Alcohol Consumption and Physical Activity in College Students: Investigating the Role of Guilt and Body Image

Jonathan R. Spencer
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ALCOHOL CONSUMPTION AND PHYSICAL ACTIVITY IN COLLEGE STUDENTS: INVESTIGATING THE ROLE OF GUILT AND BODY IMAGE

by

Jonathan R. Spencer

A Thesis
Submitted to the Faculty of Purdue University
In Partial Fulfillment of the Requirements for the degree of

Master of Science

Department of Health & Kinesiology
West Lafayette, Indiana
August 2018
THE PURDUE UNIVERSITY GRADUATE SCHOOL
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ACKNOWLEDGMENTS

I would like to thank my advisor and Committee Chair, Dr. Steve Amireault, for all that he has done for me over the last two years. I learned more than I ever thought I would in my time as his student, and this project would not have been possible without his guidance every step of the way. I would also like to thank the other members of my thesis committee, Dr. Sean Lane and Dr. Yumary Ruiz, for their invaluable input. Finally, I would like to thank all the Health and Kinesiology faculty and graduate students who participated in HK-670 from 2017-18 for listening to oral presentations of this project and providing me with feedback.
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ABSTRACT

Author: Spencer, Jonathan, R. MS  
Institution: Purdue University  
Degree Received: August 2018  
Title: Alcohol Consumption and Physical Activity in College Students: Investigation the Role of Guilt and Body Image  
Major Professor: Dr. Steve Amireault

Background. Recent studies have shown evidence of a positive relationship between alcohol consumption and physical activity among college students. However, the association is weak and there is high variability across studies with respect to the measurement of both behaviors and analysis methods. Purpose. Two studies are contained within this research. The aim of Study 1 was to provide reliability and validity evidence for the use and interpretation of the measurement instruments in college students. The specific aims of Study 2 were (1) to determine whether the feeling of guilt related to alcohol use mediates the alcohol use - physical activity behavior association, and (2) to determine whether body image (i.e., appearance evaluation and appearance orientation sub dimensions) moderates the alcohol consumption - physical activity behavior association in college students (18-25 years). Methods. Participants for both studies were sent invitation emails to an online survey through Purdue Registrar Request. Study 2 participants were sent a link to a follow-up survey 30-days after the sending of the initial invitation email. Variables measured by the surveys included physical activity, alcohol consumption, guilt from drinking, body image, extraversion, and demographic characteristics. Study 1 Results. Reliability evidence was gathered for all measures. Validity evidence was gathered for body image measures (appearance evaluation and orientation sub-dimensions), but not for the guilt from drinking scale. Study 2 Results. 596 Participants completed the survey at Time 1, 239 of which completed the survey at Time 2 as well. Alcohol consumption and physical activity were positively related, with small effect sizes. No mediation effect of guilt from drinking was found. In the cross-sectional data (Time 1), appearance evaluation was shown to moderate the association, resulting in a stronger association between frequency and quantity of alcohol consumption and physical activity frequency among those with lower levels of appearance evaluation. Conclusion. Consistent with previous literature, we found a significant
positive association between alcohol use and physical activity. Those who are less satisfied with their appearance may exhibit a stronger relationship between these behaviors.
INTRODUCTION

Physical Activity and Health

Physical activity is beneficial to health in a variety of ways through favorable physiological, psychological, and biochemical changes and improvement of functioning (Fentem, 1994). Benefits of regular physical activity include a reduction in risk for coronary heart disease, stroke, osteoporosis, and mental illness (Fentem, 1994; Lee, Shiroma, Lobelo, Puska, Blair, & Katzmarzy, 2012; Warburton, Nicol, & Bredin, 2006; Warburton, Charlesworth, Ivey, Nettlefold, & Bredin, 2010). Other benefits of physical activity include increased cardiorespiratory and muscular fitness, healthier body composition, improved bone health, and improved cognitive function (World Health Organization, 2010). Physical inactivity has been estimated to be a major factor for 6% of the burden of disease from coronary heart disease, 7% of type 2 diabetes, 10% of breast cancer, and 9% of premature mortality which equates to 5.3 million deaths (Lee & Paffenbarger, 2000). In 2013, the global economic cost of physical inactivity to health-care systems was estimated to be $53.8 billion- 80% of which was burdened to high-income countries (Ding et al., 2016). The relationship between physical activity and health has been shown to follow a dose-response pattern (Shuval, Barlow, Chartier, & Gabriel, 2012; Soedamah-Muthu, De Neve, Shelton, Tielmans, & Stamatakis, 2013; Warburton, Charlesworth, Ivey, Nettlefold, & Bredin, 2010) with higher levels of physical activity resulting in better health.

Alcohol Consumption

Alcohol is a commonly used drug around the world. Although drinking alcohol itself is not necessarily a problem, harmful use of alcohol is a leading risk factor for morbidity, disability, and mortality (Klatsky, 2003). High levels of alcohol consumption is associated with liver cirrhosis, cancer, tuberculosis, heart disease, and diabetes mellitus, and is also related to neuropsychological conditions such as depression, anxiety, and epilepsy (Klatsky, 2003. Worldwide, 5.9% of deaths can be attributed to alcohol consumption (World Health Organization, 2004). Estimates of the economic costs for alcohol consumption related conditions in the United States are approximately $185 billion dollars, including but not limited to $87.6
billion in lost productivity, $36.5 billion related to premature deaths, $10.1 billion related to
criminal behavior, and some $26.3 billion for health care spending (Harwood, 2000).

When discussing alcohol consumption and health, it is important to distinguish between
moderate, heavy drinking, and alcohol use disorders because the health impact of alcohol
depends on amount consumed. Table 1 shows guidelines used to define drinking levels.

Table 1. Drinking levels defined by quantity

<table>
<thead>
<tr>
<th>Drinking Level</th>
<th>Quantity of alcohol consumed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstainer</td>
<td>0</td>
</tr>
<tr>
<td>Light</td>
<td>&lt;1 drink per day</td>
</tr>
<tr>
<td>Moderate</td>
<td>1-2 drinks per day</td>
</tr>
<tr>
<td>Heavy</td>
<td>3-4 drinks per day</td>
</tr>
<tr>
<td>Binge drinking</td>
<td>Equal to or more than 4 (females) or 5 (males) drinks in a 2 hour period</td>
</tr>
<tr>
<td>Harmful drinking</td>
<td>5 or more Binge episodes in 1 month</td>
</tr>
</tbody>
</table>

*Note. Table adapted from Baker et al. (2002). Drinking level definitions are aligned with the U.S. Department of Health and Human Services “Dietary Guidelines for Americans 2015-2020”.*

Alcohol use disorder is a chronic relapsing brain disease characterized by compulsive
alcohol use, loss of control over intake, and negative emotional state and/or withdrawal
symptoms when sober (American Psychiatric Association, 2013). Moderate consumers have 1-2
drinks per day, and heavy drinking is anything that exceeds those amounts (Chick, 1998). As
opposed to alcohol use disorders and heavy drinking levels, there is evidence of protective
benefits of moderate alcohol consumption (Castelnuovo, Rotondo, Iacoviello, Donati, &
Gaetano, 2002; Perreault et al., 2017; Stampfer, Colditz, Willett, Speizer, & Hennekens, 1988;
Wannamethee, Shaper, Perry, & Alberti, 2002), most notably by a reduction in risk of coronary
heart disease, protection against blood clot formation, and promotion of blood clot dissolution
(Rehm et al., 2003).
Physical Activity, Alcohol Consumption, and Health

Since moderate alcohol consumption and regular engagement in physical activity have been shown to independently reduce risk for chronic disease, it’s been suggested that pairing the two behaviors could result in an amplified cardio–protective lifestyle (Smothers & Bertolucci, 2001). Researchers have investigated health outcomes among individuals who both consume alcohol and regularly engage in physical activity to better understand why moderate alcohol intake has been shown to be associated with protective health benefits (Perreault et al., 2017; Shuval et al., 2012; Soedamah-Muthu et al., 2013). In a study done by Perreault and colleagues (2017), a direct association between alcohol consumption and cancer mortality risk was found starting from drinkers within the guidelines to harmful drinking (5 binge drinking episodes in one month). Ex-drinkers showed a higher risk for all-cause mortality compared with those who have never consumed alcohol. In addition, a protective effect of light drinking against all-cause mortality and cardiovascular disease was seen in those who met physical activity recommendations – Hazard Ratio [HR (95% CI)] = .68 (.46-.99) – and those who did not meet physical activity recommendations [< 7 Metabolic Equivalent of Tasks (MET) - hour/week] showed evidence of a dose-response relationship between alcohol consumption and cancer (Perreault et al., 2017).

Similar results can be seen in studies examining the relationship between cardiorespiratory fitness, alcohol consumption, and all-cause mortality, which found that moderate and high levels of cardiorespiratory fitness were protective against all-cause mortality irrespective of participant alcohol consumption level (nondrinker, light, moderate, or heavy drinkers; Shuval et al., 2012), and that physically active moderate drinkers had a lower risk for cardiovascular mortality compared to physically inactive adults who do not drink (Soedamah-Muthu et al., 2013). Additionally, protective benefits of physical activity were found in a brain imaging study on white matter (used for communication between brain regions). This study found that regular aerobic exercise reduces white matter damage caused by heavy drinking (Karoly et al., 2013). It’s also been suggested that physical activity may act as a buffer against health issues that are at increased risk with excessive alcohol use. Such health issues include alcohol use disorders, which could help to explain why no study in the current literature has found an association between physical activity and Alcohol Use Disorders (Leasure et al., 2015). This is of particular importance due to interest in physical activity interventions for potential
prevention and adjunctive treatment of alcohol use disorders. Though findings are mixed on the efficacy of these interventions, there has been some research finding benefits. Adults who participated at least twice per week in an exercise program in addition to residential treatment for severe alcohol use disorders reported higher quality of life, higher physical activity level, lowered relapse rate of abstinence to drinking, improved vitality and physical functioning, higher general health perception, and better mental health over a one year period compared to a group of participants allocated in a control group (Giesen, Zimmer, & Bloch, 2016). The efficacy of physical activity interventions benefiting substance use disorders may depend on the type of exercise performed, and certain exercise conditions may be ineffective or have detrimental effects on participants. Efficacy of such interventions also depends on the stage and progression of the disorder. For example, exercise may impact participants differently at use initiation and in times of withdrawal (Lynch, Peterson, Sanchez, Abel, & Smith, 2013). Further research into the low physical activity/high alcohol consumption relationship is needed to inform whether or not physical activity interventions and/or exercise programs can be useful to reduce alcohol use disorders (Kopp et al., 2015). In summary, there is empirical evidence to support the fact that physical activity may, to some extent, act as a buffer against the negative health impact of alcohol consumption.

