement, you should answer with a “7.” Agreement that is fairly strong but not total is indicated by selecting a “5,” while agreement that is fairly weak is indicated by a “3.” Total disagreement is indicated by selecting “1.”

In answering the items on study habits and teachers, you should draw primarily on your **pre-college experiences**.

Click on the radio button that corresponds to the option you have selected.

	1	2	3	4	5	6	7
31. I get a great deal of personal satisfaction from reading.							
32. My previous teachers respected me and treated me fairly.							
33. Participating in big social events is of little interest to me.							
34. Choosing a career is very confusing to me.							
35. Enter a “5” for this item.							
36. I have the financial resources I need to finish college.							
37. Math has always been a challenge for me.							

38. I'm prepared to make the effort and sacrifices needed to achieve my educational goals.							
39. I would like to talk to a counselor about eliminating an unwanted habit (involving food, drugs, cigarettes, or alcohol, etc.).							
40. My studying is irregular and unpredictable.							
41. I can feel comfortable with someone who does not share my opinions on social issues.							
42. I would like individual help in improving my writing skills.							
43. I would like to find out more about student leadership and activities.							
44. I would like help selecting an educational plan that will prepare me to get a good job.							
45. Growing up, my family did not understand my feelings at all.							
46. I would like to talk with a counselor about difficulties in my personal relationships or social life.							
47. I would like to talk with someone about getting a loan to help me with school.							
48. I enjoy getting together with a group and having fun.							
49. It is difficult to organize my ideas on paper and use correct punctuation and grammar.							
50. I understand general biology and life processes very well.							

**Instructions:** Items in this section measure a variety of attitudes toward college. Use the following rating scale to answer each item.

NOT AT ALL TRUE   1   2   3   4   5   6   7   COMPLETELY TRUE

If you agree completely with a statement, you should answer with a "7." Agreement that is fairly strong but not total is indicated by selecting a "5," while agreement that is fairly weak is indicated by a "3." Total disagreement is indicated by selecting "1."

In answering the items on study habits and teachers, you should draw primarily on your **pre-college experiences**.

Click on the radio button that corresponds to the option you have selected.

	1	2	3	4	5	6	7
51. I'm dedicated to finishing college – no matter what obstacles get in my way.							
52. I don't enjoy reading serious books and articles and only do it when I have to.							

53. I have begun planning my life around the career I have decided to enter.							
54. Many teachers are more concerned about themselves than their students.							
55. I would like to talk with someone about the salaries and future outlook for various careers.							
56. Enter a "4" for this item.							
57. I am very good at figuring out the deeper meaning of a short story or novel.							
58. I would like individual help in improving my math skills.							
59. I don't have financial problems that will interfere with my coursework.							
60. I am determined to complete my college education.							
61. I would like to talk with a counselor about a family problem.							
62. I study hard for my courses, even those I don't like.							
63. I can be friends with people whose political ideas differ sharply from mine.							
64. I have a hard time understanding and solving complex math problems.							
65. My family and I understand and respect each other's point of view.							
66. Most teachers have a superior attitude that I find annoying.							
67. I would like to meet an experienced student who can show me around and give me some advice.							
68. I would like to talk with someone about getting a scholarship.							
69. Learning new vocabulary words is a slow and difficult process for me.							
70. I would like help selecting a career that is well suited to my interests and abilities.							

**Instructions:** Items in this section measure a variety of attitudes toward college. Use the following rating scale to answer each item.

NOT AT ALL TRUE   1   2   3   4   5   6   7   COMPLETELY TRUE

If you agree completely with a statement, you should answer with a "7." Agreement that is fairly strong but not total is indicated by selecting a "5," while agreement that is fairly weak is indicated by a "3." Total disagreement is indicated by selecting "1."

In answering the items on study habits and teachers, you should draw primarily on your **pre-college experiences.**

Click on the radio button that corresponds to the option you have selected.

