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# Loneliness and Student Health: Replication and Exploratory Analysis

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Loneliness and Student Health: Replication and Exploratory Analysis

by

John Copeland

A Thesis Submitted to the Department of Psychology

in partial fulfillment of the requirements for the degree of

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UNIVERSITY OF NORTH FLORIDA

COLLEGE OF ARTS AND SCIENCES

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CERTIFICATE OF APPROVAL

Loneliness and Student Health: Replication and Exploratory Analysis

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## Abstract

Loneliness occurs in the absence of belonging or social connectedness and has been linked to many physical and mental health problems. Among these conditions are depression, anxiety, sleep disturbance, and stress. College students report these four conditions as the largest barriers to good academic performance. For as much is known about loneliness, much less is known about belonging and health or the role loneliness plays in these relationships prompting a need for investigation. Using a sample of 301 university students, we replicated previous findings that loneliness predicts depression, anxiety, sleep disturbance, and stress. Next we replicated and contributed new findings for the relationship between social connectedness and the same health outcomes of interest. Previous research has found gender to be a moderator in the relationship between loneliness and social connectedness. The current study found no evidence of moderation. Based upon the available literature, it was hypothesized that loneliness would mediate the relationship between social connectedness and the health outcomes of interest. Using conditional process modeling, loneliness was found to be a mediator in every case. These findings validate previous findings on the effects of loneliness on health. They also highlight the significance of social connectedness as a factor in health. Future research should investigate the effectiveness of social connectedness as focal point for treatment of mental and physical health conditions.

*Keywords:* Loneliness, belonging, social connectedness, depression, anxiety, sleep disturbance, moderation, mediation, conditional process model

### Loneliness and Student Health: Testing a Belonging Mediation Model

The prevalence of loneliness is a concerning public health and social issue. In addition to being among the most common symptoms presented by those seeking counseling, it's linked to higher rates of mortality, poorer physical health, such as impaired immune functioning, cardiac health, and progression of Alzheimer's disease. It's associated with alcohol abuse, drug abuse, suicide ideation, attempts, and completion. It predicts mental illness such as depression and perceptions of stress and anxiety (Cacioppo, Hawkley, & Thisted, 2010; Lee & Robbins, 1998; Mathers, 2008) Although the connection between loneliness and these illnesses has been established, there has been little research into constructs that interrupt the relationship between loneliness and these illnesses. Generally, the previous literature has focused on social support as an intervention for these illnesses, despite for example, empirical evidence suggesting social support does little to predict longitudinal changes in depression (Cacioppo et al., 2010).

Psychological treatment for these illnesses may be improved with an adjusted approach. For example, in addition to treating the illness, focusing treatment on mediating the effects of antecedent conditions such as loneliness would be prudent and worth study. Additionally, while the popularity of social support in literature searches suggest it is a "cure all" for these illnesses, perhaps a related and more universal concept, belonging, more specifically social connectedness, should receive the attention as a potential psychological panacea. Accordingly the purpose of the present study is to replicate the relationships between loneliness, social connectedness, and health. Additionally, an exploratory analysis will test whether loneliness mediates the relationship between belonging (assessed through social connectedness) and health outcomes of



interest. However before introducing the study, some background on belonging, social connectedness, loneliness, and their relationships with physical and mental health is needed.

### **Belonging**

The concept of belonging in psychology dates back nearly fifty years to Maslow, who ranked “love and belongingness needs” third in his motivational hierarchy (A. Maslow, 1968). In his hierarchy, physiological needs such as food, water, shelter, sleep, air, and warmth are most urgent. Once physiological needs are met, safety needs, such as protection from the elements, stability, order, and law becomes the priority. In order to reach the final two tiers of the hierarchy, self-esteem (achievement, mastery, independence, and status), and self-actualization (self-fulfillment, realization of potential, and peak experiences), love and belongingness needs must be satisfied. Maslow noted that love and belonging needs are particularly difficult to achieve and maintain in industrialized societies. He further remarked that failure to satisfy these needs could lead to pathology and maladjustment; suggesting for the first time that belonging may play an important role in well being. Although Maslow recognized the importance of belonging, he also noted that despite it being a pervasive theme in autobiographies, novels, poems, and plays, it was mostly absent from the focus of psychological study (A. H. Maslow, Frager, Fadiman, McReynolds, & Cox, 1970).

Since Maslow’s commentary, belonging has become a popular topic of inquiry and studied in psychology, psychiatry, nursing, education, anthropology, religion, behavioral economics, and other social sciences. As a consequence, belonging has a variety of interpretations depending on the perspective it is studied from. For example, belonging from the sociological perspective connotes membership to a group or system (Jones, 2009). From a

physical perspective, it is defined as possessing objects, persons, or places. The spiritual definition asserts belonging occurs when a metaphysical relationship with a being or place takes place on a universal level (B. M. Hagerty, Lynch-Sauer, Patusky, Bouwsema, & Collier, 1992). However, for purposes of this study the psychological perspective of belonging will be the focus. But even in the psychological literature there is some discrepancy in how belonging is defined. These nuanced definitions do share a common theme: belonging is a personal evaluative feeling or perspective (B. M. Hagerty et al., 1992). The personal nature of the concept is why “sense of belonging” is often used interchangeably with belonging in the psychological literature.

Baumeister and Leary’s (1995) proposal of the “belonging hypothesis” provides an excellent theoretical framework for further study of belonging. The belonging hypothesis states simply that the need to belong is a fundamental human motivation. The authors arrive at this conclusion through arguably the most comprehensive review of the belonging literature and their establishment of nine criteria that must be met in order to be considered a fundamental motive; one of which is being universally applicable to all people (for all nine criteria see appendix A). Much like Maslow, the authors suggest there are health consequences when this pervasive belonging need is not met. However, unlike Maslow, who predicted these health consequences but lacked empirical support, Baumeister and Leary draw upon numerous studies linking belonging or its absence to compromised health (Wahba & Bridwell, 1976). For example, one study found the absence of belonging to be a direct antecedent of social dysfunction and psychopathology (Solomon, Waysman, & Mikulincer, 1990).

Baumeister and Leary (1995) suggest the need to belong is satisfied and belonging implicitly achieved when two criteria are met. The first requires affectively pleasant interactions with others and the second, interactions are enduring and consist of mutual liking (or love) and

concern for one another's well-being. As a consequence of an established sense of belonging, individuals form a positive interaction cycle with others that provides a buffer against the effects of stress and mental and physical illness.

By this account, we have a broad and conceptually organized definition of belonging. However there are limitations. First, this conception of belonging lacks a metric for empirical study. Second, this perspective focuses on reciprocal relationships with proximal others while neglecting the possibility for a sense of connectedness with the world at large. Finally, this definition of belonging is oriented towards social/motivational psychology whereas the prevailing depiction of belonging is that of a personal evaluative feeling or perspective. Building upon this, loneliness, which will be considered the current study's primary threat to health, is defined as a personal perception as well (Hawkley & Cacioppo, 2010). In order to accurately measure belonging with relation to loneliness there must be a metric that also operates from a self-psychology paradigm. Fortunately the social connectedness construct (and scale) offers the solution.

### **Social Connectedness**

Social connectedness is an extended conceptualization of belonging. The belonging construct originates in social psychology and operates as a motivational paradigm. That is, the need to belong motivates individuals to maintain relationships with proximal others and behave in ways that thwart social exclusion - the purposeful exclusion from relationships by other people (Seppala, Rossomando, & Doty, 2013). In contrast, social connectedness is a term coined by personality psychologists, emphasizing self-psychology and development in its conceptualization. Like belonging, social connectedness has been studied in multiple academic disciplines and thus has different interpretations. For example, personality psychologists tend to

describe individual differences in connection to others as social connection and clinical psychology blends social connectedness with a related concept, social support in which concepts such as instrumental support (providing another individual with labor, money, or time) are part of the definition (Seppala et al., 2013). For purposes of this study and consolidation of concepts in the literature, we will use the definition provided by Lee and Robbins (1995, 2001).

In their original article titled: “Measuring Belongingness: The Social Connectedness and the Social Assurance Scales” Lee and Robbins (1995) provide a comprehensive review of the social connectedness literature while creating and validating a metric for belonging, called the social connectedness scale (there was little evidence for the social assurance scale). They define social connectedness as a component of the independent self that represents cognitions about enduring relationships with others and the social world at large. In other words, social connectedness has three basic forms: connection to the self, others, and a greater purpose or social world at large (Bellingham, Cohen, Jones, & Spaniol, 1989).

While social connectedness and belonging both emphasize relationships with proximal others, there are several points of distinction between the two. For example, unlike the Baumeister and Leary (1995) belonging paradigm, social connectedness includes an emphasis on the independent self and the social world at large. Additionally, in the belonging paradigm, once individuals have satisfied the need to belong they are no longer motivated to seek new relationships. Socially connected individuals by contrast, will continue to pursue formation of new relationships (Lee & Robbins, 1998).

Referring back to the developmental aspect of social connectedness; while the need to belong is stable throughout life, social connectedness expands in scope throughout the developmental stages. That is, while mere group membership and peer affiliation will satisfy the

need to belong regardless of developmental stage, the criteria for social connectedness expands with the individual's social world throughout development. These criteria include "being part of" something larger than oneself, having "a pervasive sense of security" and being "human among humans", in other words, feeling a connection to a greater purpose or social world at large. In childhood, attachments to caregivers provide initial affiliation with others and a sense of security. Adolescence allows individuals to develop connections with peers who share common interests and join groups with similar others. In adulthood, the culmination of lifetime relationship experiences are progressively incorporated into the overall sense of self, producing a somewhat stable sense of connectedness. This acts as a protective factor against acute changes in relationships, such as loss of a companion or exclusion from a social group (Lee, Draper, & Lee, 2001).

To summarize, belonging and social connectedness are overlapping concepts but belonging subsumes social connectedness in the vernacular (Scheff, 2004). Social connectedness expands belonging by focusing on the independent self and extending beyond group membership and peer affiliation to sense of connectedness with the world at large. Additionally, social connectedness has a validated measure and is founded on the independent self while also measuring a critical aspect of one's social relationship status, their feeling of belonging or connectedness to the greater social world. Social connectedness is also relatively unexplored in the literature. Consequently, social connectedness makes a reasonable variable of study when examining transition periods, and antecedents to mental and physical illness that orbit around the self such as loneliness.