Association between Physical Activity and Alcohol Consumption

Due to an apparent contrast in health implications, one would not expect physical activity and alcohol consumption to be positively related. However, this “incongruous positive association between alcohol consumption (an unhealthy behavior) and physical activity (a healthy behavior)” warrants further examination (Musselman & Rutledge, 2010, p. 614). Within the last few decades, research has shown a positive association between alcohol consumption and physical activity participation among the general adult population (Barry & Piazza-Gardner, 2012; Conroy et al., 2015; Davis, Riley, Smith, Milich, & Burris, 2017; French, Popovici, & Maclean, 2009; Lisha, Martens, & Leventhal, 2011; Musselman & Rutledge, 2010; Smothers & Bertolucci, 2001; Vickers et al., 2004) while some found a negative association (Raitakari et al., 1995), and others found it to be weak or trivial (Bigelow, Villarruel, & Ronis, 2014; Blair, Jacobs, & Powell, 1985; Kopp et al., 2015). Findings regarding the shape of the relationship are also inconsistent— it may take curvilinear form with a positive linear trend and a negative
quadratic trend (Kunz, 1997; Leasure, Neighbors, Henderson, & Young, 2015; Smothers & Bertolucci, 2001) or reflect a positive linear relationship in which more alcohol consumption results in more physical activity (Piazza-Gardner & Barry, 2012). While most studies analyze the linear association between the two, trend analysis from Smothers and Bertolucci (2001) showed a positive linear trend and a negative quadratic trend, causing an upside down J shape of the data (Smothers & Bertolucci, 2001).

**College Student Population**

College students have been identified as an important subgroup in which to study the association between alcohol consumption and physical activity (Dodge, Clarke, & Dwan, 2017; Musselman & Rutledge, 2010; Piazza-Gardner & Barry, 2011). College students comprise a growing population worldwide (Schofer & Meyer, 2005) and tend to be in the age range of 18-24, which is a critical developmental period in which lifelong health behaviors start to take form (Williams, Holmbeck, & Greenley, 2002). In the college years, individuals make an important developmental transition from late adolescence to early adulthood. Health behaviors learned in this time frame tend to continue into later adulthood, meaning health behavior learned in college could effect life-long health (Bell & Lee, 2005). A large amount of college students do not reach the recommended amount of physical activity. In fact, studies consistently find that 40-50% of college students can be labelled as insufficiently active (Keating, Guan, Piñero, & Bridges, 2005). In addition physical inactivity, binge drinking has been identified as the most important health hazard to the college student population (National Institute on Alcohol Abuse and Alcoholism, 2015). Considering that health behaviors learned in the college years tend to stick around, studying the association between alcohol consumption and physical activity participation in the college population is important (Musselman & Rutledge, 2010).

**Literature Review**

Table 2 summarizes results from 20 studies reporting on the association between alcohol use and physical activity related behaviors in college populations. Studies in Table 2 are similar in that they investigate the association between alcohol consumption and physical activity participation, but differ in the measurement and conceptualization of key variables. With respect to the measurement of alcohol consumption, for example, some studies measure quantity of
alcohol use (e.g., number of drinks/day (Abrantes, Scalco, O’Donnell, Minami, & Read, 2017; Buscemi, Martens, Murphy, Yurasek, & Smith, 2011; Leasure & Neighbors, 2014), while some measured quantity and frequency of alcohol use (Niedermeier, Frühauf, Kopp-Wilfling, Rumpold, & Kopp, 2018; Overman & Terry, 1991; Zhou, Heim, & O’Brien, 2015) and others measured occurrence of binge drinking (Barry & Piazza-Gardner, 2012; Dunn & Wang, 2003; Ford, 2007; Walker, Langdon, & Johnson, 2015; Wechsler, Davenport, Dowdall, Grossman, & Zanakos, 1997). Similar to alcohol consumption, the conceptualization and operationalization of physical activity varies between studies as well. All studies in Table 2 measured self-reported physical activity, but type of activity and recall timeframes varied. Some studies used 7-day physical activity recall measures (Davis, Riley, Smith, Milich, & Burris, 2017; Dinger, Brittain, & Hutchinson, 2014; Musselman & Rutledge, 2010; Walker et al., 2015) while others used 30-day (VanKim, Laska, Ehlinger, Lust, & Story, 2010) and 90-day measures (Abrantes et al., 2017). Other variations on the conceptualization of physical activity include frequency of 20 minute bouts of physical activity (Dunn & Wang, 2003), total minutes of physical activity (Conroy et al., 2015; French, Popovici, & Maclean, 2009), and classification into low, moderate, and high levels of activity based on Metabolic Equivalents (METs) (Niedermeier et al., 2018). The differences in conceptualization of the two main behavioral variables make it difficult to compare findings between studies.

A systematic review done by Piazza-Gardner & Barry (2012) identified six studies in the college population that investigated the association between alcohol consumption and physical activity participation. Five out of six of the included studies (83%) reported a positive association between the main variables. The number of participants included in these studies ranged from 296 (Musselman & Rutledge, 2010) to 3,206 (Nelson, Lust, Story, & Ehlinger, 2009). As mentioned earlier, a difference between the designs of the studies is in the conceptualization of physical activity participation. Some studies used measures of METs/week in order to separate participants into groups based on their activity level (Musselman & Rutledge, 2010; Vickers et al., 2004), some organized participants by whether or not they met the recommended guidelines for physical activity based on recall of moderate and vigorous activity (Dunn & Wang, 2003; Nelson et al., 2009; Seo, Nehl, Agley, & Shang-Min, 2007), and another measured frequency of vigorous activity only (Moore & Werch, 2008). In regards to alcohol consumption, all 6 studies measured binge drinking, and one study measured frequency
and quantity of alcohol use along with binge drinking (Musselman & Rutledge, 2010). The conceptualization of the temporal direction of the relationship was also inconsistent between studies. Two studies labelled alcohol consumption as the independent variable (i.e., the predictor) and physical activity as the dependent variable (the outcome) (Musselman & Rutledge, 2010; M. C. Nelson et al., 2009), while the four remaining studies labelled this association in the opposite direction (Dunn & Wang, 2003; Moore & Werch, 2008; Seo et al., 2007; Vickers et al., 2004). The temporal direction of the association between these two behaviors is a key part of understanding the connection between them. Currently, it’s unclear whether there is something about physical activity participation that leads to alcohol consumption or vice versa. Also, identifying which variable acts as the predictor could help programs intending to increase physical activity in college students avoid simultaneous increases in alcohol consumption (Dodge et al., 2017).

A more recent review done by Dodge and colleagues (2017) identified eight studies investigating the association between alcohol consumption and physical activity participation in the college student population. Of those eight studies, four were unique from the previously discussed review (Barry & Piazza-Gardner, 2012; Buchholz & Crowther, 2014; Buscemi et al., 2011; VanKim et al., 2010). The results from these four studies are summarized in Table 2. In college students, seven out of eight studies (87.5%) reported a positive relationship between physical activity and alcohol consumption. Five out of eight studies (62.5%) conceptualized physical activity participation as the independent variable (Dodge, Clarke, & Dwan, 2017).

It is worth noting that the Piazza-Gardner et al. (2012) and Dodge et al. (2017) reviews used a “vote-counting” procedure to synthesize findings from peer-review published literature. This procedure comes with risk of publication bias- studies may have had a greater chance to be published (and retrieved by the review teams) if they reported a statistically significant ($p < .05$) association (in any direction) because they may be more appealing to editors, reviewers, and readers. On the other hand, some studies reporting a positive association may have had a lessened chance to be submitted for publication because the authors may not have expected these two behaviors to be positively related due to a contrast in health implications (Piazza-Gardner & Barry, 2011). In this situation (since the result was opposite to their hypothesis), it is possible that authors may not have submitted for publication. The extent to which publication bias has impacted the summary findings of the aforementioned systematic reviews was not discussed by
the review authors. It is thus difficult to determine if publication bias has a trivial, moderate or large impact on the review conclusions.

One key study reviewed by Piazza-Gardner & Barry was done by Musselman and Rutledge (2010). They collected data from 296 college students age 18-23 years (mean = 19.75 years) to investigate the relationship between physical activity and alcohol consumption in college students. A distinguishing characteristic of the Musselman study lies in the measurement of various alcohol use related behavior: alcohol use- frequency, quantity, frequency \times quantity, and heavy (binge) drinking. By measuring four aspects of alcohol consumption, the authors were able to identify which aspects of alcohol consumption were most strongly related to physical activity. Using the International physical activity questionnaire (IPAQ) college students were classified into three activity categories- low (<600 METs) moderate (600-2999 METs), or high (>2999 METs). Results of logistic regression analyses showed that all four aspects of alcohol consumption increased the odds of being classified into moderate and high physical activity groups. Drinking frequency [odds ratio (OR) =1.32 (95% CI; 1.12-1.56)] showed the strongest relationship with physical activity participation followed by binge drinking (OR=1.22; 1.06-1.39). Quantity of alcohol consumed [OR= 1.13(1.06-1.21)] and frequency-quantity [OR = 1.03 (1.02-1.06)] also significantly increased odds of being classified as moderately or highly active (Musselman & Rutledge, 2010). Similar results were reported by another study from Dunn and Wang (2003). In this study participants were divided into three groups based on activity level: no-activity, low-activity (1 to 2 days of moderate to vigorous activity per week), and high-activity (3 or more days of moderate to vigorous physical activity per week). Results showed that high-activity females were more likely to have binge drank in the past 30 days compared to those reporting no activity [OR = 1.56 (1.20-2.02]. High-activity females were also more likely to report having at least one drink in the last 30 days [OR = 1.33 (1.02-1.72)]. Also, high-activity males [OR = 1.76 (1.25-2.46)] and low-activity males [OR=1.57 (1.09-2.26)] were more likely to binge drink compared to non-active males (Dunn & Wang, 2003).

Another study of alcohol consumption in college students done by Vickers and colleagues (2004) used Metabolic Equivalents (METs) to measure physical activity. This study explored correlates of binge drinking in 412 female college students age 18-24. The authors hypothesized that binge drinking would be positively associated with higher weight concerns and depressive symptoms but negatively correlated with physical activity level based on METs.
Table 2. Studies on alcohol consumption and physical activity among college students (k = 20)

<table>
<thead>
<tr>
<th>Authors (year of publication)</th>
<th>Sample</th>
<th>Alcohol consumption</th>
<th>Physical activity</th>
<th>Main Results</th>
</tr>
</thead>
</table>
| Dunn & Wang (2003)            | $N = 2,436$ college students | **Construct:** Binge drinking  
**Operationalization:** Binge drank in the last 30 days; Y/N  
Drank in last 30 days; Y/N | **Construct:** Frequency of LTPA/Exercise  
**Operationalization:** Performed at least 3 bouts of 20+ minutes of exercise and sports per week; Y/N | Risk of binge drinking was higher among females and males exercising 20 minutes/day 3x/week (female RR=1.56, 1.20-2.02; male RR=1.76, 1.25-2.46). Those same females were also at a higher risk for reporting having at least one drink in the last 30 days (RR=1.33, 1.02-1.72) |
**Operationalization:** 2-week recall on binge drinking frequency | **Construct:** Energy expenditure  
**Operationalization:** Weekly energy cost (METs) of physical activity | Physical activity was a significant predictor of binge drinking (chi-square 8.74, p=.03), physical activity levels >15 METs associated with more reported binge drinking compared to <15 METs; 15-34.9 METs (OR=2.03,1.08-3.84), 35-54.9 METs (OR=2.77, .27-6.04), >55 (OR=2.02, .94-4.34) |
| Musselman & Rutledge (2010)   | $N = 296$ college students | **Construct:** Drinking frequency and quantity; Binge drinking  
**Operationalization:** 30 day recall of drinking days, typical quantity per drinking day, and binge drinking | **Construct:** Frequency of LTPA  
**Operationalization:** 7-day recall of frequency and average duration of strenuous, moderate, and mild activity | Quantity (OR=1.13, 1.06-1.39), frequency (OR=1.32, 1.12-1.56), frequency-quantity (OR=1.03, 1.02-1.06), and binge drinking (OR=1.22, 1.06-1.39) increased the odds of being classified as moderately or highly active |
Table 2 continued