	1	2	3	4	5	6	7
71. It is hard for me to relax and just have fun in a group.							
72. My understanding of the physical sciences is very weak.							
73. If society didn't pressure people to go to college, I'd be doing other things.							
74. I have no desire before finishing a degree at this college or university.							
75. Reading has broadened my horizons and stimulated my imagination.							
76. Enter a "7" for this item.							
77. I'm confused about what career to pursue.							
78. I developed a solid system of self-discipline that helps me keep up with my course work.							
79. My finances and the pressure to earn extra money will likely interfere with my studies.							
80. I am capable of writing a clear and well-organized paper.							
81. I feel uneasy and distrustful of people whose way of thinking differs from mine.							
82. I would like tutoring in one or more of my courses.							
83. When I try to study, I usually get bored and quit after a few minutes.							
84. I would like to talk with a counselor about the emotional stress that I'm experiencing.							
85. There are many things I would rather do than go to college.							
86. I enjoy trying to solve complex math problems.							
87. Growing up, my family often said hurtful things that caused bad feelings.							
88. I liked my teachers and feel they did a good job.							
89. I stay away from people with very different ideas because they irritate me.							
90. In English classes, I've had difficulty analyzing an author's style and theme.							

**Instructions:** Items in this section measure a variety of attitudes toward college. Use the following rating scale to answer each item.

NOT AT ALL TRUE   1   2   3   4   5   6   7   COMPLETELY TRUE

If you agree completely with a statement, you should answer with a "7." Agreement that is fairly strong but not total is indicated by selecting a "5," while agreement that is fairly weak is indicated by a "3." Total disagreement is indicated by selecting "1."

In answering the items on study habits and teachers, you should draw primarily on your **pre-college experiences**.

Click on the radio button that corresponds to the option you have selected.

	1	2	3	4	5	6	7
91. I would like to find out more about the clubs and social organizations at my college.							
92. I would like to talk to someone about opportunities for summer employment.							
93. I have a good grasp of scientific ideas I've studied in school.							
94. I wonder if a college education is really worth the time, money, and effort I have to put into it.							
95. Enter a "6" for this item.							
96. I am very adventurous and outgoing at social events.							
97. I would like to talk with a counselor about ongoing feelings of discouragement or unhappy thoughts.							
98. I would like to talk with someone about the advantages and disadvantages of various careers.							
99. I would like help in improving my reading skills.							

100. By clicking "yes" below, I (1) authorize my institution to share results from this inventory with my advisor/success coach and other student service offices, which will help me with my educational planning and decisions and (2) disclose the information about me within this survey, including the results, to service providers that my institution uses to further my educational purposes.
- ☐ YES
  - ☐ NO (if you select this option, all of your reports will be kept on file with the Coordinator of this program, as soon as the Student Report is available, you will be able to obtain it from the Coordinator).

**Study Survey Part B: Identifying contributions to Idaho's higher education crises**

101. How would you describe your general health?
- ☐ Excellent
  - ☐ Very Good
  - ☐ Good
  - ☐ Fair
  - ☐ Poor
  - ☐ Don't know
102. In the past 12 months were you in a physical fight?
- ☐ Yes