**Loneliness**

Loneliness is defined as an individual's distressing feelings associated with the perception of deficiency in both the quantity and quality of social relationships; most commonly following the loss of specific relationship(s) (Lee et al., 2001). That is, loneliness requires *perceiving* a lack of *intimate* connections with others, as it can be experienced in the presence or absence of abundant social contact (R. R. F. Baumeister, 1995; Heinrich & Gullone, 2006).

Baumeister and Leary (1995) suggest that loneliness emerges when belonging needs are not met. The antagonistic relationship between loneliness and belonging is so robust that regardless of how belonging is defined, loneliness arises from an absence of belonging (B. M. Hagerty, Williams, Coyne, & Early, 1996). While these concepts are related, they are distinct phenomena, not merely the antithesis of one another. For example, while social connectedness and loneliness both share a cognitive element of personal perception, loneliness is either chronic or acute. Furthermore, loneliness focuses on emotions associated with the perception of lost relationships while social connectedness contains elements of a developmental process, and unlike loneliness, extends beyond the self and intimate others to relationships with the social world at large (Lee & Robbins, 1995; Lee et al., 2001).

Admittedly, studying loneliness is challenging due to its multidimensionality. That is, loneliness can be experienced in two categories (emotional and social) each with dimensions of their own. For example, loneliness can be experienced with regard to absence of intimate connections with close others (emotional) or a lack of a social network in which one feels they belong (social). These experiences of loneliness can also vary in intensity. Finally, both can be experienced as either chronic/trait, or acute/state loneliness occurring situationally or globally (Heinrich & Gullone, 2006). Due to this multidimensionality, creating a metric that captures all

aspects of loneliness is needed for future study. The dominating measure, the UCLA and R-UCLA loneliness scales have been criticized for failing to distinguish between acute and chronic loneliness (Marangoni & Ickes, 1989). However, creating a revised metric is beyond the scope of the present study and despite any shortcomings, the UCLA loneliness scale continues to be the preferred measure of choice. Further mention of the instruments will be included in the methods section.

While the multidimensionality of loneliness is a unique challenge, it highlights the need for more research on the topic. Other related social constructs such as social support have received proportionally more attention. For example, a search of abstracts for “social support” and “health” on the PsychINFO database yielded 831 results while another search for “loneliness” and “health” produced only 61 search results. One more search for “loneliness” and “social connectedness” only produced 5 results. Again, there appears to be a gap in the literature surrounding loneliness, health and the role of belonging between the two. The research that is available will be reviewed below.

### **Relationships with Health: Belonging, Social Connectedness, Loneliness and Outcomes of Interest**

**Belonging.** Maslow (1954) commented that an absence of belonging could have destructive effects on health for individuals in increasingly industrialized societies. He further predicted the effects of belonging on health when he noted that belonging is crucial for the maintenance of health and avoidance of sickness (A. H. Maslow et al., 1970). Baumeister and Leary (1995) echoed these sentiments suggesting that individuals who are “socially deprived should exhibit signs of maladjustment or stress, behavioral or psychological pathology, and possibly health problems” (page 500). Corresponding to these predictions, a variety of mental

and physical health outcomes have been associated with belonging in the literature. Beginning with Baumeister and Leary (1995) they review a considerable amount of literature supporting belonging's negative relationship with anxiety, depression, stress, loneliness, quality of life, and others. In support, Hagerty and Williams (1999) found a link between belonging, loneliness, and depression in their research. Furthermore, another study found that belonging interventions improved the GPAs, happiness, and over-all self reported health of minority students in a three year study (Walton & Cohen, 2011). Taken together, this evidence suggests belonging and loneliness play a role within an expansive web of health outcomes.

**Social Connectedness.** Research on social connectedness and health is limited. One study conducted at a small, private, southern liberal arts college found that social connectedness significantly predicted depression (Armstrong & Oomen-Early, 2009). Lee and Robbins (1998) found social connectedness to be negatively associated with (trait) anxiety.

With respect to loneliness, Lee and Robbins (2000) found sex differences in the relationship between social connectedness and loneliness. Women reported a stronger relationship ( $R^2 = 67\%$ ) between loneliness and social connectedness than did men ( $R^2 = 24\%$ ) (Lee & Robbins, 2000).

The most accessible literature on social connectedness highlights its relation to well being. For example, social connectedness has been linked to life expectancy, in older adults, and resilience to cognitive decline (Haslam, Cruwys, Haslam, & Jetten, 2015). Additionally, social connectedness has been found to mediate the relationship between extraversion and subjective well-being (Lee, Dean, & Jung, 2008).

The literature on social connectedness is sparse, prompting the need for further study. Considering its close relationship with belonging, it is reasonable to predict the relationships



between belonging and health will extend to social connectedness. Especially, the outcomes of interest to the study, depression, sleep disturbance, anxiety, and stress.

**Loneliness.** Loneliness as a risk factor for death is considered to be comparable in size to sedentary lifestyles, obesity, and potentially smoking (Cacioppo et al., 2002). Even when statistically controlling for self-reports of race, life satisfaction, physical health, smoking, alcohol consumption, obesity, socioeconomic status, physical activity, and use of preventive health services, lonely individuals still suffer higher rates of mortality (Berkman & Syme, 1979). Loneliness is associated with numerous physiological outcomes that undermine physical health. These include poorer cardiac health (elevated blood pressure, vascular resistance), altered immune functioning, and expression genes for immune factors, poorer sleep quality, and progression of Alzheimer's disease (Cacioppo et al., 2010; Curtis, Lange, & Ames, 2014). The behavioral associates of loneliness include, increased use of the health care system (lonely individuals being visiting the emergency department 60% more often than nonlonely individuals), alcohol abuse, drug use, eating disorders, sleep disturbance, poor social skills, suicide ideation, attempts, and completion (Heinrich & Gullone, 2006). Finally, loneliness has been associated with a variety of mental health conditions. For example, increased perceived stress, fear of negative evaluation, anxiety, anger, and diminished optimism and self-esteem (Hawkley & Cacioppo, 2010). However the relationship is between loneliness and depression is the most significant.

**Outcomes of interest.**

**Depression.** According to the World Health Organization, depression is the leading cause of disability worldwide and is often comorbid with other illnesses such as heart disease, diabetes, hypertension, and chronic back pain(Mathers, 2008). A study in 1999 found depression treatment

accounts for approximately half of private insurance spending for mental health, each episode of major depression costing an average of \$1,059 to treat with only 33% of treatments resulting in depression-free patients (Frank, McGuire, Normand, & Goldman, 1999). The cost to society has increased since. The economic burden related to direct medical and pharmaceutical treatment of depression in 2005 was \$21.6 billion and in 2010, \$27.7 billion. Including workplace costs, suicide-related costs, and other indirect costs, the total economic burden of depression was \$173.2 billion in 2005 and \$210.5 billion in 2010 (Greenberg, Fournier, Sisitsky, Pike, & Kessler, 2015).

The prevalence and cost of depression makes combating this illness and its underlying connections to other diseases an urgent matter. Considering the economic burden of conventional treatment, an alternative approach focusing on the social factors causing the depression may be more economical. The aforementioned link between depression, loneliness, points to unmet belonging needs being a potential solution.

*Separating Depression from Loneliness.* Depending on the study, the correlation between loneliness and depression ranges from .4 to .6. In fact, loneliness has often been classified under the more established body of research on depression (Weeks, Michela, Peplau, & Bragg, 1980). However, they are separate phenomena and should not be confused. Weiss (1973) separated loneliness from depression by characterizing depression as a general feeling and loneliness as a way people feel about their social connections. Since his commentary, evidence has asserted that they are in fact, distinct. For example one study found loneliness and depressive symptoms as statistically separable and that loneliness predicted increased depressive symptoms but depressive symptoms did not predict loneliness over a 1-year interval (Cacioppo et al., 2010). Another study using structural equation modeling, found no evidence that depression

caused loneliness, or that loneliness caused depression. The authors suggested shared causes to be the most likely hypothesis for their relationship (Weeks et al., 1980).

**Stress.** Stress in the psychological sense, is strain that occurs when an external demand is perceived as either challenging or threatening, and then appraised as being either adaptive or debilitating (Sanders & Lushington, 2002). Baumeister and Leary (1995) assert stress occurs in the absence of belonging or when confronted with impending social exclusion or isolation. Hawkley and Cacioppo (2010) reflect this assertion in a review of loneliness where they found perceived stress to be a common outcome associated with loneliness. If stress is indeed an outcome of loneliness, we should expect college students to report higher levels of stress considering that college age students spend more time alone than any other demographic besides the elderly (Arnett, 2000). Indeed, a national survey in which students reported the most significant impediments to their academic achievement, stress ranked first (American College Health Association, 2014). In that same survey, cold/flu ranked fourth. This is noteworthy, considering the results of another study that found college students' perceived stress predicted clinical illness and stressful life events predicted cases of the common cold (Cohen, Tyrrell, & Smith, 1993).

**Sleep Disturbance.** The emergence of sleep deficits among many Americans points to sleep debt as a possible mechanism through which loneliness affects other health outcomes. Sleep debt decreases glucose tolerance, increases sympathetic activity, and interferes with cortisol regulation all of which resemble the effects of aging (Spiegel, Leproult, & Van Cauter, 1999). Cacioppo et al., (2002) found that lonely individuals were more likely to have subjectively worse quality sleep than non-lonely individuals supporting sleep debt may be a component of a loneliness-health mechanism. Lack of sleep is also thought to be a significant

risk factor for depression. In fact, one study found sleep quality to be a predictor of depression in college students, 11% of whom report getting a good night's sleep (Armstrong & Oomen-Early, 2009). Spence, Helmreich, and Pred (1987) in an effort to assess somatic health, created a metric which included sleep disturbance as a measure for quality of sleep. Indeed, research has shown that sleep disturbance is associated with severe chest pain (angina) depression, and poor health, all of which are associated with sleep quality (Newman, et. al, 1997). Consequently, sleep disturbance (sleep quality indirectly) will be considered an outcomes of interest in the present study.

**Anxiety.** Anxiety is characterized by a perceived inability to predict or control the outcome of a situation resulting in the perception of threat and accompanying negative affect. Anxiety emerges from an interaction between the individual and the environment. Although primarily an emotional experience, it includes added cognitive, physiological, and behavioral components (Konstam, Moser, & De Jong, 2005).