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample Description</th>
<th>Construct:</th>
<th>Operationalization:</th>
<th>Construct:</th>
<th>Operationalization:</th>
<th>Alcohol use quantity</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davis et al (2017)</td>
<td>N= 524 college students</td>
<td>Drinking frequency and quantity</td>
<td>Typical frequency of drinking days and typical quantity consumed on those days</td>
<td>Frequency of strenuous LTPA</td>
<td>7-day recall of frequency and average duration of strenuous PA</td>
<td>Alcohol use quantity positively correlated with strenuous PA for females (r=.25) and males (r=.21) at 1-year follow up. Alcohol use frequency negatively correlated with strenuous PA for females at 2-year follow-up (r=-.12), and males at 1-year follow-up (r=-.33).</td>
<td></td>
</tr>
<tr>
<td>Ford (2007)</td>
<td>N= 2,316 intercollegiate athletes</td>
<td>Binge drinking</td>
<td>Binge drank in the last 2-weeks; Y/N</td>
<td>Sport Participation</td>
<td>Sports team affiliation</td>
<td>Males- Hockey players most likely to report binge drinking (OR=2.441) compared to other sports. Females- Soccer players most likely to report binge drinking (OR=1.475)</td>
<td></td>
</tr>
<tr>
<td>Walker et al (2015)</td>
<td>N= 34,208 college students</td>
<td>Binge drinking</td>
<td>2-week recall on frequency of binge drinking</td>
<td>Aerobic exercise and strength training</td>
<td>7-day recall on frequency of moderate and vigorous cardio/aerobic activity and strength training</td>
<td>Significant relationship between meeting guidelines and binge drinking (chi-square= 199.95, p&lt;.001); weak positive association between drinking quantity and meeting recommendations (Spearman r=.07)</td>
<td></td>
</tr>
<tr>
<td>Moore &amp; Werch (2008)</td>
<td>N= 391 college freshman</td>
<td>Binge drinking</td>
<td>Drinking frequency</td>
<td>Vigorous physical activity</td>
<td>7-day recall on vigorous physical activity sessions of 20 or more minutes</td>
<td>Frequent vigorous exercisers significantly reported more frequent drinking (p=.05) and consuming a greater quantity of alcohol compared to infrequent vigorous exercisers (p=.003)</td>
<td></td>
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<tr>
<td>Buscemi et al (2011)</td>
<td>N= 310 college freshman</td>
<td>Alcohol use quantity</td>
<td>Number of drinks in a typical week over the last 30-days</td>
<td>Moderate and vigorous physical activity</td>
<td>30-day recall on sessions per week of moderate (30 minutes) and vigorous (20 minutes) physical activity</td>
<td>Vigorous PA significantly associated with alcohol use (r=.17) Moderate (r=.19) and vigorous (r=.19) physical activity were significantly associated with alcohol use for males, but not for females.</td>
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<td>Study</td>
<td>Sample Description</td>
<td>Construct: Alcohol use</td>
<td>Construct: Moderate and vigorous physical activity</td>
<td>Construct: Binge drinking</td>
<td>Construct: Physical activity participation</td>
<td>Construct: Exercise</td>
<td>Construct: Sports participation</td>
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<td>Leasure &amp; Neighbors (2014)</td>
<td>N= 198 undergraduate college students</td>
<td>Alcohol use</td>
<td>Moderate and vigorous physical activity</td>
<td>Binge drinking</td>
<td>Physical activity participation</td>
<td>Exercise</td>
<td>Sports participation</td>
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<td></td>
<td>% female: 87</td>
<td>Number of drinks in a typical week over the last 3 months</td>
<td>Number of exercise sessions per week, number of minutes of moderate and vigorous activity per session</td>
<td>2-week recall on frequency of binge drinking</td>
<td>7-day recall of moderate PA, vigorous PA, and strength training</td>
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<td>Mean age=24.11; SD=6.92</td>
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<td>Barry &amp; Piazza-Gardner (2012)</td>
<td>N= 22, 488 college students</td>
<td>Binge drinking</td>
<td>1 strength training and 1 vigorous cardio session increase odds of binge drinking (OR=1.08 and OR=1.05, respectively). 1 moderate physical activity session decreased chances of binge drinking (OR=.95)</td>
<td>Physical activity participation</td>
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<td></td>
<td>% female: 69</td>
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<td>Abrantes et al (2017)</td>
<td>N= 132 college students</td>
<td>Alcohol use</td>
<td>Between subject alcohol consumption and exercise were significantly associated (r=.36). Within subject daily exercise minutes (b= -.004) and weekly exercise minutes (b= -.101) negatively predicted drinking, and weekend drinking negatively predicted weekly exercise minutes (b= -.2.68)</td>
<td>Binge drinking</td>
<td></td>
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<tr>
<td></td>
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<tr>
<td>Wechsler et al (2001)</td>
<td>N= 17,251 college students</td>
<td>Binge drinking</td>
<td>Females and males involved in intercollegiate athletics reported more binge drinking episodes compared to those partly involved and not involved</td>
<td></td>
<td></td>
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<td></td>
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Table 2 continued

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<th>Study</th>
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<th>Physical Activity</th>
<th>Physical Activity Operationalization</th>
<th>Findings</th>
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<td>Dinger et al (2014)</td>
<td>N= 67,861 college students</td>
<td><strong>Construct:</strong> Binge drinking</td>
<td><strong>Operationalization:</strong> 2-week recall on frequency of binge drinking</td>
<td><strong>Construct:</strong> Aerobic physical activity</td>
<td><strong>Operationalization:</strong> 7-day recall on 30+ minute sessions of moderate and vigorous physical activity</td>
<td>Students not meeting the physical activity guidelines were less likely to report binge drinking (OR=.867)</td>
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<td>Overman &amp; Terry (1991)</td>
<td>N= 146 college students</td>
<td><strong>Construct:</strong> Alcohol use</td>
<td><strong>Operationalization:</strong> 2-week recall of drinking days and quantity consumed on those days</td>
<td><strong>Construct:</strong> Sports participation</td>
<td><strong>Operationalization:</strong> Athletic involvement Y/N</td>
<td>No significant difference in drinking behavior found between athletes and non-athletes</td>
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<td>Zhou et al (2015)</td>
<td>N= 1,785 college athletes</td>
<td><strong>Construct:</strong> Alcohol use</td>
<td><strong>Operationalization:</strong> AUDIT-C 12-month recall of drinking frequency and quantity</td>
<td><strong>Construct:</strong> Sports participation</td>
<td><strong>Operationalization:</strong> Athletic involvement: individual or team sport</td>
<td>Team sports participants (M=8.28) scored higher on the AUDIT-C compared to individual sports participants (M=7.05), (p&lt;.001)</td>
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<td>Seo (2007)</td>
<td>N= 1,134 college students</td>
<td><strong>Construct:</strong> Binge drinking</td>
<td><strong>Operationalization:</strong> 2-week recall of binge drinking frequency</td>
<td><strong>Construct:</strong> Physical activity participation</td>
<td><strong>Operationalization:</strong> 7-day recall of moderate and vigorous physical activity</td>
<td>No binge drinking (AOR=.92 CI=.63-1.36), Occasional binge drinking (AOR=1.20 CI=.82-1.76), frequent binge drinking (AOR=.78 CI=.50-1.21), and very frequent binge drinking (AOR=1.12 CI=.63-1.97) did not significantly change odds for meeting physical activity guidelines *Adjusted for gender, BMI, race, and age.</td>
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<th>Operationalization: 7-day recall of drinking frequency, quantity, and binge drinking</th>
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<th>Operationalization: Typical week recall of mild, moderate, and vigorous physical activity</th>
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<td>Buchholz &amp; Crowther (2014)</td>
<td>206</td>
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<td>19.5</td>
<td>Alcohol use</td>
<td>7-day recall of drinking frequency, quantity, and binge drinking</td>
<td>Physical activity participation</td>
<td>Typical week recall of mild, moderate, and vigorous physical activity</td>
<td>Significant positive relationship between physical activity and drinking quantity (r=.16, p&lt;.05). Null relationships between physical activity and drinking frequency (r=.04) and binge drinking (r=.10)</td>
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<td>Nelson et al (2009)</td>
<td>3,206</td>
<td>students</td>
<td>24.2</td>
<td>Binge drinking</td>
<td>2-week recall on frequency of binge drinking</td>
<td>Physical activity participation</td>
<td>Typical week recall of moderate PA, vigorous PA, and strength training</td>
<td>Binge drinking significantly associated with reduced risk for not meeting PA guidelines for vigorous (ARR=.92 CI=.86-.99), moderate (ARR=.92 CI=.86-.99) and strength training (ARR=.87 CI=.81-.94) *Adjusted for gender, year in school, and age</td>
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<td>VanKim et al (2010)</td>
<td>9,757</td>
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<td>Alcohol use</td>
<td>30-day recall of drinking frequency; typical week drinking quantity; 2-week recall of binge drinking</td>
<td>Physical activity participation</td>
<td>7-day recall on hours spent doing strenuous, moderate, and strength training exercises</td>
<td>Higher levels of moderate (ARR=1.29 CI=1.12-1.49), vigorous (ARR=1.44 CI=(1.19-1.75), and strength training (ARR=1.39 CI=1.14-1.71) associated with increased risk for binge drinking *Adjusted for gender, age, and race</td>
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<td>Niedermeier et al (2018)</td>
<td>861</td>
<td>students</td>
<td>24</td>
<td>Alcohol use</td>
<td>30-day recall on alcohol frequency, quantity, and heavy drinking</td>
<td>Physical activity participation</td>
<td>7-day recall on frequency and usual duration of vigorous, moderate, and walking activity</td>
<td>No relationship found between physical activity and alcohol consumption (OR, 95%CI): frequency (1.08, .96-1.21), binge (1.02, .90-1.15), quantity (1.01, .96-1.07)</td>
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</tbody>
</table>

Notes. k = number of studies. N= number of subjects; Y/N: Yes or No; LTPA: Leisure-Time Physical Activity; PA: physical activity; K: Number of studies; BMI: Body Mass Index; AUDIT-C: Alcohol Use Disorder Identification Tool; M: mean; SD: standard deviation; RR: Risk Ratio; ARR: Adjusted Risk Ratio; OR: Odds Ratio; AOR: Adjusted Odds Ratio.
Weight concern was measured with 5-items that assess fear of weight gain, worry over weight and body shape, importance of weight, perceived fatness, and diet history. Binge drinking was assessed using one question from the Core Alcohol and Drug Survey. The question was a self-report recall asking participants how many times they binge drank in the last two weeks. Physical activity was measured using the Aerobics Center Longitudinal Survey Physical Activity Questionnaire which estimates METs per week. Results showed that physical activity was a statistically significant predictor of binge drinking. Participants who reported physical activity level of 15-34.9 METs/week [OR = 2.03 (1.08-3.84)] and 35-54.9 METs/week [OR = 2.77 (1.27-6.04)] were more likely to report binge drinking than those who with a physical activity level of under 15 METs/week (Vickers et al., 2004).