- ☐ No
    - ☐ Prefer not to answer
  - 103. In the past 12 months were you verbally threatened?
    - ☐ Yes
    - ☐ No
    - ☐ Prefer not to answer
  - 104. In the past 30 days, how many days did you use cigarettes, e-cigarettes, or other forms of tobacco?
    - ☐ Never used
    - ☐ Have used, but not in last 30 days
    - ☐ 1-2 days
    - ☐ 3-5 days
    - ☐ 6-9 days
    - ☐ 10-19 days
    - ☐ 20-29 days
    - ☐ Daily
    - ☐ Prefer not to answer
  - 105. In the past 30 days, how many days did you consume alcohol?
    - ☐ Never used
    - ☐ Have used, but not in last 30 days
    - ☐ 1-2 days
    - ☐ 3-5 days
    - ☐ 6-9 days
    - ☐ 10-19 days
    - ☐ 20-29 days
    - ☐ Daily
    - ☐ Prefer not to answer
- One drink of alcohol is defined as a 12 oz. can or bottle of beer or wine cooler, a 4 oz. glass of wine, or a shot of liquor straight or in a mixed drink.
106. The last time you “partied”/socialized how many drinks of alcohol did you have? (If you did not drink, please enter “0”) \_\_\_\_\_ number of drinks
107. The last time you “partied”/socialized, over how many hours did you drink alcohol? (If you did not drink, please enter “0”) \_\_\_\_\_ number of hours
108. How do you describe your weight?
- ☐ Very underweight
  - ☐ Slightly underweight
  - ☐ About the right weight
  - ☐ Slightly overweight

- Very overweight
109. How many days a week on average do you exercise for at least 30 minutes?
- 0
  - 1-2 times/week
  - 3-4 times/week
  - 5 or more times a week
110. Have you ever been diagnosed with depression?
- Yes
  - No
111. Within the last 12 months, how would you rate the overall level of stress you have experienced?
- No stress
  - Less than average stress
  - Average stress
  - More than average stress
  - Tremendous stress
112. If in the future you were having a personal problem that was really bothering you, would you consider seeking help from a mental health professional?
- No
  - Yes
  - Unsure
113. On how many of the past 7 days did you get enough sleep so that you felt rested when you woke up in the morning?
- 0 days
  - 1 day
  - 2 days
  - 3 days
  - 4 days
  - 5 days
  - 6 days
  - 7 days
114. People sometimes feel sleepy during the daytime. In the past 7 days, how much of a problem have you had with sleepiness (feeling sleepy, struggling to stay awake) during your daytime activities?
- No problem at all
  - A little problem
  - More than a little problem
  - A big problem
  - A very big problem

115. What term best describes your sexual orientation?
- ☐ Asexual
  - ☐ Bisexual
  - ☐ Gay
  - ☐ Lesbian
  - ☐ Pansexual
  - ☐ Queer
  - ☐ Questioning
  - ☐ Same Gender Loving
  - ☐ Straight/Heterosexual
  - ☐ Another identity (please specify) \_\_\_\_\_
  - ☐ Prefer not to answer
116. What is your height in feet in inches? \_\_\_\_\_
117. What is your weight in pounds? \_\_\_\_\_
118. What is your enrollment status?
- ☐ Full-time
  - ☐ Part-time
  - ☐ Other
119. How do you usually describe yourself?
- ☐ White
  - ☐ Black
  - ☐ Hispanic or Latino/a
  - ☐ Asian or Pacific Islander
  - ☐ American Indian, Alaskan Native, or Native Hawaiian
  - ☐ Biracial or multiracial
  - ☐ Other
120. What is your relationship status?
- ☐ Not in a relationship
  - ☐ In a relationship but not living together
  - ☐ In a relationship and living together
121. What is your marital status?
- ☐ Single
  - ☐ Married/Partnered
  - ☐ Separated
  - ☐ Divorced
  - ☐ Other
122. Where do you currently live?
- ☐ Campus residence hall

- Fraternity or sorority house
- Other college/university housing
- Parent/guardian's home
- Other off-campus housing
- Other

123. Within the last 12 months, have you been diagnosed or treated by a professional for any of the following? (Please mark the appropriate the column for each row)

	No	Yes, diagnose d but not treated	Yes, treated with medication	Yes, treated with psychotherap y	Yes, treated with medication and psychotherap y	Yes, with other treatmen t	Prefer not to answe r
Anorexia							
Anxiety							
Attention Deficit and Hyperactivit y Disorder (ADHD)							
Bipolar disorder							
Bulimia							
Depression							
Insomnia							
Other sleep disorder							
Panic attacks							
OCD							
Substance abuse							
Other mental health condition							