Baumeister and Tice (1990) argue that exclusion from social groups may be the most important cause of anxiety. Baumeister and Leary (1995) however, reason that the effects of social exclusion may be reversed and anxiety ousted with experiences of social inclusion. This immediately implicates a relationship between anxiety, social connectedness, and loneliness. These relationships, especially between loneliness and anxiety have been supported in the literature. For example, in his review of the loneliness literature, McWhirter (1990) suggested not only is there a relationship between loneliness and anxiety, loneliness could be its underlying cause. More recent publications have also found anxiety to be a product of loneliness (Hawley & Cacioppo, 2010; Heinrich & Gullone, 2006).

While anxiety may be adaptive in an acute sense, leading individuals to avoid threats either to themselves or their standing in the group; chronic anxiety associated with perceptions of loneliness could contribute to health problems (R. F. Baumeister & Tice, 1990). According to one study for example, anxiety is related to quality of life, mortality, and combined with depression, plays a role in chronic obstructive pulmonary disease and chronic heart failure (Yohannes, Willgoss, Baldwin, & Connolly, 2010).

### **Present Study**

The present study will explore relationships between loneliness, social connectedness, and health outcomes. First, the relationship between loneliness, social connectedness, depression, anxiety, stress, and sleep quality will be replicated. Based upon the literature, we hypothesize loneliness to predict increases in the outcomes of interest. Second, due to the limited available literature on social connectedness, the relationship between social connectedness and the health outcomes of interest will be explored. We assume that the established relationships between belonging and the health outcomes of interest will extend to social connectedness as Lee and Robbins (1995) used social connectedness as a measure of belonging. These findings will contribute to the understanding of the social connectedness construct. Third, Lee and Robbins (2000) found that the relationship between loneliness and social connectedness is moderated by gender. That is, the relationship was stronger for women than for men. Based upon a similar study, we expect that these findings will replicate (Ang, 2015). Finally, in an exploratory analysis, we will test a mediation model in which we predict the relationship between social connectedness and health outcomes of interest to be mediated by loneliness. To our knowledge, such a relationship has never been tested. Consequently, the findings will contribute to the loneliness and social connectedness literature.

## Method

### Participants

The 301 participants were students recruited from the University of North Florida (UNF). There were 216 females, 63 males, and 22 unreported. The average age was 23 years old ( $SD = 7.24$ ) with 18 years old being the youngest and 58 the oldest. Most participants completed the survey through university's SONA system (cloud based participant management software) for extra credit in their respective psychology courses. Classroom announcements were used to supplement recruitment. Students who expressed interest in the study following an announcement were emailed a link to the survey.

Although this population was chosen as a matter of convenience, research indicates that high school and college students report the highest levels of loneliness, with students in transition periods especially likely to report being lonely (Heinrich & Gullone, 2006). Demographic information comparing the study sample to the University of North Florida population is included in table 1 below.

**Table 1.** Student Demographics: Study sample vs. UNF population.

	Study Sample (n=301)	UNF Population (n=16,372)
Age 18-24	75.9%	71.1%
Age 25-30	14%	16%
Age 31-40	5%	7.5%
Age 41 and Over	5%	5.4%
Men	22.6%	44%
Women	77.4%	56%
White	71.3%	72.4%
Black	9.3%	9.5%
Hispanic/Latino	10.5%	7.5%
Asian	4%	4.6%
Other	4.3%	0.1%

Analyses were conducted based upon available data. Data from participants who failed to complete the majority of the survey was excluded. Additionally, missing responses was replaced by the average response of the participant, provided more than half the items of the measure were completed. In the absence of this criterion, the response was excluded from the analyses.

### **Instrumentation**

**Social Connectedness.** The Social Connectedness Scale (Lee & Robbins, 1995) was used as a measure for belonging. The scale is rated on a five point Likert scale from 1 (*Agree*) to 5 (*Disagree*) and includes statements such as “*Even around people I know, I don’t really feel that*

*I belong*". Items are reversed scored as necessary so higher scores indicate high social connectedness. The scores are summed across the eight items,  $M = 28.89$ ,  $SD = 8.9$ , range = 32. Cronbach's alpha, the selected measure for internal consistency, is .94 for the present study. This is slightly higher than the .91 Lee and Robins (1995) reported (Cronbach, 1951).

**Loneliness.** The UCLA Loneliness Scale is a 21 item scale (Russell, Peplau, & Ferguson, 1978). The scale includes statements rated on a four point Likert scale ranging from 1 (*Never*) to 4 (*Always*) and includes statements such as "*How often do you feel isolated from others around you*" and "*How often do you feel alone?*" The scores are summed across the 21 items,  $M = 45.5$ ,  $SD = 11.21$ , range = 59. Russel et al., (1978) found a coefficient *alpha* of .96 (.90 by Hartshorne (1993)), the present study found .94. Items were reverse scored as necessary so higher scores indicate greater loneliness.

Hartshorne (1993) found strong test-retest reliability for the UCLA Loneliness scale. The correlation for a sixteen subject sample, tested two weeks apart, was .85. The same study conducted a confirmatory factor analysis of the scale and found evidence for construct validity. That is, the adjusted goodness of fit index (AGFI) for the one-factor solution was .964, which is exceptional considering Cole (1987), who argues that an index of .8 indicates satisfactory fit. While up to five factors have been reported in other studies, those solutions do not offer an advantage to the one-factor solution. (Hartshorne, 1993).

**Depression.** Depression was measured using the validated and standardized Patient Health Questionnaire (PHQ-8) survey (Kroenke et al., 2009). The survey consists of eight out of nine criteria (ninth refers to thoughts of suicide) used by the DSM-IV to diagnose depressive disorders (American Psychiatric Association & American Psychiatric Association, 1994). The



items are rated on a four point Likert scale from 1 (*Not at all*) to 4 (*Nearly Every Day*) and included statements such as “*In the past four weeks, how often have felt or been bothered by: 1. feeling down depressed or hopeless 2. Losing interest or pleasure in doing things*” The scores are summed across the eight items,  $M = 8.42$ ,  $SD = 5.66$ , range = 24. Higher score indicates higher depressive symptomatology. In practice, scores  $\geq 10$  indicate the presence of a depressive disorder (Kroenke et al., 2009).

A previous study on the validity and reliability of the PHQ-8 found internal consistency/reliability to be  $\alpha = .84$ . Confirmatory factor analysis produced a goodness of fit index of .98 (Pressler et al., 2011). For the present study, the coefficient *alpha* is .87.

**Anxiety.** Anxiety was measured using 6 items extracted from the Hopkins Symptom Checklist (HSCL) Anxiety Scale, a reliable and validated measure (Deane, Leathern, & Spicer, 1992). These items measure anxiety occurring within the last month and including the day of participation. The scale uses a 4 point Likert scale ranging from 1 (*Not at all*) to 4 (*Extremely*), and includes statements such as “*How have you felt during the past 4 weeks, including today?: Heart pounding or racing*” The scores are summed across the six items,  $M = 9.48$ ,  $SD = 3.59$ , range = 17. Cronbach’s alpha for the present study is .87. Higher scores indicate higher anxiety.

**Stress.** The Perceived Stress Scale (PSS) was used to measure stress occurring in the last month (Cohen, Kamarck, & Mermelstein, 1983). This scale uses 10 items rated on a 5 point Likert scale from 1 (*Never*) to (*Very Often*). It included statements such as “*In the last month, how often have you found that you could not cope with all the things that you had to do?*” Higher scores indicate more perceived stress with scores being reversed for questions worded positively. The scores are summed across the ten items,  $M = 20.85$ ,  $SD = 6.11$ , range = 35. Cohen (1983)

examined the test-retest reliability of the PSS with two groups. One group was tested two days apart ( $n=82$ ), with a correlation of .85. The other group ( $n=64$ ), with a coefficient of .55, was tested six weeks apart. The average coefficient *alpha* for three samples was found to be .85. The coefficient *alpha* is .87 for the current study.

**Sleep Disturbance.** Sleep quality was indirectly measured using the sleep disturbance subscale of the Physical Health Questionnaire. The authors of this questionnaire developed it to measure somatic health in four dimensions: cephalgia (headaches), digestive problems, respiratory problems and sleep quality. While the portion of the questionnaire inquiring about sleep was referred to as the “sleep disturbance scale subscale” by the Schat, Kelloway, and Desmarais (2005) who validated the measure; it was developed and validated to measure sleep quality originally (Spence, Helmreich, & Pred, 1987). Subsequently, to avoid confusion it will be referred to as the “sleep disturbance” in the present study. This scale consists of four items rated on a 7 point Likert scale from 1 (*Not at all*) to 7 (*All the time*). These four items included statements such as “*Over the past month, how often have you had difficulty getting to sleep at night?*”, “*Over the past month, how often have you woken up during the night?*”, “*Over the past month, how often has your sleep peaceful and undisturbed*” and “*Over the past month, how often have you had disturbing dreams or nightmares?*”. The scores are summed across the four items,  $M = 14.89$ ,  $SD = 5.26$ , range = 23. Cronbach’s *alpha* was found to be .81 in a study that established the scale’s internal consistency (Schat, Kelloway, & Desmarais, 2005). Cronbach’s *alpha* for the present study was .77. Higher scores indicate greater sleep disturbance. Scores were reversed for items worded to positive, higher scores indicating more sleep disturbance.

## **Procedure**

Participants completed an online consent form upon selecting into the study. Participation consisted of completing an online questionnaire administered via Qualtrics. Completion took approximately forty-five minutes. Following completion of the study, participants were thanked and given a participation credit valued at one hour to be redeemed in classes offering extra credit for participation.

## **Proposed Analysis**

The variables: Gender, Race, Age Category, Household Income, Relationship Status, and First Generation College Student, were tested as potential confounding variables using ANOVAs. In order to test which levels of the confounding variables significantly differed from one another, Bonferroni post hoc analysis was used. The Bonferroni method was selected as a conservative alternative to Tukey's method because the equal sample size criterion for Tukey's was not met. The results of these analyses can be seen in table 2 below. These variables were chosen among other demographic variables based upon significant correlation to outcomes of interest to the study (See Table 3).

Hypotheses 1-4 were tested using hierarchical linear regression with the moderation and mediation tests conducted using the conditional process model (Hayes, 2013). Each analysis included the necessary controls for confounding variables. Because five regressions were conducted for each hypothesis, the Bonferroni correction was used. Thus, the cutoff for significance was  $(.05/5)$  or  $p < .01$ . For hypothesis one, previous results were gathered and compared to the present findings using a Z-test. A non-significant result illustrates that the findings of the current study are consistent with the previous research.