Sport participation has been shown to be an important variable in the association between alcohol consumption and physical activity. Participation in sports may be associated with increases in alcohol consumption. A systematic review of the literature examining the association between alcohol consumption and sport participation was performed by (Martens, Dams-O’Connor, & Beck, 2006). Results showed that a greater percentage of female and male athletes report binge drinking compared to non-athletes (Leichliter, Philip W. Meilman, Presley, & Cashin, 1998; T. F. Nelson & Wechsler, 2001; Wechsler et al., 1997). Athletes also report consuming more drinks per week (Leichliter et al., 1998). Drinks per week also increased along with competition level of athletic involvement. Comparing people who were never competitive athletes to 1) athletes currently involved in intercollegiate athletics and 2) those who competed in high school but are not competing at the college level, higher drinking was seen in the intercollegiate athlete and high school athlete groups compared to those who were never competitive athletes. Similar patterns were also seen with binge drinking (Hildebrand, Johnson, & Bogle, 2001). Possible explanations for these results are peer influence, sport-related pressure/anxiety, and cultural links between sport and alcohol (Leichliter et al., 1998).

Other studies, though, report findings on the nature of the alcohol consumption – physical activity participation association that are contradictory to those previously discussed. Davis and colleagues (2017) did a longitudinal study of 524 college students with a follow up after one (n = 228) or two years (n = 296) (two different cohorts). The use of two cohorts helped researchers determine whether short term results (1-year follow-up) differed from results of a longer term (2-year follow-up). Participants were recruited from an introductory psychology survey course.
Baseline measures were taken during participant’s freshman year (mean age = 18.95 years). Alcohol use was measured with two questions- one assessing quantity and another assessing frequency of alcohol use. Physical activity was measured using a modified version of the Godin-Shephard Leisure-Time Physical Activity Questionnaire. Participants were asked three questions measuring frequency and average duration of strenuous leisure time physical activity. Attrition rate was 86.25% in the one-year follow-up cohort and 79.58% in the two-year follow-up. Results showed that baseline alcohol use quantity was positively correlated with strenuous PA for females ($r = .25$) and males ($r = .21$) at 1-year follow up. Baseline alcohol use frequency was negatively correlated with strenuous PA for males ($r = -.33$) at 1-year follow-up. Baseline alcohol use quantity was positively correlated with strenuous PA for females ($r = .12$) at 2-year follow-up. Baseline alcohol use frequency was negatively correlated with strenuous PA for females ($r = -.14$) at 2-year follow-up (Davis et al., 2017).

The study by Davis and colleagues (2017) is not the only study to find evidence of a negative relationship between alcohol consumption and physical activity. Despite most findings in this population suggesting the existence of a positive association between alcohol consumption and physical activity (Dodge et al., 2017; Piazza-Gardner & Barry, 2011), multiple studies report a non-significant or a significant small-to-moderate negative association between these two behaviors. For example, a cross-sectional study by Niedermeier et al (2018) on 861 Austrian college students. Niedermeier and colleagues measured self-report alcohol consumption using three items assessing frequency, quantity, and binge drinking over the past 30-days. Physical activity was measured using the International Physical Activity Questionnaire (IPAQ) to group participants into low, moderate, and high activity levels. Those in the high activity group achieved 20 or more minutes of vigorous activity at least three times per week accumulating >1500 MET-minutes per week and/or sessions of walking, moderate, or vigorous activity on >6 days per week resulting in >2999 MET-minutes per week. Those in the moderate group did not meet the criteria of the high activity group but achieved three days of vigorous activity for 20 minutes or more per week or more than 4 days of moderate activity or walking for more than 30 minutes per session, or more than 4 days of any combination of walking, moderate, and vigorous activity resulting in >599 MET-minutes per week. Low active participants did not meet any of the criteria for the moderate or high active groups. Using ordinal regression, all odd’s ratio confidence limits contained 0, indicating no significant positive relationship between
physical activity and any of the alcohol consumption measures (Niedermeier et al., 2018). In summary, a majority of published studies report a positive small-to-moderate association between alcohol consumption and physical activity participation. However, some report a non-statistically significant association or a negative small-to-moderate association between these two behaviors.

**Moderators of the Alcohol Consumption – Physical Activity Association**

The strength of the association between alcohol use and physical activity behaviors may be influenced by various factors. (Dodge et al., 2017; Leasure, Neighbors, Henderson, & Young, 2015). As such, identifying moderators of the association between alcohol consumption and physical activity will help researchers specify for whom this association is weaker and stronger. A moderator is a variable that changes the direction or strength of the effect of an independent (predictor) variable on a dependent (outcome) variable (MacKinnon, 2008). In current literature, reported moderators include gender, Greek status, and impulsivity (Ford, 2007; Leasure & Neighbors, 2014; Martens et al., 2006). For instance, the association between alcohol use and physical activity behaviors was found to be stronger for males compared to females (Buscemi et al., 2011). This moderating effect could be explained by the fact that males are more likely to exercise and also consume more alcohol than females (Buscemi, Martens, Murphy, Yurasek, & Smith, 2011).

Those involved in Greek life have also been shown more likely to report binge drinking (Buscemi et al., 2011). In a two-way moderation analysis, Greek status significantly moderated the association between vigorous and moderate physical activity and alcohol consumption. Follow-up simple slopes analysis indicated a significant positive association for Greeks between moderate \( r = .55, p < .001 \) and vigorous \( r = .42, p < .001 \) physical activity and alcohol consumption, but found non-statistically significant association between those variables for non-Greeks (Buscemi et al., 2011). Impulsivity has also been shown as a moderator of this relationship (Leasure & Neighbors, 2014). Results showed a significant interaction between impulsivity measures and moderate physical activity in their relationship to alcohol consumption. The largest interactions were seen with positive urgency \( \times \) moderate activity \( (B = .354, p < .001) \) and sensation seeking \( \times \) moderate activity \( (B = .270, p < .001) \).
Mediators of the Alcohol Consumption – Physical Activity Association

Identifying mediator variables will help to explain the association between alcohol consumption and physical activity participation (Dodge et al., 2017; Leasure et al., 2015). A mediator is a variable on the causal pathway between an independent and a dependent variable; the independent (predictor) variable ‘causes’ the mediator which ‘causes’ the dependent (outcome) variable (MacKinnon, 2008). Some mediation hypotheses have been proposed to explain why alcohol consumption and physical activity may be related. These hypotheses include the “work hard, play hard” (Parker & Williams, 2003), “celebration” (Leasure et al., 2015), “body image” or “damage control” (Leasure et al., 2015; Musselman & Rutledge, 2010), and “guilt” hypotheses (Leasure et al., 2015). Work hard, play hard is the idea that people who are working hard during the week at their place of work and on their physical fitness may be consuming alcohol on the weekends to let out steam. Celebration refers to when people consume alcohol after some sort of physical activity triumph such as a personal best, winning a game, reaching a fitness goal, or finishing a race. Body image/damage control stems from the idea that people who are concerned about their weight or physical appearance may use exercise to compensate for extra calories consumed as a consequence of drinking alcohol. It is worth nothing that body image is a complex, multifaceted construct (Tiggerman, 2004). With respect to the body image/damage control hypothesis, appearance evaluation (satisfaction with one’s body shape) and appearance orientation (cognitive and behavioral investment in one’s appearance) (Cash, 2015) may be the most relevant to the alcohol use-physical activity participation association. Those low in appearance evaluation and high in appearance orientation may be more concerned with the extra calories consumed during drinking, therefore more motivated to erase the damage (extra calories) by engaging in physical activity. Similar to the body image hypothesis, people may feel guilty from drinking alcohol because of associated negative health consequences, and, in order to help relieve that guilt, they may engage in physical activity.

The body image/damage control and guilt hypotheses find further support from the Compensatory Health Beliefs model (CHBs). Compensatory health beliefs may influence one’s decision to engage in a certain behavior or not (Knäuper, Rabiau, Cohen, & Patriciu, 2004). CHBs theorize that pleasurable but negative health impacting behaviors (e.g., alcohol consumption) may be followed by health promoting behaviors (e.g., physical activity) as compensation (Geller, Lippke, & Nigg, 2017; Knäuper et al., 2004). Intention to perform
compensatory behaviors (such as intention to exercise the day after binge drinking) may increase chances of engaging in risky behaviors because of a rationalization that compensatory behaviors can mitigate negative effects of risky behaviors (Geller et al., 2017). Similarly, guilt can serve as motivation to make reparations (Tangney, 1991). Guilt from drinking alcohol, which has negative impacts on health and body appearance, may cause an uncomfortable feeling in an individual who then may participate in physical activity in order to relieve that feeling. This motivation may be stronger in those who care more about their physical appearance, therefore making physical activity participation more likely.

**Summary**

There is evidence that alcohol use and physical activity related-behaviors are positively related (Barry & Piazza-Gardner, 2012; Conroy et al., 2015; Davis, Riley, Smith, Milich, & Burris, 2017; French, Popovici, & Maclean, 2009; Lisha, Martens, & Leventhal, 2011; Musselman & Rutledge, 2010; Piazza-Gardner & Barry, 2012; Smothers & Bertolucci, 2001; Vickers et al., 2004). Gender and Greek status have been shown to moderate the association (Buscemi et al., 2011; Ford, 2007; Lisha, Martens, & Leventhal, 2011). Explanations have been posited to help understand why these behaviors may be related, including body image/damage control (Leasure et al., 2015; Musselman & Rutledge, 2010), and guilt (Leasure et al., 2015). The Compensatory Health Beliefs model also lends support to why these two behaviors may be related. It is possible that physical activity participation (positive health impacting behavior) is being used to compensate for consuming alcohol (negative health impacting behavior).
RESEARCH OBJECTIVES

The overall objective of this MSc research project is to examine the direction and assess the strength of the association between alcohol consumption and physical activity participation among undergraduate and graduate students 18-25 years of age from Purdue University. Based on empirical and theoretical evidence, we propose the following specific aims:

1- To determine whether the feeling of guilt related to alcohol use mediates the alcohol use - physical activity related-behaviors association.

*Hypothesis:* Alcohol consumption will be positively associated with the feeling of guilt related to alcohol use. In turn, the feeling of guilt related to alcohol use will be positively associated with physical activity participation. The alcohol consumption – physical activity participation association will be partially mediated by the feeling of guilt related to alcohol consumption.

2- To determine whether body image (i.e., appearance evaluation and appearance orientation sub dimensions) moderates the alcohol consumption - physical activity behavior association. This would also suggest that body image may moderate the mediation effect described in specific aim 1, thereby indicating that the strength and/or direction of mediated effect of the feeling of guilt related to alcohol consumption may change at different values of body image.

*Hypothesis:* Those with higher appearance orientation and lower appearance evaluation scores will show a stronger positive association between physical activity and alcohol consumption.

This study will address multiple gaps identified in previously published literature. First, we used a longitudinal design to begin to shed light on the temporal relationship between alcohol consumption and physical activity. Second, relevant factors (i.e., intention towards physical activity and personality characteristics, such as extroversion) that could potentially confound the association between alcohol consumption and physical activity will be taken into account in the analytical model. Third, two hypotheses by which alcohol consumption and physical activity
may be linked were tested- the mediation effect of guilt from drinking and the moderating effect of body image.

Figure 1. Conceptual model
STUDY 1 METHODS

The objective of the preliminary study (Study 1) was to provide reliability and validity evidence for the use of an online survey that includes all key variables needed to test the two proposed specific aims. Study 1 was deemed necessary because there is no validity evidence supporting the measurement of the feeling of guilt related to alcohol consumption among college-aged students reported in the scientific literature. In addition, information about response rate was collected.