124. Within the last 12 months, have any of the following been traumatic or very difficult for you to handle? (please mark the appropriate column for each row)

	No	Yes
Academics		
Career-related issue		
Death of family or friend		
Family problems		
Intimate relationships		
Other social relationships		
Finances		
Personal appearance		
Health issues		
Sleep difficulties		
Other		

Over the past two weeks have you been bothered by any of the following problems? (Questions 125-134)

	Not at all	Several days	More than half the days	Nearly every day
125. Little interest or pleasure in doing anything				
126. Feeling down, depressed, hopeless				
127. Trouble falling or staying asleep, sleeping too much				
128. Feeling tired of having little energy				
129. Poor appetite or overeating				
130. Feeling bad about yourself or that you are a failure or have let you or your family down				
131. Trouble concentrating on things such as reading the newspaper or watching television				
132. Moving or speaking so slowly that other people have noticed. Or the opposite, being so fidgety or restless that you have been moving around a lot more than usual				

133. Thoughts that you would be better off dead, or of hurting yourself				
---	--	--	--	--

134. If you checked off any problems in questions 125-133, how difficult have they made it for you to do your work, take care of things at work, or get along with people?

- ☐ Not difficult at all
- ☐ Somewhat difficult
- ☐ Very difficult
- ☐ Extremely difficult

## Appendix D

### Second Session Survey

#### Mid-Year Student Assessment

**Instructions:** The main body of the inventory contains 70 items. Answer each item by selecting the option that best describes you. Click on the radio button that corresponds to the option you have selected.

Begin with the first item and complete items 1 through 7 before moving on to the next section.

1. While I'm enrolled in classes, the amount of time I spend **working at a job** is approximately:
  - ☐ 0 (I do not work)
  - ☐ 1 to 10 hours per week
  - ☐ 11 to 20 hours per week
  - ☐ 21 to 30 hours per week
  - ☐ 31 to 40 hours per week
  - ☐ More than 40 hours per week
2. The **average** of all my grades the **first term** is (will be) approximately:
  - ☐ A
  - ☐ Halfway between A and B
  - ☐ B
  - ☐ Halfway between B and C
  - ☐ C
  - ☐ Halfway between C and D
  - ☐ D or less
3. **Compared to other students in my classes**, I consider my general academic knowledge related to core courses (e.g. English, math, science, history) to be in the:
  - ☐ Highest 20%
  - ☐ Next to the highest 20%
  - ☐ Middle 20%
  - ☐ Next to the lowest 20%
  - ☐ Lowest 20%
4. The highest degree that I plan to pursue is:
  - ☐ None
  - ☐ A 1-year certificate
  - ☐ A 2-year college degree (associate)
  - ☐ A 4-year college degree (bachelor's)
  - ☐ A master's degree
  - ☐ A professional degree (medicine, dentistry, law, philosophy, or other similar degrees)

5. In relation to the **general population** of our society, I consider my academic ability to be:
- Considerably below average
  - Slightly below average
  - Average
  - Slightly above average
  - Considerably above average (in the top 20%)
  - Extremely high (in the top 5%)
6. The statement that best describes the time I need to study is:
- Not as much as I expected.
  - About what I expected.
  - A lot more than I expected.
7. The statement that most accurately describes my **current** college plans is:
- I plan to complete my degree/certificate at this college or university.
  - I plan to transfer to another college or university to complete my degree.
  - College is not right for me at this time, and I do not plan to re-enroll next term.
  - I have not made a decision about my plans for next term.

NOT AT ALL TRUE   1   2   3   4   5   6   7   COMPLETELY TRUE

If you agree completely with a statement, you should answer with a “7.” Agreement that is fairly strong but not total is indicated by selecting a “5”, while agreement that is fairly weak is indicated by a “3”. Total disagreement is indicated by selecting “1”.