Based upon the results of the ANOVA, the variables First Generation College Student, Gender, and Age Category had specific collinear relationships with variables of interest to the study. Status as a First Generation College Student significantly predicted an increase in loneliness,  $F(1, 284) = 4.8, p = .029, \eta_p^2 = 0.02$ . Female gender predicted higher stress scores  $F(1, 277) = 24.9, p = .00, \eta_p^2 = 0.082$ . Finally, Age Category predicted both Sleep Disturbance and Stress. With regard to Sleep Disturbance,  $F(3, 274) = 3.1, p = .03, \eta_p^2 = 0.03$ , post hoc analysis using the Bonferroni method revealed a significant difference in sleep disturbance with 25-30 year olds more likely to have sleep disturbances than the 18-24 year old group ( $p = .025$ ). Regarding stress,  $F(3, 274) = 5.3, p = .001, \eta_p^2 = 0.055$ , again post hoc analysis (Bonferroni) showed that 18-24 year olds and 25-30 year olds were more likely to have higher stress scores than the 41 years and older group ( $p = .001$ ) but not significantly different from each other. For more results, see table 2 below.

**Table 2.** Differential Analysis of Confounding Variables

Variable	<i>n</i>	Anxiety		Sleep Disturbance		Stress	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
<b>Age Category</b>							
>18-24	206	9.59	3.77	14.4 <sup>a</sup>	5.11	21.38 <sup>a</sup>	5.85
25-30	38	9.28	2.99	17 <sup>b</sup>	4.86	20.71 <sup>a</sup>	6.07
31-40	13	9.79	3.83	15.07	6	20.14	7.88
41 and Over	14	8.21	2.39	16.07	5.87	14.79 <sup>b</sup>	6.67
<b>Relationship Status</b>							
Single	130	9.71	3.71	14.74	5.27	21.1	5.89
In a relationship	102	9.37	3.65	14.53	5.1	21.1	6.03
Married	39	8.9	3	16.65	5.48	19.63	7.31
<b>Gender</b>							
Female	208	9.71	3.57	15.2	5.23	21.85 <sup>a</sup>	5.73
Male	63	8.76	3.63	14.1	5.3	17.62 <sup>b</sup>	6.53
<b>Household Annual Income</b>							
Under \$10,000	47	10.25	3.8	14.34	5.47	21.19	5.51
\$10,000-\$19,999	22	9.77	3.82	14.22	4.6	19.41	6.57

\$20,000-\$29,000	25	10.04	3.26	16.08	5.69	21.28	6.04
\$30,000-\$39,999	32	9.41	4.11	15.68	5.24	23.53	5.68
\$40,000-\$49,000	29	10	4.32	15	5.04	21.35	6.24
\$50,000-\$74,000	47	9.29	3.31	15.06	5.17	20.25	6.12
\$75,000-\$99,999	29	8.59	3.33	15.72	5.09	21.41	6.31
\$100,000-\$150,000	19	8.45	2.19	13.65	5.95	19	5.79
Over \$150,000	21	8.81	3.5	14.19	5.11	20.1	6.56
<b>First Generation Student?</b>							
No	164	9.29	3.63	14.63	4.94	20.63	6.01
Yes	122	9.73	3.54	15.28	5.71	21.15	6.22
<b>Race/Ethnicity</b>							
Caucasian	194	9.28	3.49	14.92	5.45	20.82	5.92
African American	24	9.46	3.66	16	4.34	18.73	5.58
Hispanic	28	10.1	3.9	14.28	4.93	20.79	7.27
Asian	12	11.83	3.61	15	5.17	23.42	6.24
Other/Multiple Ethnicities	13	9.15	4.3	14.92	4.84	24	7.27

Means with a different superscript are significantly different at  $p < .05$

**Table 2.** Continued

Variable	<i>n</i>	<u>Loneliness</u>		<u>Social Connectedness</u>		<u>Depression</u>	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
<b>Age Category</b>							
>18-24	206	44.94	11.35	29.13	8.79	8.45	5.76
25-30	38	48.74	10.49	26.1	8.33	8.18	4.94
31-40	13	44.71	10.84	27.36	9.1	10.86	7.14
41 and Over	14	45.93	10.99	32	8.95	6.6	5
<b>Relationship Status</b>							
Single	130	46.6	11.44	28.75	9	8.72	5.8
In a relationship	102	44.26	10.88	28.89	8.46	8.22	5.63
Married	39	44.53	11.15	29.13	9.46	7.95	5.83
<b>Gender</b>							
Female	208	45.19	10.71	28.8	8.77	8.66	5.74
Male	63	46.37	12.85	29	9.11	7.66	5.5
<b>Household Annual Income</b>							
Under \$10,000	47	47.36	10.17	27.45	8.85	9.49	5.6
\$10,000-\$19,999	22	43.18	12.52	30.31	9.05	8.31	5.1
\$20,000-\$29,000	25	49.48	11.44	25.04	8.03	10.32	6.24
\$30,000-\$39,999	32	49.19	11.39	27.44	9.05	9.25	5.21
\$40,000-\$49,000	29	42.72	10.6	30.76	7.39	7.9	4.66

\$50,000-\$74,000	47	44	11.24	29.48	9.09	8.56	5.28
\$75,000-\$99,999	29	47.25	10.77	28.19	8.93	7.1	6.89
\$100,000-\$150,000	19	42.15	11.41	30.4	9.16	5.38	4.91
Over \$150,000	21	40.38	9.77	32.19	8.93	8.39	5.54
<b>First Generation Student?</b>							
No	164	44.15 <sup>a</sup>	10.84	29.37	8.32	8.18	5.67
Yes	122	47.07 <sup>b</sup>	11.53	28.25	9.51	8.76	5.67
<b>Race/Ethnicity</b>							
Caucasian	194	44.94	11.29	29.47	8.31	8.14	5.6
African American	24	45.46	10.83	29.96	8.75	8.15	4.81
Hispanic	28	47.35	11.33	25.57	10.63	9.82	6.86
Asian	12	50.67	9.49	22.33	10.86	10.83	7.08
Other/Multiple Ethnicities	13	44.46	11.82	30.85	7.13	8.1	4.35

Means with a different superscript are significantly different at  $p < .05$

**Correlation.** Based upon the test for multicollinearity, potential confounding variables were identified and controlled for. Following that analysis, bivariate correlations were conducted as a supplemental illustration for the relationships between outcomes of interest to the study and the potential confounding demographic variables. Seen in table 3 (Appendix B), all six of the variables of interest were significantly correlated with each other.

## Results

Based upon the results of the ANOVAs, relationship status, household income, first generation college student, age category, gender, and race were identified as confounds and controlled for in the analyses of each hypothesis test. The analyses were conducted as a series of hierarchical linear regressions where step one included confounding variables, and step two included the predictors for the total model.

### Replication of Loneliness Findings

Hypothesis one predicted that previous associations between loneliness and the health outcomes would replicate. The tests consisted of four hierarchical linear regressions in which loneliness was the predictor, the dependent variable was one of the health outcomes of interest and the confounding variables mentioned above were controlled. Consistent with previous findings, loneliness significantly predicted all the health outcomes of interest. The statistical figures for each regression can be seen below in tables 4-7. Loneliness significantly predicted increases in depression scores,  $\beta = .54$ ,  $t(262) = 10.33$ ,  $p < .01$ . Loneliness also explained a significant proportion of variance in depression scores,  $R^2 = .32$ ,  $F(7,262) = 18$ ,  $p < .01$ . A priori calculation by (<http://www.danielsoper.com/statcalc/calculator.aspx?id=1>) for a power level of 0.9 and an effect size of 0.15 at  $p < .01$  indicated a minimum of 163 participants were needed. These criteria were exceeded with the present, and following analyses. That is, for hypotheses 1 and 2, the expected power is greater than 0.9. Loneliness significantly predicted increases in anxiety scores,  $\beta = .38$ ,  $t(263) = 6.63$ ,  $p < .01$ . Loneliness also explained a significant proportion of variance in anxiety scores,  $R^2 = .19$ ,  $F(7,263) = 8.76$ ,  $p < .01$ . Additional information can be seen below in table 5. Loneliness predicted increases in sleep disturbance,  $\beta = .38$ ,  $t(263) = 6.48$ ,  $p < .01$ . Loneliness also explained a significant proportion of variance in sleep disturbance scores,  $R^2 = .17$ ,  $F(7,263) = 7.56$ ,  $p < .01$ . More information is available below in table 6. Loneliness significantly predicted increases in stress scores,  $\beta = .48$ ,  $t(264) = 6.63$ ,  $p < .01$ . Loneliness also explained a significant proportion of variance in stress scores,  $R^2 = .35$ ,  $F(7,264) = 20.28$ ,  $p < .01$ . For additional figures, see table 7 below.

**Table 4.** Statistical figures of Regression on Loneliness and Depression

Model 1 (Step 1)	$\beta$	SE	t	B	$\Delta R^2$
First Generation Student?	0.04	0.7	0.62	0.44	
Yearly Household Income	-.17**	0.14	-2.83	-0.39	
Age Category	0.05	0.46	0.75	0.35	
Relationship Status	-0.06	0.5	-0.88	-0.44	
Gender	-0.08	0.8	-1.37	-1.13	
Race	0.08	0.3	1.38	0.42	
Model 2 (Step 2)					
Loneliness	0.54**	0.03	10.33	0.27	0.28

Note: Predictor Variable is Loneliness, Outcome Variable is Depression

\* Indicates significance at  $p < .05$

\*\* Indicates significance at  $p < .01$

**Table 5.** Statistical figures of Regression on Loneliness and Anxiety

Model 1 (Step 1)	$\beta$	SE	t	B	$\Delta R^2$
First Generation Student?	0.06	0.45	0.97	0.43	
Yearly Household Income	-.14*	0.09	-2.31	-0.2	
Age Category	0	0.3	0.97	-0.01	
Relationship Status	-0.07	0.32	-1.1	-0.35	
Gender	-0.11	0.52	-1.8	-0.96	
Race	0.09	0.1	1.6	0.31	
Model 2 (Step 2)					
Loneliness	0.38**	0.02	6.63	0.12	0.14

Note: Predictor Variable is Loneliness, Outcome Variable is Anxiety

\* Indicates significance at  $p < .05$

\*\* Indicates significance at  $p < .01$



**Table 6.** Statistical figures of Regression on Loneliness and Sleep Disturbance

Model 1 (Step 1)	$\beta$	<i>SE</i>	<i>t</i>	<i>B</i>	$\Delta R^2$
First Generation Student?	0.07	0.66	1.12	0.74	
Yearly Household Income	-0.02	0.13	-0.37	-0.05	
Age Category	0.12	0.43	0.71	0.77	
Relationship Status	0.05	0.47	0.08	0.37	
Gender	-0.12*	0.77	0.43	-1.53	
Race	0	0.28	0.05	0	
Model 2 (Step 2)					
Loneliness	.38**	0.03	6.48	0.17	0.133