Study Design

This study is cross-sectional in design.

Population, Participants, and Sample Size

Participants for Study 1 were randomly selected from the Purdue University Students population. Participants had to be aged between 18-25 years old, and be current Purdue University students. To obtain more precise reliability and validity estimates, at least 50 to 100 participants needed to be recruited (Baumgartner and Chung, 2001). Therefore, we aimed to recruit at least 100 participants for Study 1.

Procedure

Participants were invited to complete an online questionnaire. We used Registrar Request, a program run through the Purdue University registrar office, to recruit participants. First, Registrar Request sent out an email containing the recruitment letter and a link to our questionnaire to eligible students on February 28th, 2018. Second, a thank you/reminder email was sent five days later (March 5th, 2018). Third, another thank you/reminder email was sent out 10 days after the initial recruitment email (March 9th, 2018). From previous experiences, we expected around a 10% response rate. Since we were aiming to recruit around 100 participants, we asked Registrar Request to send our recruitment emails to 1,000 students who were randomly selected by the Registrar Request Office, and who met our inclusion criteria. The number of students who responded at each contact point are reported in Figure 2.
Measures

Alcohol consumption (National Institute on Alcohol Abuse and Alcoholism, 2003) leisure-time physical activity (Godin, 2011; Milton, Bull, & Bauman, 2011) body image (appearance evaluation and appearance orientation sub-dimensions) (Cash, 2000) and feeling of guilt associated with alcohol consumption were assessed using self-reported measures. The guilt from dinking scale was adapted in accordance with Tilghman-Osborne et al. (2010) recommendations for defining and measuring guilt (i.e. tie the experience of guilt to a specific situational context, create multiple items representing a diversity of such situations), and used to assess the feeling of guilt associated with alcohol consumption. Extraversion (Thompson, 2008) and intention toward physical activity were measured, as they are potential confounders. Demographic characteristics were also measured- sex, age, height, weight, ethnicity, Greek status, athletic involvement at Purdue, and undergraduate/graduate student status. A complete version of the online survey used for Study 1 can be found in Appendix B.

Validity Hypotheses

Studies have found links between feelings of guilt and morality; whereas body image represents one of the sub-dimensions of self-esteem (Tiggeman, 2004). We expected to detect a positive correlation between feelings of guilt and morality; and between self-esteem and body image. Therefore, self-esteem was assessed using the Rosenberg Self-Esteem Scale (Gray-Little, Williams, & Hancock, 1997; Rosenberg, 1965) and moral norm related to drinking responsibly was also assessed (Godin, Conner, Sheeran, Bélanger-Gravel, & Germain, 2007).
Statistical Analysis

First, descriptive statistic were reported. Second, reliability of the guilt from drinking, moral norm, body image evaluation and orientation, and self-esteem was appraised by computing the Cronbach alpha. Validity evidence supporting the use and interpretation of the guilt from drinking scale was provided by measuring the strength of its association (correlation coefficient) with moral norm and self-esteem. Validity evidence for use of the appearance evaluation and appearance orientation body image scales was gathered by looking at the correlation between body image scores and self-esteem. Information on the response rate to the email survey invitation and rate of missing data for behavioral measures and all the other variables were also be obtained.

STUDY 1 RESULTS

Study 1 sample characteristics are reported in Table 3. In total, \( N = 129 \) students participated. Of the 129 participants, 85 questionnaires were entirely completed. The sample was mostly made up of undergraduate (91.8%) white (76.7%) males (72.1%). The mean age of the sample was 20 years old. The program most strongly represented in the sample was the college of Engineering (36.4%). A total of 24 students reported involvement in Greek life (28.2%).

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<td>36.4</td>
</tr>
<tr>
<td>Education</td>
<td>1</td>
<td>1.2</td>
</tr>
<tr>
<td>Agriculture</td>
<td>3</td>
<td>3.5</td>
</tr>
<tr>
<td>Exploratory Studies</td>
<td>1</td>
<td>1.2</td>
</tr>
<tr>
<td>Health/Human Sciences</td>
<td>5</td>
<td>5.9</td>
</tr>
<tr>
<td>Honors College</td>
<td>1</td>
<td>1.2</td>
</tr>
<tr>
<td>Liberal Arts</td>
<td>8</td>
<td>9.4</td>
</tr>
<tr>
<td>Management</td>
<td>8</td>
<td>9.4</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>3</td>
<td>3.5</td>
</tr>
<tr>
<td>Polytechnic</td>
<td>6</td>
<td>7.1</td>
</tr>
<tr>
<td>Other</td>
<td>18</td>
<td>21.2</td>
</tr>
<tr>
<td>Education</td>
<td>85</td>
<td>44</td>
</tr>
<tr>
<td>Undergraduate</td>
<td>78</td>
<td>91.8</td>
</tr>
<tr>
<td>Graduate</td>
<td>7</td>
<td>8.2</td>
</tr>
<tr>
<td>Greek</td>
<td>85</td>
<td>44</td>
</tr>
<tr>
<td>Yes</td>
<td>24</td>
<td>28.2</td>
</tr>
<tr>
<td>No</td>
<td>61</td>
<td>77.8</td>
</tr>
</tbody>
</table>

Table 4 shows the distribution of scores and reliability statistics for key variables in study 1. Cronbach alphas ranged from .871-.983. Of the three variables on a 1-7 scale, intention showed the highest mean (5.71). Guilt from drinking had a low mean of 1.77. Of the four variables on 1-5 scales, body-image evaluation ($M= 3.47$) and self-esteem ($M= 3.52$) were the highest. Missing data rates for physical activity variables ranged from 14-19%, and 22-23% for alcohol variables.
Table 4. Summary of scores from Study 1 variables

<table>
<thead>
<tr>
<th>Variables (Range)</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Q1</th>
<th>Q3</th>
<th>Min-Max</th>
<th>α</th>
<th>Missing Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moral Norm (1-7) 3-items</td>
<td>73</td>
<td>5.21</td>
<td>1.57</td>
<td>5.67</td>
<td>4.33</td>
<td>6.67</td>
<td>1.00-7.00</td>
<td>.897</td>
<td>34%</td>
</tr>
<tr>
<td>Guilt from Drinking (1-7) 5-items</td>
<td>79</td>
<td>1.77</td>
<td>1.02</td>
<td>1.20</td>
<td>1.00</td>
<td>2.00</td>
<td>1.00-5.20</td>
<td>.892</td>
<td>29%</td>
</tr>
<tr>
<td>Intention (1-7) 3-items</td>
<td>98</td>
<td>5.71</td>
<td>1.79</td>
<td>5.71</td>
<td>5.25</td>
<td>7.00</td>
<td>1.00-7.00</td>
<td>.983</td>
<td>24%</td>
</tr>
<tr>
<td>Extraversion (1-5) 8-items</td>
<td>94</td>
<td>3.15</td>
<td>0.97</td>
<td>3.13</td>
<td>3.20</td>
<td>3.75</td>
<td>1.00-5.00</td>
<td>.923</td>
<td>27%</td>
</tr>
<tr>
<td>Body Image Orientation (1-5) 12-items</td>
<td>93</td>
<td>3.06</td>
<td>0.73</td>
<td>3.17</td>
<td>2.58</td>
<td>3.58</td>
<td>1.17-4.42</td>
<td>.889</td>
<td>28%</td>
</tr>
<tr>
<td>Body Image Evaluation (1-5) 7-items</td>
<td>93</td>
<td>3.47</td>
<td>0.78</td>
<td>3.71</td>
<td>2.86</td>
<td>4.00</td>
<td>1.29-5.00</td>
<td>.871</td>
<td>28%</td>
</tr>
<tr>
<td>Self-Esteem (1-5) 11-items</td>
<td>88</td>
<td>3.52</td>
<td>0.60</td>
<td>3.50</td>
<td>3.20</td>
<td>4.00</td>
<td>2.30-4.50</td>
<td>.924</td>
<td>37%</td>
</tr>
</tbody>
</table>

Note. SD: Standard Deviation.

Table 5 contains the correlation between all key variables in study 1. Self-esteem was significantly correlated with appearance evaluation (r = .584). Moral norm and guilt from drinking were also positively, albeit non-statistically, correlated (r = .106). Statistically significant correlations were seen between appearance orientation and guilt from drinking (r = .311), and between self-esteem and guilt from drinking (r = -.285).
Table 5. Pearson correlation coefficients (r) of between Study 1 key variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Guilt from Drinking</th>
<th>Body Image Orientation</th>
<th>Body Image Evaluation</th>
<th>Moral Norm</th>
<th>Self-Esteem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guilt From Drinking</td>
<td>1</td>
<td>.311**</td>
<td>-.048</td>
<td>.106</td>
<td>-.285*</td>
</tr>
<tr>
<td></td>
<td>n= 79</td>
<td>n= 93</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body Image Orientation</td>
<td>.311**</td>
<td>1</td>
<td>-.029</td>
<td>-.115</td>
<td>-.194</td>
</tr>
<tr>
<td></td>
<td>n= 93</td>
<td>n= 93</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body Image Evaluation</td>
<td>-.048</td>
<td>-.029</td>
<td>1</td>
<td>-.025</td>
<td>.584**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>n= 93</td>
<td>n= 93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moral Norm</td>
<td>.106</td>
<td>-.115</td>
<td>-.025</td>
<td>1</td>
<td>.119</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>n=73</td>
<td></td>
</tr>
<tr>
<td>Self-Esteem</td>
<td>-.285*</td>
<td>-.194</td>
<td>.584**</td>
<td>.119</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>n=88</td>
<td></td>
</tr>
</tbody>
</table>

*p < .05 level (2-tailed)

**p < .01 level (2-tailed)
STUDY 2 METHODS

The first aim of Study 2 is to determine whether guilt from drinking mediates the alcohol consumption - physical activity behavior association. The second aim of Study 2 is to determine whether body image (i.e., appearance evaluation and appearance orientation sub dimensions of the body image construct) moderates the alcohol consumption - physical activity behavior association. This would also suggest that body image may moderate the mediation effect of guilt from drinking, thereby indicating that the strength and/or direction of mediated effect of the feeling of guilt related to alcohol consumption may change at different values of body image.

Study Design

This study is longitudinal in design.