Use any number between 1 and 7. Select your answer by clicking the corresponding response button.

8. I have found a potential career that strongly interests me.	1	2	3	4	5	6	7
9. My instructors are very caring and dedicated.							
10. I don't have any financial problems that will interfere with my schoolwork.							
11. I get along well with people who disagree with my opinion openly.							
12. I take clear notes during class, and I review them carefully before a test.							
13. My family understands me and treats me in ways that help me grow.							
14. I pick up new vocabulary words quickly and find it easy to use them in my speech and writing.							
15. Going to college is definitely the most satisfying thing I could do at this point.							
16. I get a great deal of personal satisfaction from reading.							
17. My instructors respect me and treat me fairly.							



18. I have the financial resources that I need to finish college.							
19. I'm prepared to make the effort and sacrifices needed to achieve my educational goals.							
20. I feel comfortable with someone who does not share my opinions on social issues.							
21. I greatly enjoy getting together with a group and having fun.							
22. I understand general biology and life processes very well.							
23. I am very strongly dedicated to finishing college – no matter what obstacles get in my way.							
24. I have begun planning my life around the career I have decided to enter.							
25. I am very good at figuring out the deeper meaning of a short story or novel.							
26. I am determined to complete my college education.							
27. I study very hard for all my courses, even those I don't like.							
28. I can be friends with people whose political ideas differ sharply from mine.							
29. My family and I understand and respect each other's points of view.							
30. Reading has broadened my horizons and stimulated my imagination.							
31. I have developed a solid system of self-discipline that helps me keep up with my course work.							
32. I am capable of writing a very clear and well-organized paper.							
33. I enjoy trying to solve complex math problems.							
34. I like instructors and I feel they do a good job.							
35. I have a very good grasp of the scientific ideas I've studied.							
36. I am very adventurous and outgoing at social events.							

### Specific Needs and Interests

**Instructions:** Items in this section allow you to indicate your use of programs and services in specific areas, as well as your desire to receive additional assistance or information in these areas.

- Review each statement from the list of specific needs and interests *in the center column*.
- On the *left of each statement*, tell us whether or not you have received assistance or information in this area already.
- On the *right of each statement*, tell us whether or not you would like to receive, or continue to receive, assistance or information.

Select your response for **each side** by clicking the corresponding response button.

I have received assistance or information already.		<b>My Academic Needs</b>	I would like to receive (additional) assistance or information	
<b>YES</b>	<b>NO</b>		<b>YES</b>	<b>NO</b>
		37. Instruction in effective ways to take college exams		
		38. Help in improving my study habits		
		39. Help in improving my writing skills		
		40. Help in improving my math skills		
		41. Tutoring in one or more of my courses		
		42. Training to improve my reading skills		
I have received assistance or information already.		<b>My Interest in Career Services</b>	I would like to receive (additional) assistance or information	
<b>YES</b>	<b>NO</b>		<b>YES</b>	<b>NO</b>
		43. Discuss qualifications needed for certain occupations		
		44. Receive help with an educational plan to prepare for a good job.		
		45. Discuss salaries and future outlook for various occupations		
		46. Discuss advantages and disadvantages of various occupations		
		47. Receive help selecting an occupation well suited to my interests and abilities		
I have received assistance or information already.		<b>My Interest in Personal Support</b>	I would like to receive (additional) assistance or information	
<b>YES</b>	<b>NO</b>		<b>YES</b>	<b>NO</b>
		48. Talk with a counselor about my general attitude toward school		
		49. Talk about feelings of discouragement or unhappy thoughts that keep bothering me		
		50. Talk with a counselor about eliminating an unwanted habit (involving food, drugs, cigarettes, or alcohol, etc.)		