Note: Predictor Variable is Loneliness, Outcome Variable is Sleep Disturbance

\* Indicates significance at  $p < .05$

\*\* Indicates significance at  $p < .01$

**Table 7.** Statistical figures of Regression on Loneliness and Stress

Model 1 (Step 1)	$\beta$	<i>SE</i>	<i>t</i>	<i>B</i>	$\Delta R^2$
First Generation Student?	0.07	0.73	1.17	0.85	
Yearly Household Income	-0.02	0.14	-0.42	-0.06	
Age Category	-0.13*	0.48	-2.1	-0.99	
Relationship Status	-0.02	0.52	-0.39	-0.2	
Gender	-.29**	0.85	-4.9	-4.14	
Race	0.11	0.31	1.88	0.59	
Model 2 (Step 2)					
Loneliness	.48**	0.03	9.46	0.26	0.22

Note: Predictor Variable is Loneliness, Outcome Variable is Stress

\* Indicates significance at  $p < .05$

\*\* Indicates significance at  $p < .01$

To further illustrate the consistency between previous and current findings, Z-tests were conducted using the standardized betas from the previous and current studies. Non-significant Z-tests were evidence of consistency between findings. However there were two exceptions. First, the social connectedness betas were significantly different. This may be due to the addition of controlled factors in the present study that were absent from the previous. Second, the necessary data was not accessible to conduct the Z-test for anxiety and was labeled “Not Applicable” (N/A). The betas were gathered from previous studies that used the same measures and scoring methods as the present study. However, the variables controlled for in the present study differed from, or were absent from the previous literature. The Z-test results can be seen below in Table 8.

**Table 8.** Loneliness Regression Analysis with Health Outcomes

DV	$\beta$	$\beta_{Previous}$	Z Score	Source ( $\beta_{Previous}$ )
Social Connectedness	-0.76**	-0.68	-3.26**	(Lee & Robbins, 2000)
Depression	0.54**	0.34	65.78	(Adams, Sanders, & Auth, 2004)
Anxiety	0.38**	0.2	N/A	(Russell, Cutrona, Rose, & Yurko, 1984)
Sleep Disturbance	0.38**	0.07	83.47	(Kurina et al., 2011)
Stress	0.48**	0.33	2.22	(Stoliker & Lafreniere, 2015)

*Note:* Independent Variable is Loneliness

\* Indicates significance at  $p < .05$

\*\* Indicates significance at  $p < .01$

### Social Connectedness and Health

Consistent with hypothesis two, social connectedness significantly predicted loneliness, depression, anxiety, sleep disturbance, and stress. Again, two step hierarchical linear regressions were conducted in which confounds were tested in step one and social connectedness added as a predictor in step two. The results of the individual regressions can be seen below in tables 9-12.

Social connectedness significantly predicted decreases in depression scores,  $\beta = -.46$ ,  $t(262) = -8.49$ ,  $p < .01$ . Also, Social connectedness explained a significant proportion of variance in depression scores,  $R^2 = .25$ ,  $F(7,262) = 12.78$ ,  $p < .01$ . Additional information can be seen in table 9. A negative relationship was found between social connectedness and anxiety scores,  $\beta = -.29$ ,  $t(263) = -5.06$ ,  $p < .01$ . Furthermore, Social connectedness explained a significant proportion of variance in anxiety scores,  $R^2 = .14$ ,  $F(7,263) = 5.99$ ,  $p < .01$ . Additional figures can be found in table 10. Social connectedness predicted decreases in sleep disturbance scores,  $\beta = -.28$ ,  $t(263) = -4.7$ ,  $p < .01$ . Social connectedness explained 11% of the variance in sleep disturbance scores,  $R^2 = .11$ ,  $F(7,263) = 4.66$ ,  $p < .01$ . More results are available below in table 11. Social connectedness was negatively related to stress scores,  $\beta = -.40$ ,  $t(263) = -7.5$ ,  $p < .01$ . Social connectedness also explained nearly 30% of the variance in anxiety scores,  $R^2 = .28$ ,  $F(7,263) = 14.84$ ,  $p < .01$ . Additional results can be found below in table 12.

**Table 9.** Statistical figures of Regression on Social Connectedness and Depression

Model 1 (Step 1)	$\beta$	$SE$	$t$	$B$	$\Delta R^2$
First Generation Student?	0.04	0.7	0.62	0.44	
Yearly Household Income	-0.17**	0.14	-2.8	-0.39	
Age Category	0.05	0.46	0.75	0.35	
Relationship Status	-0.06	0.5	-0.88	-0.44	
Gender	-0.08	0.82	-1.4	-1.1	
Race	0.08	0.3	1.4	0.42	
Model 2 (Step 2)					
Social Connectedness	-.46**	0.03	-8.49	-.29	0.21

Note: Predictor Variable is Social Connectedness, Outcome Variable is Depression

\* Indicates significance at  $p < .05$

\*\* Indicates significance at  $p < .01$

**Table 10.** Statistical figures of Regression on Social Connectedness and Anxiety

Model 1 (Step 1)	$\beta$	<i>SE</i>	<i>t</i>	<i>B</i>	$\Delta R^2$
First Generation Student?	0.06	0.06	0.97	0.43	
Yearly Household Income	-0.14	0.09	-2.3	-0.2	
Age Category	0	0.3	-0.03	-0.01	
Relationship Status	-0.07	0.32	-1.1	-0.35	
Gender	-0.11	0.52	-1.8	-0.96	
Race	0.1	0.19	1.6	0.31	
Model 2 (Step 2)					
Social Connectedness	-0.29**	0.02	-5.06	-0.12	0.08

Note: Predictor Variable is Social Connectedness, Outcome Variable is Anxiety

\* Indicates significance at  $p < .05$

\*\* Indicates significance at  $p < .01$

**Table 11.** Statistical figures of Regression on Social Connectedness and Sleep Disturbance

Model 1 (Step 1)	$\beta$	<i>SE</i>	<i>t</i>	<i>B</i>	$\Delta R^2$
First Generation Student?	0.07	0.66	1.12	0.74	
Yearly Household Income	-0.02	0.13	-0.37	-0.05	
Age Category	0.12	0.43	1.77	0.77	
Relationship Status	0.5	0.47	0.79	0.37	
Gender	-0.12	0.77	-2	-1.5	
Race	0	0.28	0.01	0	
Model 2 (Step 2)					
Social Connectedness	-.28**		-4.7	-0.17	0.09

Note: Predictor Variable is Social Connectedness, Outcome Variable is Sleep Disturbance

\* Indicates significance at  $p < .05$

\*\* Indicates significance at  $p < .01$

**Table 12.** Statistical figures of Regression on Social Connectedness and Stress

Model 1 (Step 1)	$\beta$	<i>SE</i>	<i>t</i>	<i>B</i>	$\Delta R^2$
First Generation Student?	0.07	0.73	1.17	0.85	
Yearly Household Income	-0.02	0.14	-0.42	-0.06	
Age Category	-0.13*	0.48	-2.1	-0.99	
Relationship Status	-0.02	0.52	-0.39	-0.2	
Gender	-.29**	0.85	-4.9	-4.14	
Race	0.11	0.31	1.88	0.59	
Model 2 (Step 2)					
Social Connectedness	-.40**	0.04	-7.5	-0.28	0.15

Note: Predictor Variable is Social Connectedness,  
Outcome Variable is Stress

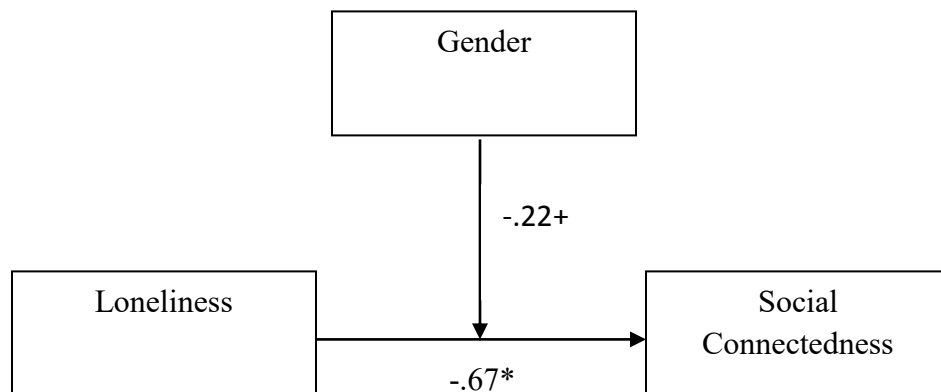
\* Indicates significance at  $p < .05$

\*\* Indicates significance at  $p < .01$

### Gender Moderation of the Relationship between Social Connectedness and Loneliness

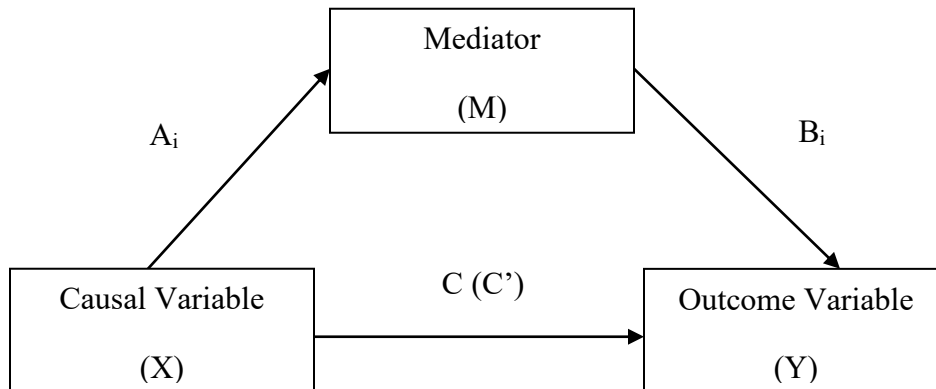
Lee and Robins (2000) found gender moderated the relationship between loneliness and social connectedness such that the effect was stronger for women than men. The current study's replication of the moderation analysis found no significant moderating effect of gender (figure 1). Overall, the model explained a significant increase in variance in loneliness,  $R^2 = .59$ ,  $F(8,262) = 46.44$ ,  $p < .001$ .,  $t(262) = -4.27$   $p < .001$  with a negative relationship between loneliness and social connectedness. Through Conditional Process Modeling, bootstrapping procedures were used to create 5,000 samples (Hayes, 2013). Had the results been significant, the direction of the effect was opposite what Lee and Robbins (2000) found; in this case the relationship was stronger for men.