Participants

Participants recruited to take the survey were randomly selected from Purdue University students aged 18-25 by the Office of Registrar. Study 1 participants were excluded from Study 2. The effect size reflecting the association between alcohol consumption and physical activity behavior among adults aged 18-25 years is expected to be of small-to-moderate magnitude (Pearson correlation coefficient; $r = .12$ to $.19$ (Dodge et al., 2017). Under the untenable assumption that there is no measurement error, and based on Fritz & Mackinnon (2007) effect size estimation for mediation, at least 391 participants are needed to test the mediation hypothesis of this research proposal ($\alpha = 0.05$; $\beta = 0.80$; $a' = .27$ and $b' = .47$. Based on an estimated 70% attrition rate at follow-up (Dillman, Smyth and Christian, 2014), 558 participants will be needed [391 ÷ 70% × 100% = 558]. As stated earlier, this number is calculated assuming that there is no measurement error. This is a strong assumption, and even though Study 1 aims to minimize measurement error and biases, perfect measurement accuracy is unlikely. Consequently, we roughly estimated that an extra 100 participants would be needed. Therefore, up to 660 participants will be recruited (558 + 102 = 660). We expect approximately the same response rate that we saw in Study 1 (13.4%). Therefore, Registrar Request sent out recruitment emails to 6600 Purdue Students meeting our inclusion criteria.
Procedure

The first email for Study 2 (Time 1) was a recruitment letter containing a link to our questionnaire, and was distributed on March 27th, 2018. Three days later (March 30th) the first thank you/reminder email was sent. 6 days after the initial recruitment email (April 2nd), the second thank you/reminder email was sent (see Figure 3 for more details). Both thank you reminders contained links to the questionnaire. Approximately 1 month after the initial recruitment letter for T1 (April 25th) another email with a link to the follow-up questionnaire (Time 2) was sent to the same 6600 students who were randomly selected to receive the initial recruitment letter. Similar to Time 1, two thank you reminder emails were sent; the first on April 30th and the second on May 2nd. Participant data from the baseline questionnaire was connected to the follow-up data by using an alpha-numeric code created by the participant at the beginning of each questionnaire. The alpha numeric code consists of the first letter of the participant’s first and last name, day of birth, gender (M=male, F=female, O=other, x=prefer not to answer), and the first letter of the participant’s birth month.

<table>
<thead>
<tr>
<th>March 27, 2018</th>
<th>March 30, 2018</th>
<th>April 2, 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 Invitation email</td>
<td>T1 First thank you/reminder email +172 participants</td>
<td>T1 Second and final thank you/reminder email +168 participants</td>
</tr>
<tr>
<td>+307 participants</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>April 25th, 2018</th>
<th>April 30th, 2018</th>
<th>May 02, 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>T2 Invitation email</td>
<td>T2 First thank you/reminder email +48 Participants</td>
<td>T2 Second and final thank you/reminder email +37 Participants</td>
</tr>
<tr>
<td>+155 Participants</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3. Recruitment Strategy and Timeline for Study 2: Main Study (Time 1 and Time 2)

Measures

Baseline (Time 1) measures in Study 2 include alcohol consumption (alcohol use frequency, alcohol use quantity and occurrence of binge drinking; (National Institute on Alcohol Abuse and Alcoholism, 2003), frequency and the amount of leisure-time physical activity
(Godin, 2011; Milton et al., 2011), sport participation and body image (appearance evaluation and appearance orientation sub-dimensions) (Cash, 2000). The feeling of guilt associated with alcohol consumption will be assed using self-reported measures (same as Study 1). Extroversion (Thompson, 2008) and intention toward physical activity were also measured, as they are potential confounders. Demographic characteristics will also be measured- sex, age, height, weight, ethnicity, Greek status, athletic involvement at Purdue, and undergraduate/graduate student status. Measures used in the follow-up questionnaire (Time 2) are the same as baseline with the exception of extraversion and demographic characteristics which will not be assessed. A complete version of the online survey used for Study 2 can be found in Appendix C.

**Statistical Analysis**

Data was checked for univariate outliers (observation that are equal to the mean + (4 × standard deviation)). We reviewed responses to our three questions which measured leisure time physical activity for plausibility. Cases were reviewed individually. Participants that report ≥ 40 15-minute bouts of mild, moderate, or strenuous physical activity per week were deemed as non-plausible observations, and excluded from the analyses. Also, if participants reported an excessively high number of 15-minute bouts at all three physical activity intensity levels (i.e. 30 sessions of mild, 30 sessions of moderate and 30 sessions of vigorous activity per week) they were excluded from the analyses. Descriptive statistics (mean, standard deviation) as well as a Cronbach alpha was calculated for all key study variables.

Temporal stability indicators were calculated for alcohol consumption and physical activity variables to evaluate the extent to which these two behaviors changed or remained stable over the 30-day period of the Study 2. Intraclass coefficients are reported in Table 7. All values can be described as having “good to excellent” reliability according to Koo and Mae (2016) suggesting that, on average, there was little change in alcohol consumption and physical activity participation between data collection performed at in Time 1 (March 2018) and time 2 (April 2018). Therefore, analyses were not performed based on residual change scores from Time 1 to Time 2. Instead, the alcohol consumption – physical activity association was examined at Time 1 (cross-sectional analyses) and using Time 1 alcohol consumption variables and Time 2 physical activity variables, controlling for Time 1 physical activity variable (longitudinal analyses).
Covariate Analysis

Prior to conducting the mediation and moderation analyses, the association between alcohol consumption, physical activity participation and their covariates were investigated. Because prior studies have reported that the alcohol use – physical activity behavior association may take a curvilinear, upside down J shape (Smothers & Bertolucci, 2001), the quadratic term for frequency and quantity of alcohol use was tested. In addition, interaction terms were tested prior to statistical adjustment for all covariates (i.e., gender, Greek status, extraversion, and intention toward physical activity) using the three-step procedures suggested by Aiken and West (1991). First, physical activity variables were regressed on alcohol use outcomes. Second, the moderator (i.e., the covariate) was added. Third, the interaction term (i.e., alcohol consumption \( \times \) moderator variable) was added. A moderator effect was detected if the explained variance (\( R^2 \)) from step 1 to step 3 was significantly increased (\( p < .05 \)). If a moderator effect was detected, simple slope for each level of moderator variable was computed (i.e., low level; one standard deviation [SD] below the mean, medium level; at the mean and high level; one SD above the mean). Unless otherwise stated, no interaction effects were found. All analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA).

Specific Aim #1- Mediation Analysis

Mediation models were built using multiple linear regression analyses, controlling for extraversion, gender, Greek status (for cross-sectional analyses), and intention toward physical activity and past physical activity behavior (for longitudinal analyses). The product of coefficient \( a \times b \) approach was used to test the mediation effect (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). More specifically, the unstandardized beta coefficient of the \( a, b, c, \) and \( c' \) paths represents, respectively, the effect of alcohol consumption on the mediator (alcohol consumption \( \rightarrow \) feelings of guilt), the effect of the mediator on the outcome (feelings of guilt \( \rightarrow \) physical activity), the total effect of alcohol consumption on the physical activity outcomes (alcohol consumption \( \rightarrow \) physical activity), and the partial effect of alcohol consumption, adjusting for the mediator variable, on the physical activity outcome (alcohol consumption, feelings of guilt \( \rightarrow \) physical activity). Bias-corrected and -accelerated (BCa) bootstrap estimates (10,000 bootstrap samples) of the 95% confidence interval [95% CI] for the mediated effect were obtained using
Hayes SAS PROCESS macro model 4 (Hayes, 2012). Significant mediation was detected if the BCa [95% CI] did not include the zero value.

\[
\text{Percent Mediation} = \frac{(a \times b)}{c}
\]

Figure 4. Mediation Model

Specific Aim #2- Moderation Analysis

Interaction terms were tested using the two-step procedures. First, physical activity variables were regressed on alcohol use outcomes. Second, the moderators (i.e., appearance evaluation and orientation) and their respective interaction terms were added in a block. A moderator effect was detected if the explained variance \( (R^2) \) from step 1 to step 2 was significantly increased \( (p < .05; \text{Aiken and West, 1991}) \). If a moderator effect for body image (i.e., alcohol consumption variables \( \times \) appearance evaluation and/or alcohol consumption \( \times \) appearance orientation) is detected, simple slope for each level of the moderator variable will be computed (i.e., low level; one standard deviation [SD] below the mean, medium level; at the mean, and high level; one SD above the mean).
Figure 5. Moderation Model

- Alcohol Use
- Body Image
- Physical Activity
STUDY 2 RESULTS

Sample Characteristics

Time 1 (March 2018) data set will be referred to as cross-sectional, and Time 1 (March 2018) to Time 2 (April 2018) combined data set will be referred to as longitudinal. Sample characteristics from both data sets are reported in Table 6. In total for the cross-sectional sample, \( n = 596 \) students participated. Of the 596 participants, 464 questionnaires were fully completed. Similar to Study 1, the sample was mostly made up of undergraduate (90.8%) white (79.2%) males (55.5%). Unlike Study 1, we did not ask participants their exact age, but the median reported birth year was 1997. The program most strongly represented in the sample was the College of Engineering (36.9%). 78 students reported involvement in Greek life (16.7%). For the longitudinal sample, there was a total of \( n = 239 \) students. Of the 239, 224 questionnaires were entirely completed. Again, the sample was mostly made up of undergraduate (86.2%) white (84.4%) males (60.7%), the program most strongly represented in the sample was the College of Engineering (38.4%). The median reported birth year was 1997, indicating that about 50% of the sample were aged \( \geq 21 \) years old. A total of 36 students reported involvement in Greek life (16%). In the cross-sectional sample, over half of the participants reported engaging in one or more physical activities for at least 20-30 minutes, twice per week. A total of 43% of the sample reported they participated on at least one organized sports team over the past 12-months. Among those who drink, the average participant reported consuming alcohol on 2-3 occasions per month, and 35% reported at least one binge drinking episode. Guilt from drinking scores for the cross-sectional and longitudinal samples were on average low (\( M= 1.95 \) and \( M= 1.22 \), respectively). Table 8 shows the summary of scores from other key variables, along with missing data and Cronbach alpha statistics. Since those who reported abstinence were not shown guilt from drinking questions, missing data was calculated by dividing the total number of participants eligible to answer each question by the number of responses.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Cross-sectional</th>
<th>Longitudinal</th>
</tr>
</thead>
<tbody>
<tr>
<td>n= 596</td>
<td></td>
<td>n=239</td>
</tr>
<tr>
<td>Gender</td>
<td>467 129</td>
<td>224 15</td>
</tr>
<tr>
<td>Male</td>
<td>259 55.5</td>
<td>136 60.7</td>
</tr>
<tr>
<td>Female</td>
<td>203 43.5</td>
<td>88 39.3</td>
</tr>
<tr>
<td>Other</td>
<td>5 1</td>
<td>0 0</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>466 130</td>
<td>225 14</td>
</tr>
<tr>
<td>White</td>
<td>369 79.2</td>
<td>190 84.4</td>
</tr>
<tr>
<td>Black</td>
<td>9 1.9</td>
<td>4 1.8</td>
</tr>
<tr>
<td>Asian</td>
<td>44 9.4</td>
<td>15 6.7</td>
</tr>
<tr>
<td>Hispanic</td>
<td>25 5.4</td>
<td>11 4.9</td>
</tr>
<tr>
<td>Other</td>
<td>19 4.1</td>
<td>5 2.2</td>
</tr>
<tr>
<td>College</td>
<td>464 132</td>
<td>224 15</td>
</tr>
<tr>
<td>Agriculture</td>
<td>35 7.5</td>
<td>21 9.4</td>
</tr>
<tr>
<td>Education</td>
<td>10 4.6</td>
<td>3 1.3</td>
</tr>
<tr>
<td>Engineering</td>
<td>171 36.9</td>
<td>86 38.4</td>
</tr>
<tr>
<td>Exploratory Studies</td>
<td>14 3</td>
<td>0 0</td>
</tr>
<tr>
<td>Health/Human Sciences</td>
<td>63 13.6</td>
<td>35 15.6</td>
</tr>
<tr>
<td>Honors</td>
<td>1 0.22</td>
<td>0 0</td>
</tr>
<tr>
<td>Liberal Arts</td>
<td>27 5.8</td>
<td>15 6.7</td>
</tr>
<tr>
<td>Management</td>
<td>13 5.8</td>
<td>10 4.5</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>17 3.6</td>
<td>10 4.5</td>
</tr>
<tr>
<td>Polytechnic</td>
<td>41 8.8</td>
<td>19 8.5</td>
</tr>
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<td>Vet. Medicine</td>
<td>5 1.1</td>
<td>1 0.4</td>
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<td>Science</td>
<td>57 12.3</td>
<td>23 10.3</td>
</tr>
<tr>
<td>Education</td>
<td>467 129</td>
<td>225 14</td>
</tr>
<tr>
<td>Undergraduate</td>
<td>424 90.8</td>
<td>194 86.2</td>
</tr>
<tr>
<td>Graduate</td>
<td>43 9.2</td>
<td>31 13.8</td>
</tr>
<tr>
<td>Greek</td>
<td>467 129</td>
<td>225 14</td>
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<tr>
<td>Yes</td>
<td>78 16.7</td>
<td>36 16</td>
</tr>
<tr>
<td>No</td>
<td>389 83.3</td>
<td>189 84</td>
</tr>
</tbody>
</table>
Table 7 presents the correlation of key variables from the cross-sectional (bottom half of diagonal) and longitudinal samples (top half of diagonal). In the cross-sectional data \((n= 596)\), physical activity frequency was positively correlated with alcohol frequency \((r=.14, p <.01)\), alcohol quantity \((r=.16, p <.01)\), and binge drinking \((r=.16, p <.01)\). Sport participation was also positively correlated with alcohol frequency \((r=.11, p <.05)\), alcohol quantity \((r=.12, p <.01)\), and binge drinking \((r=.16, p <.01)\). In the longitudinal sample \((n = 239)\), Time 2 physical activity frequency was positively correlated with Time 1 alcohol quantity \((r =.15, p <.05)\). Time 2 sports participation was significantly positively correlated with Time 1 alcohol quantity \((r =.15, p <.05)\), but not Time 2 alcohol frequency \((r =.12, p >.05)\). Similar to the cross-sectional sample, Time 1 binge drinking was significantly associated with Time 2 sports participation \((r =.21, p <.01)\). Reported along the diagonal running from top left to bottom right of Table 7 are intraclass correlation coefficients (ICC) of key variables from the longitudinal data. As shown in table 7, ICC of variables were high, suggesting there was little difference between Time 1 and Time 2 behavioral responses.