		51. Discuss difficulties in my personal relationships or social life		
		52. Talk with a counselor about some family issues		
		53. Talk with a counselor about emotional tensions that are bothering me		
I have received assistance or information already.		<b>My Interest in Financial Guidance</b>	I would like to receive (additional) assistance or information	
<b>YES</b>	<b>NO</b>		<b>YES</b>	<b>NO</b>
		54. Talk with someone about getting a part-time job		
		55. Discuss pros and cons of getting a student loan		
		56. Talk with someone about how to manage finances, including loans, work, and credit cards		
		57. Get information about opportunities for holiday or summer jobs		

I have received assistance or information already.		<b>My Interest in Social Activities</b>	I would like to receive (additional) assistance or information	
<b>YES</b>	<b>NO</b>		<b>YES</b>	<b>NO</b>
		58. Get information about informal gatherings to meet some new friends		
		59. Find out about student government and various student activities		
		60. Find out about clubs and social organizations at my college		

VERY DISSATISFIED   1   2   3   4   5   6   7   VERY SATISFIED

Click on the response button that corresponds to the option you have selected.

61. Assistance in selecting a program of study or major	1	2	3	4	5	6	7
62. Safety and security on campus							
63. Availability of financial resources							
64. Level of interaction with other students							
65. Opportunities for community service and other volunteer work							
66. Level of interaction with faculty in class							
67. Level of interaction with faculty outside of class							
68. Level of interaction with my advisor							
69. Sense of belonging to this college community							

The following is not a rating item. Select Yes if you agree with the statement. Select No if you do not.

70. By clicking “yes” below, I (1) authorize my institution to share results from this inventory with my advisor/success coach and other student service offices, which will help me with my educational planning and decisions and (2) disclose the information about me within this survey, including the results, to service providers that my institution uses to further my educational purposes.

- ☐ YES
- ☐ NO (If you select this option, all of your reports will be kept on file with the Coordinator of this program; as soon as the Student Report is available, you will be able to obtain it from the Coordinator).

**Study Survey Part B: Identifying contributions to Idaho's higher education crises**

71. How would you describe your general health?

- ☐ Excellent
- ☐ Very Good
- ☐ Good
- ☐ Fair
- ☐ Poor
- ☐ Don't know

72. In the past 12 months were you in a physical fight?

- ☐ Yes
- ☐ No
- ☐ Prefer not to answer

73. In the past 12 months were you verbally threatened?

- ☐ Yes
- ☐ No
- ☐ Prefer not to answer

74. In the past 30 days, how many days did you use cigarettes, e-cigarettes, or other forms of tobacco?

- ☐ Never used
- ☐ Have used, but not in last 30 days
- ☐ 1-2 days
- ☐ 3-5 days
- ☐ 6-9 days
- ☐ 10-19 days
- ☐ 20-29 days
- ☐ Daily
- ☐ Prefer not to answer

75. In the past 30 days, how many days did you consume alcohol?
- ☐ Never used
  - ☐ Have used, but not in last 30 days
  - ☐ 1-2 days
  - ☐ 3-5 days
  - ☐ 6-9 days
  - ☐ 10-19 days
  - ☐ 20-29 days
  - ☐ Daily
  - ☐ Prefer not to answer

One drink of alcohol is defined as a 12 oz. can or bottle of beer or wine cooler, a 4 oz. glass of wine, or a shot of liquor straight or in a mixed drink.

76. The last time you “partied”/socialized how many drinks of alcohol did you have? (If you did not drink, please enter “0”) \_\_\_\_\_ number of drinks

77. The last time you “partied”/socialized, over how many hours did you drink alcohol? (If you did not drink, please enter “0”) \_\_\_\_\_ number of hours

78. How do you describe your weight?
- ☐ Very underweight
  - ☐ Slightly underweight
  - ☐ About the right weight
  - ☐ Slightly overweight
  - ☐ Very overweight

79. How many days a week on average do you exercise for at least 30 minutes?
- ☐ 0
  - ☐ 1-2 times/week
  - ☐ 3-4 times/week
  - ☐ 5 or more times a week

80. Have you ever been diagnosed with depression?
- ☐ Yes
  - ☐ No

81. Within the last 12 months, how would you rate the overall level of stress you have experienced?
- ☐ No stress
  - ☐ Less than average stress
  - ☐ Average stress
  - ☐ More than average stress
  - ☐ Tremendous stress

82. If in the future you were having a personal problem that was really bothering you, would you consider seeking help from a mental health professional?