**Figure 1.** Moderation effects of gender on the relationship between Loneliness and Social Connectedness.

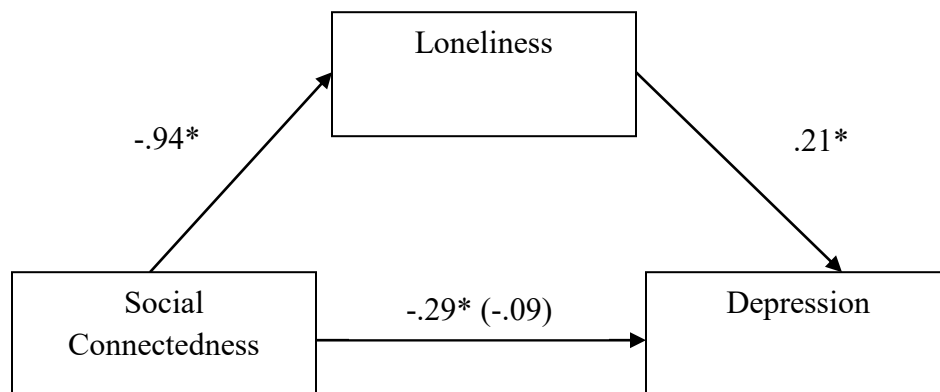


### Loneliness Mediation of Health Outcomes

The mediating effects of loneliness on the relationship between social connectedness and depression, anxiety, sleep disturbance, and stress were tested using Conditional Process Modeling developed by Hayes (2013). The process modeling bootstrapped the indirect effect (mediation effect) to 5,000 samples and produced a 95% confidence interval. The confounds: relationship status, first generation student, annual household income, race, and age category were controlled for in each test. The final mediation test included gender due to its strong association with stress. Loneliness successfully mediated each relationship. The results and supporting figures for each mediation test are presented below. Supporting figures will illustrate effects using the classical mediation model adapted by Baron and Kenny (1986) seen below (figure 2.)  $A_i$  represents the regression coefficient predicting the mediator (M) by the causal variable (X),  $B_i$  is the coefficient predicting the outcome variable (Y) by M. C represents the coefficient predicting Y from X and  $C'$  represents the coefficient predicting Y from X when the mediator is included.

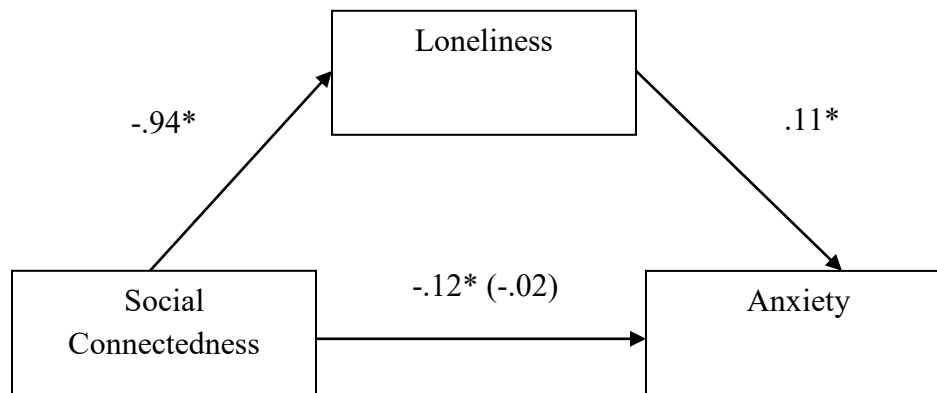
**Figure 2.** Mediation Model by Baron and Kenny (1986)

**Depression.** The relationship between social connectedness and depression was mediated by loneliness. Social connectedness was negatively associated with loneliness  $\beta = -.94$   $t(264) = -18.09$ ,  $p < .001$ . Higher loneliness predicted an increase in depression  $\beta = .21$   $t(263) = 5.51$   $p < .001$ . Social connectedness had a negative relationship with depression, predicting decreases in depression scores  $\beta = -.29$ ,  $t(264) = -.854$ ,  $p < .001$ . The overall model was significant,  $F(6,264) = 14.82$ ,  $p < .001$ ,  $R^2 = .25$ . The indirect effect was  $\beta = -.20$  and the 95% bootstrapped confidence interval ranged from  $-.27$ , to  $.13$ . Thus, the indirect effect was statistically significant. The direct effect,  $\beta = -.09$   $t(263) = -1.91$   $p = .056$  was not significant at the  $p < .05$  level. The Sobel test was significant which supported the mediation findings ( $z = -5.26$ ,  $p < .001$ ). Figure 3 below illustrates the effects

**Figure 3.** Mediation model of social connectedness and loneliness. \* indicates significance.

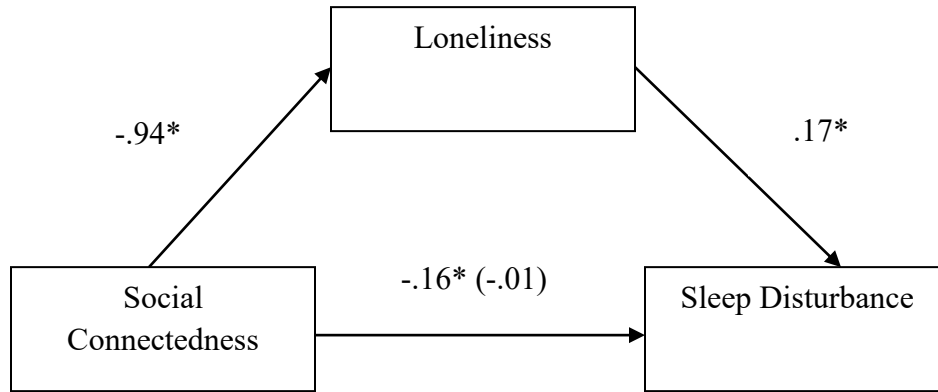
**Anxiety.** The relationship between social connectedness and anxiety was mediated by loneliness. The overall model was significant. Social connectedness was negatively associated with loneliness  $\beta = -.94$   $t(265) = -18.15$ ,  $p < .001$ . Higher loneliness predicted an increase in anxiety  $\beta = .11$   $t(264) = 4.13$   $p < .001$ . Social connectedness had a negative relationship with anxiety, predicting decreases in anxiety scores  $\beta = -.12$ ,  $t(265) = -5.10$ ,  $p < .001$ . The overall model was significant,  $F(6,265) = 6.80$ ,  $p < .001$ ,  $R^2 = .13$ . The indirect effect was  $\beta = -.11$  and the 95% bootstrapped confidence interval ranged from  $-.16$ , to  $.05$ . Thus, the indirect effect was statistically significant. The direct effect,  $\beta = -.02$   $t(264) = -.43$   $p = .67$  was not significant at the  $p < .05$  level. The Sobel test was significant which supported the mediation findings ( $z = -4.02$ ,  $p < .001$ ). Figure 4 below illustrates the effects.



**Figure 4.** Mediation model of social connectedness and loneliness. \* indicates significance.

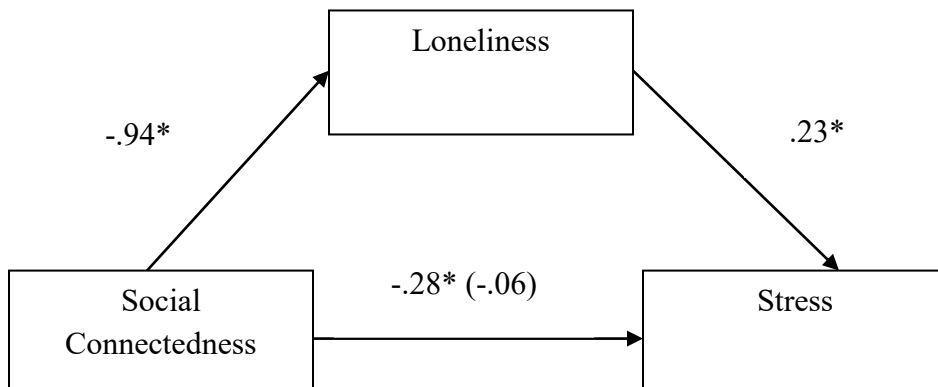
**Sleep Disturbance.** The relationship between social connectedness and sleep disturbance was mediated by loneliness. Social connectedness was negatively associated with loneliness  $\beta = -.94$   $t(265) = -18.15, p < .001$ . Higher loneliness predicted an increase in sleep disturbance  $\beta = .17$   $t(264) = 4.20, p < .001$ . Social connectedness had a negative relationship with sleep disturbance, predicting decreases in sleep disturbance scores  $\beta = -.17, t(265) = -4.78, p < .001$ . The overall model was significant,  $F(6,265) = 4.63, p < .0001, R^2 = .10$ . The indirect effect was  $\beta = -.16$  and the 95% bootstrapped confidence interval ranged from  $-.24$ , to  $.08$ . Thus, the indirect effect was statistically significant. The direct effect,  $\beta = -.01, t(264) = -1.6, p = .87$  was not significant at the  $p < .05$  level. The Sobel test was significant which supported the mediation findings ( $z = -4.09, p < .001$ ). Figure 5 below illustrates the effects

**Figure 5.** Mediation model of social connectedness and loneliness. \* indicates significance.



**Stress.** The relationship between social connectedness and stress was mediated by loneliness. Social connectedness was negatively associated with loneliness  $\beta = -.94$   $t(263) = -18.13$ ,  $p < .001$ . Higher loneliness predicted an increase in stress  $\beta = .23$   $t(262) = 5.66$   $p < .001$ . Social connectedness had a negative relationship with stress, predicting decreases in stress scores  $\beta = -.28$ ,  $t(263) = -7.59$ ,  $p < .001$ . The overall model was significant,  $F(7,263) = 15.95$ ,  $p < .0001$ ,  $R^2 = .30$ . The indirect effect was  $\beta = -.22$  and the 95% bootstrapped confidence interval ranged from  $-.30$ , to  $.15$ . Thus, the indirect effect was statistically significant. The direct effect,  $\beta = -.06$   $t(262) = -1.13$   $p = .26$  was not significant at the  $p < .05$  level. The Sobel test was significant which supported the mediation findings ( $z = -5.40$ ,  $p < .001$ ). Figure 6 below illustrates the effects.