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Physical activity frequency</td>
<td>0.79</td>
<td>0.49**</td>
<td>0.21**</td>
<td>0.12</td>
<td>0.15*</td>
<td>0.08</td>
<td>0.03</td>
<td>0.19**</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>(n=234)</td>
<td>(n=225)</td>
<td>(n=235)</td>
<td>(n=225)</td>
<td>(n=225)</td>
<td>(n=225)</td>
<td>(n=175)</td>
<td>(n=221)</td>
<td>(n=221)</td>
</tr>
<tr>
<td>2. Leisure Score Index</td>
<td>0.39**</td>
<td>0.62</td>
<td>0.10</td>
<td>-0.05</td>
<td>0.05</td>
<td>-0.002</td>
<td>-0.07</td>
<td>0.17*</td>
<td>0.03</td>
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<td></td>
<td>(n=544)</td>
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<td>(n=169)</td>
<td>(n=212)</td>
<td>(n=212)</td>
<td>(n=212)</td>
</tr>
<tr>
<td>3. Sport participation</td>
<td>0.26**</td>
<td>0.17**</td>
<td>0.86</td>
<td>0.12</td>
<td>0.15*</td>
<td>0.21**</td>
<td>-0.03</td>
<td>0.13</td>
<td>-0.11</td>
</tr>
<tr>
<td></td>
<td>(n=587)</td>
<td>(n=543)</td>
<td>(n=237)</td>
<td>(n=229)</td>
<td>(n=229)</td>
<td>(n=229)</td>
<td>(n=177)</td>
<td>(n=225)</td>
<td>(n=225)</td>
</tr>
<tr>
<td>4. Alcohol frequency</td>
<td>0.14**</td>
<td>-0.03</td>
<td>0.11*</td>
<td>0.91</td>
<td>0.73**</td>
<td>0.76**</td>
<td>-0.20**</td>
<td>0.16*</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td>(n=511)</td>
<td>(n=501)</td>
<td>(n=510)</td>
<td>(n=211)</td>
<td>(n=229)</td>
<td>(n=229)</td>
<td>(n=177)</td>
<td>(n=225)</td>
<td>(n=225)</td>
</tr>
<tr>
<td>5. Alcohol quantity</td>
<td>0.16**</td>
<td>-0.02</td>
<td>0.12**</td>
<td>0.75**</td>
<td>0.85</td>
<td>0.77**</td>
<td>-0.15</td>
<td>0.15*</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>(n=509)</td>
<td>(n=500)</td>
<td>(n=508)</td>
<td>(n=509)</td>
<td>(n=210)</td>
<td>(n=229)</td>
<td>(n=177)</td>
<td>(n=225)</td>
<td>(n=225)</td>
</tr>
<tr>
<td>6. Binge drinking</td>
<td>0.16**</td>
<td>0.00</td>
<td>0.16**</td>
<td>0.73**</td>
<td>0.78**</td>
<td>0.76</td>
<td>-0.08</td>
<td>0.11</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>(n=506)</td>
<td>(n=498)</td>
<td>(n=505)</td>
<td>(n=506)</td>
<td>(n=506)</td>
<td>(n=161)</td>
<td>(n=177)</td>
<td>(n=225)</td>
<td>(n=225)</td>
</tr>
<tr>
<td>7. Feelings of guilt</td>
<td>-0.03</td>
<td>-0.03</td>
<td>0.00</td>
<td>-0.19**</td>
<td>-0.17**</td>
<td>-0.08</td>
<td>0.80</td>
<td>-0.17*</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>(n=385)</td>
<td>(n=381)</td>
<td>(n=384)</td>
<td>(n=385)</td>
<td>(n=385)</td>
<td>(n=385)</td>
<td>(n=160)</td>
<td>(n=175)</td>
<td>(n=175)</td>
</tr>
</tbody>
</table>
Table 7 continued

<table>
<thead>
<tr>
<th>8. Appearance evaluation</th>
<th>0.20**</th>
<th>0.06</th>
<th>0.07</th>
<th>0.12*</th>
<th>0.11*</th>
<th>0.08</th>
<th>-0.11*</th>
<th>0.87</th>
<th>0.01</th>
</tr>
</thead>
<tbody>
<tr>
<td>n = 467</td>
<td>n = 460</td>
<td>n = 466</td>
<td>n = 467</td>
<td>n = 467</td>
<td>n = 372</td>
<td>n = 204</td>
<td>n = 225</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>9. Appearance orientation</th>
<th>0.05</th>
<th>0.00</th>
<th>-0.01</th>
<th>0.15**</th>
<th>0.13**</th>
<th>0.08</th>
<th>-0.04</th>
<th>0.86</th>
</tr>
</thead>
<tbody>
<tr>
<td>n = 467</td>
<td>n = 460</td>
<td>n = 466</td>
<td>n = 467</td>
<td>n = 467</td>
<td>n = 372</td>
<td>n = 467</td>
<td>n = 204</td>
<td></td>
</tr>
</tbody>
</table>

Note. Pearson correlations for Study 2 – cross-sectional (March 2018) and Study 2 – longitudinal (March 2018-April 2018) are reported at the bottom and top of the diagonal, respectively. Reliability coefficient [Intraclass coefficient (2,1); 30-day test-retest] for each study variables are presented in the diagonal. Kappa coefficient and Weighted Kappa coefficient are reported for binge drinking and sport participation, respectively.

*p < 0.05; **p < 0.01.

Table 8. Summary of scores from Study 2 variables

<table>
<thead>
<tr>
<th>Variables (Range)</th>
<th>Cross-sectional</th>
<th>Longitudinal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
</tr>
<tr>
<td>Guilt from Drinking (1-7) 5-items</td>
<td>385</td>
<td>1.95</td>
</tr>
<tr>
<td>Intention (1-7) 3-items</td>
<td>517</td>
<td>5.70</td>
</tr>
<tr>
<td>Extraversion (1-5) 8-items</td>
<td>458</td>
<td>3.22</td>
</tr>
<tr>
<td>Appearance Orientation (1-5) 12-items</td>
<td>467</td>
<td>3.24</td>
</tr>
<tr>
<td>Appearance Evaluation (1-5) 7-items</td>
<td>467</td>
<td>3.41</td>
</tr>
</tbody>
</table>

Note. SD: Standard Deviation. α: Cronbach Alpha
Shape of the Alcohol Consumption – Physical Activity Association

The linear and quadratic term (alcohol use × alcohol use) were examined as predictors of the frequency of physical activity and leisure score index for both the cross-sectional and longitudinal samples. Results are reported in Table 9. In cross-sectional, unadjusted analyses, a positive linear and negative quadratic effects of alcohol use frequency on the frequency and leisure score index were detected. The inverted U-shape of the association between alcohol use frequency and frequency of physical activity is depicted in Figure 6. Similarly, a positive linear and negative quadratic effects of alcohol use quantity was detected when related to the frequency of physical activity, but not with the levels of leisure-time physical activity. Only the positive linear and negative quadratic effects of alcohol use frequency on the frequency of physical activity was mirrored in the longitudinal sample (see Table 10).

Covariate Analyses

Preliminary tests of the possible moderation effect of Greek status, gender, and extraversion, intention toward physical activity and past physical activity behavior did not provide evidence for a moderation effect.

Main Analyses

Specific Aim #1

Results of the mediation analyses are reported in Table 11-16. Guilt from drinking was not found to have a significant mediating effect on the association between alcohol use and physical activity behaviors in any of the models. The product of coefficient mediation analysis revealed that feelings of guilt did not mediate the alcohol use frequency and leisure-time physical activity frequency association. It is worth noting however that alcohol use frequency and alcohol use quantity were both negatively associated with feelings of guilt related to drinking (see Table 7).
Table 9. Association between Alcohol Consumption and Physical Activity among Purdue University Students Aged 18-25 years – March 2018 (Cross-Sectional Analysis)

<table>
<thead>
<tr>
<th>Physical Activity Outcome Variable</th>
<th>Frequency of Physical Activity</th>
<th>Leisure Score Index$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$B$</td>
<td>$\beta$</td>
</tr>
<tr>
<td>Alcohol Use Frequency</td>
<td>.47</td>
<td>.48</td>
</tr>
<tr>
<td>Alcohol Use Frequency$^2$</td>
<td>-.07</td>
<td>-.36</td>
</tr>
<tr>
<td>Analyzed Sample Size, Adjusted $R^2$, and Omnibus $F$ test</td>
<td>$n = 511$</td>
<td>$R^2 = .03$</td>
</tr>
<tr>
<td>Alcohol Use Quantity</td>
<td>.34</td>
<td>.38</td>
</tr>
<tr>
<td>Alcohol Use Quantity$^2$</td>
<td>-.03</td>
<td>-.24</td>
</tr>
<tr>
<td>Analyzed Sample Size, Adjusted $R^2$, and Omnibus $F$ test</td>
<td>$n = 508$</td>
<td>$R^2 = .03$</td>
</tr>
</tbody>
</table>

*Note. $^a$Leisure Score Index represents the frequency of 15-minute bouts of leisure-time physical activity in a typical week multiplied by Metabolic Equivalent of Tasks (METs) associated with mild, moderate and strenuous physical activity intensity. A square root transformation was applied to leisure score index values, so that the residuals of the regression follow a normal distribution.