- ☐ No
- ☐ Yes
- ☐ Unsure

83. On how many of the past 7 days did you get enough sleep so that you felt rested when you woke up in the morning?

- ☐ 0 days
- ☐ 1 day
- ☐ 2 days
- ☐ 3 days
- ☐ 4 days
- ☐ 5 days
- ☐ 6 days
- ☐ 7 days

84. People sometimes feel sleepy during the daytime. In the past 7 days, how much of a problem have you had with sleepiness (feeling sleepy, struggling to stay awake) during your daytime activities?

- ☐ No problem at all
- ☐ A little problem
- ☐ More than a little problem
- ☐ A big problem
- ☐ A very big problem

85. What term best describes your sexual orientation?

- ☐ Asexual
- ☐ Bisexual
- ☐ Gay
- ☐ Lesbian
- ☐ Pansexual
- ☐ Queer
- ☐ Questioning
- ☐ Same Gender Loving
- ☐ Straight/Heterosexual
- ☐ Another identity (please specify) \_\_\_\_\_
- ☐ Prefer not to answer

86. What is your height in feet in inches? \_\_\_\_\_

87. What is your weight in pounds? \_\_\_\_\_

88. What is your enrollment status?

- ☐ Full-time

- Part-time
  - Other
89. How do you usually describe yourself?
- White
  - Black
  - Hispanic or Latino/a
  - Asian or Pacific Islander
  - American Indian, Alaskan Native, or Native Hawaiian
  - Biracial or multiracial
  - Other
90. What is your relationship status?
- Not in a relationship
  - In a relationship but not living together
  - In a relationship and living together
91. What is your marital status?
- Single
  - Married/Partnered
  - Separated
  - Divorced
  - Other
92. Where do you currently live?
- Campus residence hall
  - Fraternity or sorority house
  - Other college/university housing
  - Parent/guardian's home
  - Other off-campus housing
  - Other
93. Within the last 12 months, have you been diagnosed or treated by a professional for any of the following? (Please mark the appropriate the column for each row)

	No	Yes, diagnose d but not treated	Yes, treated with medicatio n	Yes, treated with psychotherap y	Yes, treated with medication and psychotherap y	Yes, with other treatmen t	Prefer not to answe r
Anorexia							
Anxiety							
Attention Deficit and Hyperactivit							

ADHD							
Bipolar disorder							
Bulimia							
Depression							
Insomnia							
Other sleep disorder							
Panic attacks							
OCD							
Substance abuse							
Other mental health condition							

94. Within the last 12 months, have any of the following been traumatic or very difficult for you to handle? (please mark the appropriate column for each row)

	No	Yes
Academics		
Career-related issue		
Death of family or friend		
Family problems		
Intimate relationships		
Other social relationships		
Finances		
Personal appearance		
Health issues		
Sleep difficulties		
Other		

Over the past two weeks have you been bothered by any of the following problems? (Questions 125-134)



	Not at all	Several days	More than half the days	Nearly every day
95. Little interest or pleasure in doing anything				
96. Feeling down, depressed, hopeless				
97. Trouble falling or staying asleep, sleeping too much				
98. Feeling tired of having little energy				
99. Poor appetite or overeating				
100. Feeling bad about yourself or that you are a failure or have let you or your family down				
101. Trouble concentrating on things such as reading the newspaper or watching television				
102. Moving or speaking so slowly that other people have noticed. Or the opposite, being so fidgety or restless that you have been moving around a lot more than usual				
103. Thoughts that you would be better off dead, or of hurting yourself				

104. If you checked off any problems in questions 125-133, how difficult have they made it for you to do your work, take care of things at work, or get along with people?