**Figure 6.** Mediation model of social connectedness and loneliness. \* indicates significance.



## Discussion

Loneliness has a powerful undermining effect on physical and mental health. Even when controlling for self-reported physical health, physical activity, poor health behaviors (smoking and alcohol consumption), obesity, socioeconomic status, and life satisfaction, lonely individuals suffer higher rates of mortality (Berkman & Syme, 1979). This effect endures even when accounting for use of preventative health services. It's no surprise then that loneliness is highly comorbid with Alzheimer's, poorer cardiac health (elevated blood pressure, vascular resistance), altered immune functioning, and expression genes for immune factors, poorer sleep quality (Cacioppo et al., 2010; Curtis et al., 2014). Loneliness is also highly comorbid with depression, which is considered by the World Health Organization to be the leading cause of disability worldwide and one of greatest economic burdens in terms of mental healthcare (Greenberg et al., 2015; Mathers, 2008). When we consider the two groups most likely to suffer loneliness, the elderly and college age students, are also two of the largest populations in our country; loneliness takes focus as a concerning public health issue (Arnett, 2000).

To address this public health issue we turned to belonging. The research on belongingness insists that loneliness occurs in the absence of belonging. The belonging research also shows high levels of belonging (measured through social connectedness) to be associated with decreases in nearly all negative health outcomes associated with loneliness. However, for as much is known about loneliness, much less is known about the relationship between belonging and health when loneliness is introduced. Furthermore, much of the belonging and social connectedness literature is about twenty years old. This presents two unique problems and a need for the present study. The first is the need for updated research on belonging/social

connectedness as it relates to health and the second is the need for an exploratory analysis of loneliness as a potential mediating factor in the relationship between belonging and health.

The present study addresses these problems by replicating previous findings on social connectedness and conducting an exploratory analysis into the mediating effects of loneliness. We hypothesized that increased social connectedness would predict decreases in depression, anxiety, stress, and sleep disturbance and that these relationships would be moderated by gender and mediated by loneliness.

With the exception of the moderation analyses, the results supported our hypotheses. In support of hypothesis one, loneliness predicted increased scores in all health outcomes of interest. Loneliness most predicted depression, followed by stress. These findings are consistent with the previous literature (R. F. Baumeister & Leary, 1995; Cacioppo et al., 2010). The z-test of betas from the present study and previous research further illustrates the consistency of the findings. The only exception was the betas for the loneliness and social connectedness regressions. The likely reason for these betas being significantly different was the previous study did not report the error values for their calculations which were necessary for our z-tests. These error values were approximated using the available values that were reported. As a consequence, there may be human error in calculation that led to the discrepancy in findings. Ultimately, social connectedness wasn't an outcome of interest but was included to provide additional results on the often overlooked relationship between social connectedness and loneliness. The benefit of replicating these findings is in twofold. First, the various associations between loneliness and health are collected and presented in one study, expediting future study. Second, through replication we validate previous findings and know these findings are enduring the changing social climate.

Hypothesis two was also supported; social connectedness predicted decreases in all health outcomes of interest. The strongest predictive relationship was for depression, followed by stress which is consistent with previous findings (Armstrong & Oomen-Early, 2009). Despite evidence for its effects on health, little research has been done on social connectedness. For this reason, and considering much of the social connectedness literature is over fifteen years old, there is a need for replication of findings and modern study of the topic. The present study fills that need and contributes twice more: first by consolidating, summarizing, and presenting research on social connectedness in one location expediting future research; and second, contributing new findings. To our knowledge, the relationship between social connectedness and sleep disturbance has never been tested.

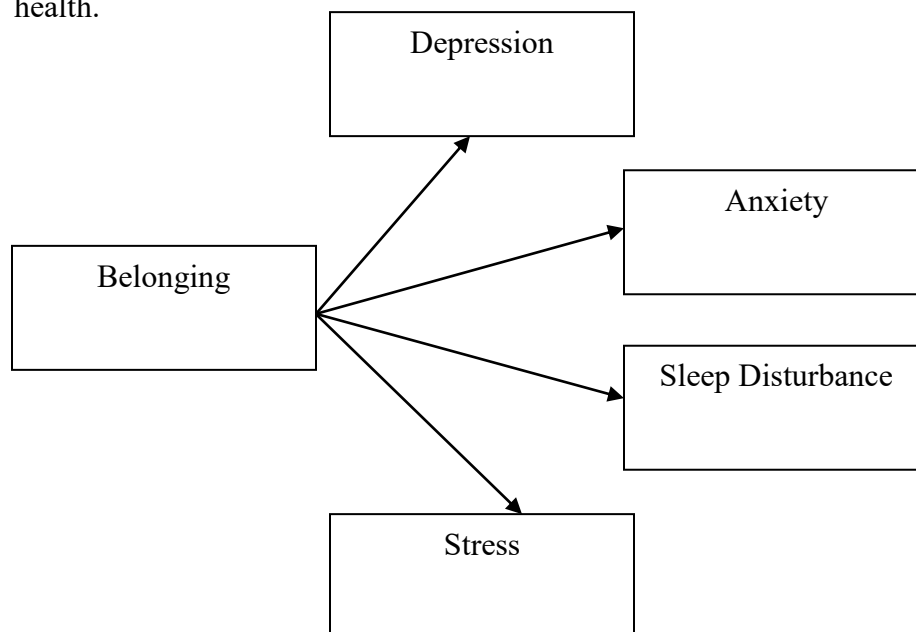
Gender did not moderate the relationship between loneliness and social connectedness, making hypothesis three the only unsupported prediction of the study. Although Lee and Robbins (2000) found these moderating effects such that the relationship was stronger for women than for men; had the results been significant in our study, these effects were in the opposite direction of previous findings. One possible explanation for the lack of significance was the low sample size for men. There were 216 women and only 63 men. The priori power analysis called for at least 161 participants to achieve the desired power level, the number of males fell well short. However, the analyses bootstrapping procedures created 5,000 samples, making it unlikely the absence of significant findings is attributable to sample size. The inability to replicate the previous findings and even the observation of opposing effects highlights the benefit of replication studies.

Hypothesis four predicted loneliness would mediate the relationship between social connectedness and the health outcomes of interest. The results supported this hypothesis for all

four health outcomes. The strongest mediating effects were for depression and stress, followed by sleep disturbance and anxiety. To our knowledge these mediating relationships have never been tested.

The findings of the present study suggest a new model for the relationship between belonging, loneliness, and health. With regard to loneliness, Cacioppo (2010) found loneliness to predict poor health outcomes but excluded belonging from this relationship. In the belonging literature, Baumeister and Leary (1995) and Lee and Robins (1995) describe a similar model in which belonging precedes health outcomes. This model is illustrated below in figure 7.

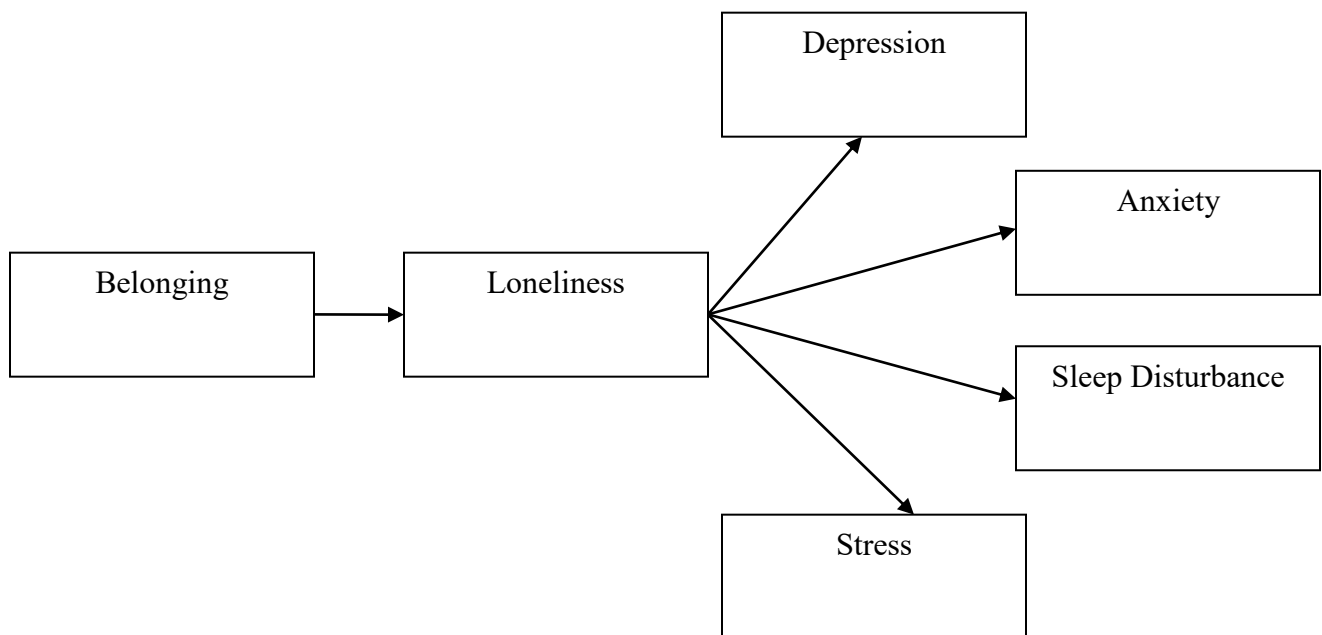
**Figure 7.** Baumeister and Leary (1995) and Lee and Robins (1995) model of belonging and health.



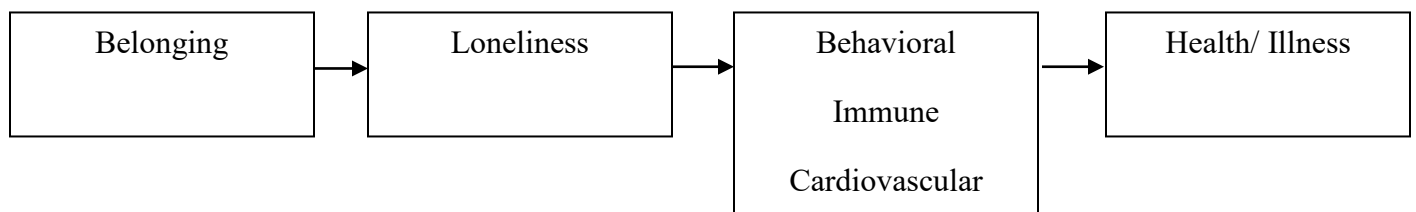
We know that belonging and loneliness are related yet both variables are not included simultaneously in either model. Thus, the question arises of their relationship to each other in association with health. The model suggested by the present study, resolves this question by showing that loneliness acts as a mediator in the relationship between belonging and health (seen

below in Figure 8). Based on the findings of the present study, future research would be best directed towards exploring an expanded version of the model presented in Figure 8. In this theoretical model (seen below in figure 9.), the behavioral, immune, and cardiovascular factors associated with depression, anxiety, sleep disturbance, are tested as mechanisms through which belonging and loneliness directly affect health and illness.