- ☐ Not difficult at all
- ☐ Somewhat difficult
- ☐ Very difficult
- ☐ Extremely difficult

## Appendix E

### PHQ-9 Questionnaire and Scoring Index

Over the last 2 weeks, how often have you been  
bothered by any of the following problems?

(use "✓" to indicate your answer)

	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself—or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed. Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead, or of hurting yourself	0	1	2	3

add columns  +  +

(Healthcare professional: For interpretation of TOTAL, please refer to accompanying scoring card). TOTAL:

10. If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?	Not difficult at all	<input type="text"/>
	Somewhat difficult	<input type="text"/>
	Very difficult	<input type="text"/>
	Extremely difficult	<input type="text"/>

**For initial diagnosis:**

1. Patient completes PHQ-9 Quick Depression Assessment.
2. If there are at least 4 ✓s in the shaded section (including Questions #1 and #2), consider a depressive disorder. Add score to determine severity.

**Consider Major Depressive Disorder**

- if there are at least 5 ✓s in the shaded section (one of which corresponds to Question #1 or #2)

**Consider Other Depressive Disorder**

- if there are 2-4 ✓s in the shaded section (one of which corresponds to Question #1 or #2)

**Note:** Since the questionnaire relies on patient self-report, all responses should be verified by the clinician, and a definitive diagnosis is made on clinical grounds taking into account how well the patient understood the questionnaire, as well as other relevant information from the patient.

Diagnoses of Major Depressive Disorder or Other Depressive Disorder also require impairment of social, occupational, or other important areas of functioning (Question #10) and ruling out normal bereavement, a history of a Manic Episode (Bipolar Disorder), and a physical disorder, medication, or other drug as the biological cause of the depressive symptoms.

**To monitor severity over time for newly diagnosed patients or patients in current treatment for depression:**

1. Patients may complete questionnaires at baseline and at regular intervals (eg, every 2 weeks) at home and bring them in at their next appointment for scoring or they may complete the questionnaire during each scheduled appointment.
2. Add up ✓s by column. For every ✓: Several days = 1 More than half the days = 2 Nearly every day = 3
3. Add together column scores to get a TOTAL score.
4. Refer to the accompanying **PHQ-9 Scoring Box** to interpret the TOTAL score.
5. Results may be included in patient files to assist you in setting up a treatment goal, determining degree of response, as well as guiding treatment intervention.

**Scoring: add up all checked boxes on PHQ-9**

**For every ✓** Not at all = 0; Several days = 1;  
More than half the days = 2; Nearly every day = 3

**Interpretation of Total Score**

Total Score	Depression Severity
1-4	Minimal depression
5-9	Mild depression
10-14	Moderate depression
15-19	Moderately severe depression
20-27	Severe depression

## PHQ-9 TREATMENT RECOMMENDATION

PHQ-9 Score	Provisional Diagnosis	Treatment Recommendation
5-9	Minimal Symptoms*	Support, educate to call if worse; return in 1 month
10-14	Minor depression++ Dysthymia* Major depression, <i>mild</i>	Support, watchful waiting Antidepressant or psychotherapy Antidepressant or psychotherapy
15-19	Major depression, <i>moderately severe</i>	Antidepressant or psychotherapy
≥ 20	Major depression, <i>severe</i>	Antidepressant <u>and</u> psychotherapy (especially if not improved on monotherapy)

\* If symptoms present ≥ two years, then probable chronic depression which warrants antidepressants or psychotherapy (ask, "*In the past 2 years have you felt depressed or sad most days, even if you felt okay sometimes?*").

++ If symptoms present ≥ one month or severe functional impairment, consider active treatment.