**Figure 8.** Study model of belonging, loneliness, and health relationship



**Figure 9.** Hypothetical model for social connection and mechanisms leading to health outcomes.



Colleges and Universities would benefit from considering this study in their policy making. We know that the main barriers to academic achievement are cold/flu, stress, sleep difficulty, anxiety, and depression (American College Health Association, 2014). Each of these was associated with belonging and loneliness. We also know that college age students spend more time alone than any other group besides the elderly (Arnett, 2000). Rather than administrations targeting these barriers with individual programs or initiatives and spending money in the process; it may be more efficient to focus on providing opportunities for students to connect with one another. Improved performance from the students would be reflected in the schools statistics such as graduation, potentially attracting more students to the university either because of prestige or rumor of community.

Non-traditional students are the main student population needing loneliness intervention. According to the National Center for Education Statistics (NCES), non-traditional students are now the majority. Of the 17.6 million undergraduates, 38% are over the age of 25 and 25% are over the age of 30. Furthermore, the percentage of students 25 and older is expected to increase 23% by 2019 (Kena et al., 2016). In fact, only 16% of students fit the “traditional” image of a college student: ages 18-22 living on campus and financially dependent on parents. (Pelletier, 2010).

Though typically defined as students over the age of 25, transfer students, and student veterans; the NCES reports non-traditional students meet one of seven criteria: delayed enrollment into postsecondary education; attends college part-time but works full time; is considered financially independent for financial aid purposes; has dependents other than a spouse; is a single parent; or does not have a high school diploma (Kena et al., 2016). These criteria describe the majority of students. Unfortunately colleges and universities aren't shifting



their practices and policies to fit with these students and as a consequence there are systemic barriers alienating these students from feeling connected to campus community. For example many non-traditional adult students are working and commute to campus in the evenings.

Student support services such as tutoring, advising, billing, and career counseling are on a 9 to 5 schedule which prevents access to these services by non-traditional students (Pelletier, 2010).

This consequently affects their sense of belonging to the university or college and potentially their academic performance. If their academic performance suffers, so does the reputation of the university.

Addressing these systemic barriers is just one of the many adjustments colleges and universities can make to improve students' connection to the university and each other. Another includes offering courses with an option for either traditional or a service learning curriculum to improve student belonging. Service learning involves extending and reinforcing the course curriculum through community service. In addition to the sense of camaraderie established through shared goals, students working together on community service projects often develop a sense of social responsibility, personal identity, and develop morally and spiritually (Eyler, Giles Jr, Stenson, & Gray, 2001). Service learning of course must be optional as mandatory service learning has been found to decrease intention for future service in students (Stukas, Snyder, & Clary, 1999). There are some concerns about service learning benefits the agenda of the students and the administration more than the community; however it is still an option for universities to consider as a method for promoting connection between students (Eby, 1998).

### **Limitations and Future Directions**

The sample consisted of University of North Florida (UNF) students. UNF is a public university located in the Southeast with an enrollment of approximately 16,372. The sample did not include other regions of the country, larger or smaller universities, or private colleges and universities which limits the generalizability of results. Participants self-selected into the study.

The loneliness metric may be another limitation of the study. A revised UCLA loneliness scale has been developed which addresses some of the concerns raised by the original scale (Marangoni & Ickes, 1989). The present study uses the older scale which may have limited the accuracy of loneliness measurement.

The cross sectional design of the study presents the biggest limitation. Although we controlled for confounds (third variables), we cannot infer a cause and effect relationship as temporal precedence is unclear. Additionally, the snapshot view of phenomena in cross sectional study makes it difficult to be sure the findings are representative. For example students filling out the survey in their first term or even at the beginning of the semester before they have had the opportunity to connect with their new peers, may report higher loneliness that would otherwise be lower at later times in the semester.

### **Conclusion**

Consistent with the literature, loneliness predicted all health outcomes. The four outcomes of interest to the current study were also the most cited barriers to student academic achievement (American College Health Association, 2014). Considering that college age students spend more time alone than any other demographic besides the elderly, these findings seem intuitive, however the question of how to combat loneliness and its effects arises. Both the

health and academic achievement of students depends on an efficient solution. Belonging, measured in this study through social connectedness, appears to be a powerful tool to combat loneliness as it was negatively associated with all poor health outcomes.

Future investigation should explore the mechanisms through which social connectedness affects wellness and illness. We hypothesize that these findings would illustrate the importance of belonging to the health and development of students and citizens in general. Ideally, universities and colleges would utilize the findings of this study to foster connection between students, especially as the typical student portrait changes towards older, working, and commuting students.

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### **Appendix A**

Baumeister and Leary's criteria for fundamental motive:

“A fundamental motivation should (a) produce effects readily under all but adverse conditions, (b) have affective consequences, (c) direct cognitive processing, (d) lead to ill effects (such as on health or adjustment) when thwarted, (e) elicit goal-oriented behavior designed to satisfy it (subject to motivational patterns such as object substitutability and satiation), (f) be universal in the sense of applying to all people, (g) not be derivative of other motives, (h) affect a broad variety of behaviors, and (i) have implications that go beyond immediate psychological functioning”

## Appendix B

Table 3. Multicollinearity and Outcome Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Loneliness		-.748**	.543**	.394**	.445**	.360**	0.044	0.05	0.07	-.143*	.129*	-.087
2. Social Connectedness			-.471**	-.316**	-.405**	-.263**	0.009	-0.004	-0.107	.124*	-0.061	0.014
3. Depression				.599**	.582**	.493**	-0.074	-0.014	0.079	-.174*	0.05	-0.052
4. Anxiety					.449**	.361**	-0.111	-0.066	0.091	-.150*	0.059	-0.077
5. Stress						.335**	-.287**	-.207**	0.1	-0.056	0.042	-0.065
6. Sleep Disturbance							-0.092	.119*	-0.008	-0.002	0.062	0.091
7. Gender								.185**	0.017	-0.018	0.106	0.054
8. Age Category									-0.051	.132*	.125*	.314**
9. Race										-0.044	0.06	0.02
10. Household Income											-.119*	0.054
11. First Generation Student												0.022
12. Relationship Status												

\*  $p < .05$ \*\*  $p < .01$

## CURRICULUM VITAE

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 University of North Florida, Jacksonville, FL  
 Focus in *Health Psychology*  
 Thesis: Loneliness and Student Health: Replication and Exploratory Analysis  
 GPA: 3.4/4.0

**Bachelor of Science** in *Psychology* May 2014  
 Florida State University, Tallahassee, FL  
 Focus in *Social Psychology*, and *Physiology*  
 Minor in *Biomedical Physics*  
 Overall GPA: 3.3/4.0 Major GPA: 3.8/4.0

**Associate of Arts** May 2011  
 Florida State College at Jacksonville, Jacksonville, FL  
 Focus in *Biology*  
 Overall GPA: 3.4/4.0

**RESEARCH EXPERIENCE**

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**Lab Coordinator** December 2014 – May 2016  
 Lab: Dr. Lori Lange's Psychophysiology and Biofeedback Lab  
 Managed study utilizing heart rate variability biofeedback and diaphragmatic breathing as methods to assist veteran (military) students cope with stress. Duties included but not limited to: Investigating private and public funding for experiment, coordinating public announcements of study, collaborating with various campus organizations and departments to facilitate public action leading to a more veteran friendly campus, developing protocols, recruiting participants, conducting experiment, leading weekly lab meetings, and supervising, mentoring, and training undergraduate research assistants.

**Clinical Research Internship Program** October 2014 – May 2016  
 Supervising Clinician: Dr. Steven C. Ames  
 Served as a research assistant for study investigating the effects of loneliness on the recovery of cancer patients receiving a bone marrow transplant.

**Research Assistant** August 2013 – May 2014  
 Supervising Professor: Roy Baumeister  
 Supervising Graduate Student: Jina Park  
 Proctored experiments on behalf of graduate student, conducted literature searches and used findings to suggest experimental methodologies that were utilized in several

experiments. Met with graduate student and supervising professor weekly to discuss progress of and potential improvements to experiments.

**Research Assistant**

January 2013 – May 2014

Supervising Professor: Jon Maner

Supervising Graduate Student: Justin Moss

Lead participants through experimental procedures, documented data, met weekly with graduate students and professor for interactive presentations of findings.

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**ACADEMIC HONORS AND AWARDS**

Graduate Student Spotlight

March 2015

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**PRESENTATIONS**

Raley, M.J., Bueno, J.S., Lange, L.J. & Copeland, J. (2016, May). *Social Connectedness Trumps Social Support in Predicting Depression*. Poster presented at the 28th Association for Psychological Science (APS) Annual Convention, Chicago, IL.

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**EXPERIENCE**

**Reviews**

Ad Hoc Review for the Journal of Addictive Behaviors

March 2015

Ad Hoc Review for the Journal of Health Psychology

March 2015

**Public Appearances**

Interview on “UNF on the Record” Radio Program

June 2015

**Observership**

Clinical Psychology

October 2014 - Present

Mayo Clinic Palliative Care Interdisciplinary Team

October 2014 - Present

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**SOFTWARE/PROGRAMMING EXPERIENCE**

Statistical Package for the Social Sciences (SPSS)

Biocom Heart Tracker

Thought Technology LTD.

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**WORK EXPERIENCE**

Banquet server/bartender at Omni Amelia Island Plantation April 2015 - Present

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**REFERENCES**

**Dr. Lori Lange, Ph.D.**

Graduate Advisor  
Department Chair  
Department of Psychology  
University of North Florida, Jacksonville  
llange@unf.edu  
(904) 620-1638

**Dr. Steven Ames, Ph.D.**

Research Mentor, Thesis Committee Member  
Clinical Psychologist  
Hematology, Oncology, Pain Medicine, Palliative Care  
Mayo Clinic, Jacksonville  
Ames.steven@mayo.edu