*p < .05; *** p < .001
Table 10. Association between Alcohol Consumption (in March 2018) and Physical Activity (in April 2018) among Purdue University Students Aged 18-25 years (Longitudinal Analysis)

<table>
<thead>
<tr>
<th>Physical Activity Outcome Variable</th>
<th>Frequency of Physical Activity</th>
<th>Leisure Score Index&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>β</td>
</tr>
<tr>
<td>Alcohol Use Frequency</td>
<td>.54</td>
<td>.57</td>
</tr>
<tr>
<td>Alcohol Use Frequency&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-.09</td>
<td>-.47</td>
</tr>
<tr>
<td>Analyzed Sample Size, Adjusted &lt;em&gt;R&lt;/em&gt;&lt;sup&gt;2&lt;/sup&gt;, and Omnibus &lt;em&gt;F&lt;/em&gt; test</td>
<td>&lt;table&gt;&lt;thead&gt;&lt;tr&gt;&lt;th&gt;n&lt;/th&gt;&lt;th&gt;&lt;em&gt;R&lt;/em&gt;&lt;sup&gt;2&lt;/sup&gt;&lt;/th&gt;&lt;th&gt;&lt;em&gt;F&lt;/em&gt;(2,222) = 4.64**&lt;/th&gt;&lt;/tr&gt;&lt;/thead&gt;&lt;tbody&gt;&lt;tr&gt;&lt;td&gt;n = 225&lt;/td&gt;&lt;td&gt;.03&lt;/td&gt;&lt;td&gt;&lt;/td&gt;&lt;/tr&gt;&lt;/tbody&gt;&lt;/table&gt;</td>
<td>&lt;table&gt;&lt;thead&gt;&lt;tr&gt;&lt;th&gt;n&lt;/th&gt;&lt;th&gt;&lt;em&gt;R&lt;/em&gt;&lt;sup&gt;2&lt;/sup&gt;&lt;/th&gt;&lt;th&gt;&lt;em&gt;F&lt;/em&gt;(2,222) = 2.63&lt;/th&gt;&lt;/tr&gt;&lt;/thead&gt;&lt;tbody&gt;&lt;tr&gt;&lt;td&gt;n = 216&lt;/td&gt;&lt;td&gt;.01&lt;/td&gt;&lt;td&gt;&lt;/td&gt;&lt;/tr&gt;&lt;/tbody&gt;&lt;/table&gt;</td>
</tr>
<tr>
<td>Alcohol Use Quantity</td>
<td>.13</td>
<td>.15</td>
</tr>
<tr>
<td>Alcohol Use Quantity&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-.00</td>
<td>-.00</td>
</tr>
<tr>
<td>Analyzed Sample Size, Adjusted &lt;em&gt;R&lt;/em&gt;&lt;sup&gt;2&lt;/sup&gt;, and Omnibus &lt;em&gt;F&lt;/em&gt; test</td>
<td>&lt;table&gt;&lt;thead&gt;&lt;tr&gt;&lt;th&gt;n&lt;/th&gt;&lt;th&gt;&lt;em&gt;R&lt;/em&gt;&lt;sup&gt;2&lt;/sup&gt;&lt;/th&gt;&lt;th&gt;&lt;em&gt;F&lt;/em&gt;(2,222) = 2.52&lt;/th&gt;&lt;/tr&gt;&lt;/thead&gt;&lt;tbody&gt;&lt;tr&gt;&lt;td&gt;n = 225&lt;/td&gt;&lt;td&gt;.01&lt;/td&gt;&lt;td&gt;&lt;/td&gt;&lt;/tr&gt;&lt;/tbody&gt;&lt;/table&gt;</td>
<td>&lt;table&gt;&lt;thead&gt;&lt;tr&gt;&lt;th&gt;n&lt;/th&gt;&lt;th&gt;&lt;em&gt;R&lt;/em&gt;&lt;sup&gt;2&lt;/sup&gt;&lt;/th&gt;&lt;th&gt;&lt;em&gt;F&lt;/em&gt;(2,213) = .14&lt;/th&gt;&lt;/tr&gt;&lt;/thead&gt;&lt;tbody&gt;&lt;tr&gt;&lt;td&gt;n = 216&lt;/td&gt;&lt;td&gt;.01&lt;/td&gt;&lt;td&gt;&lt;/td&gt;&lt;/tr&gt;&lt;/tbody&gt;&lt;/table&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>Leisure Score Index represents the frequency of 15-minute bouts of leisure-time physical activity in a typical week multiplied by Metabolic Equivalent of Tasks (METs) associated with mild, moderate and strenuous intensity. A square root transformation was applied to leisure score index values, so that the residuals of the regression follow a normal distribution.

*<em>p</em> < .05; **<em>p</em> < .01
Figure 6. Association between Frequency of Physical Activity and Alcohol Use Frequency among Purdue University Student Aged 18-25 (Cross-Sectional Analysis)
Table 11. Mediation of the Effect of Alcohol Use Frequency on Physical Activity Frequency by Feelings of Guilt among Purdue University Students Aged 18-25 years (March – April 2018)

<table>
<thead>
<tr>
<th>Models</th>
<th>Path coefficients (unstandardized beta coefficient) [95%CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Path coefficients (unstandardized beta coefficient) [95%CI]</td>
</tr>
<tr>
<td></td>
<td>$a$</td>
</tr>
<tr>
<td>(Alcohol → Guilt)</td>
<td>(Guilt → PA)</td>
</tr>
<tr>
<td><strong>Alcohol Use Frequency →</strong></td>
<td><strong>Frequency of Physical Activity</strong></td>
</tr>
<tr>
<td>Cross-Sectional Analysis ($n = 366^a$)</td>
<td>-.36</td>
</tr>
<tr>
<td></td>
<td>[-.56, -.15]</td>
</tr>
<tr>
<td>Longitudinal Analysis ($n = 173^b$)</td>
<td>-.27</td>
</tr>
<tr>
<td></td>
<td>[-.57, .02]</td>
</tr>
</tbody>
</table>

Note. PA: Physical Activity (frequency of physical activity). $^a$Model adjusted for gender, Greek status, extraversion, and alcohol use frequency × alcohol use frequency. $^b$Model adjusted for gender, Greek status, extraversion, intention toward physical activity, and alcohol use frequency × alcohol use frequency. Bca [95%CI]: Bias-corrected and-accelerated bootstrap estimates 95% confidence interval of the mediated effect (10,000 bootstrap samples).
Table 12. Mediation of the Effect of Alcohol Use Frequency on Leisure Score Index by Feelings of Guilt among Purdue University Students Aged 18-25 years (March – April 2018)

<table>
<thead>
<tr>
<th>Models</th>
<th>$a$</th>
<th>$b$</th>
<th>$c'$</th>
<th>Indirect effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Alcohol → Guilt)</td>
<td>.36</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>(Guilt → PA)</td>
<td>-.07</td>
<td>.04</td>
<td>.015</td>
<td>[-.026, .124]</td>
</tr>
</tbody>
</table>

Note. PA: Physical Activity (Leisure Score Index). A square root transformation was applied to leisure score index values, so that the residuals of the regression follow a normal distribution. aModel adjusted for gender, Greek status, extraversion, and alcohol use frequency $\times$ alcohol use frequency. bModel adjusted for gender, Greek status, extraversion, intention toward physical activity, and alcohol use frequency $\times$ alcohol use frequency. cNo path coefficient was reported because the Omnibus F test was non statistically significant [Model F(6,356) = 1.64, $p = .14$]. Bca [95%CI]: Bias-corrected and-accelerated bootstrap estimates 95% confidence interval of the mediated effect (10,000 bootstrap samples).
Table 13. Mediation of the Effect of Alcohol Use Quantity on Physical Activity Frequency by Feelings of Guilt among Purdue University Students Aged 18-25 years (March – April 2018)

<table>
<thead>
<tr>
<th>Models</th>
<th>(a) (Alcohol (\rightarrow) Guilt)</th>
<th>(b) (Guilt (\rightarrow) PA)</th>
<th>(c') (Alcohol\textsubscript{Guilt} (\rightarrow) PA)</th>
<th>Indirect effect ((a \times b)) Bca [95%CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cross-Sectional Analysis(a) ((n = 366))</strong></td>
<td>-.18</td>
<td>-.01</td>
<td>.26</td>
<td>.002 [-.32, -.03] [-.17, .15] [.04, .49] [-.03, .042]</td>
</tr>
<tr>
<td><strong>Longitudinal Analysis ((n = 173))(b)</strong></td>
<td>-.12</td>
<td>.12</td>
<td>-.09</td>
<td>-.014 [-.34, .11] [-.03, .28] [-.32, .13] [-.084, .011]</td>
</tr>
</tbody>
</table>

*Note. PA: Physical Activity (frequency of physical activity).\(a\)Model adjusted for gender, Greek status, extraversion, and alcohol use quantity \(\times\) alcohol use quantity.\(b\)Model adjusted for gender, Greek status, extraversion, intention toward physical activity, and alcohol use quantity \(\times\) alcohol use quantity. Bca [95%CI]: Bias-corrected and-accelerated bootstrap estimates 95% confidence interval of the mediated effect (10,000 bootstrap samples).*
Table 14. Mediation of the Effect of Alcohol Use Quantity on Leisure Score Index by Feelings of Guilt among Purdue University Students Aged 18-25 years (March – April 2018)

<table>
<thead>
<tr>
<th>Path coefficients</th>
<th>Models</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(unstandardized beta coefficient) [95%CI]</td>
<td></td>
<td>a</td>
<td>b</td>
<td>c’</td>
<td>Indirect effect (a × b)</td>
</tr>
<tr>
<td>(Alcohol → Guilt)</td>
<td>(Guilt → PA)</td>
<td>(AlcoholGuilt → PA)</td>
<td></td>
<td>Bca [95%CI]</td>
<td></td>
</tr>
<tr>
<td><strong>Alcohol Use Quantity → Leisure Score Index</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cross-Sectional Analysis</strong>(^a)</td>
<td>(n = 363)</td>
<td>-.17</td>
<td>n.a.(^e)</td>
<td>n.a.(^e)</td>
<td>n.a.(^e)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[.32, -.03]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Longitudinal Analysis</strong> (n = 167)(^b)</td>
<td></td>
<td>-.06</td>
<td>-.04</td>
<td>-.59</td>
<td>.002</td>
</tr>
</tbody>
</table>

*Note. PA: Physical Activity (Leisure Score Index). A square root transformation was applied to leisure score index values, so that the residuals of the regression follow a normal distribution. \(^a\)Model adjusted for gender, Greek status, extraversion, and alcohol use frequency × alcohol use frequency. \(^b\)Model adjusted for gender, Greek status, extraversion, intention toward physical activity, and alcohol use frequency × alcohol use frequency. \(^c\)No path coefficient was reported because the Omnibus F test was non statistically significant [Model F(6,356) = 1.16, p = .33]. Bca [95%CI]: Bias-corrected and-accelerated bootstrap estimates 95% confidence interval of the mediated effect (10,000 bootstrap samples).
Table 15. Mediation of the Effect of Binge Drinking on Physical Activity Frequency by Feelings of Guilt among Purdue University Students Aged 18-25 years (March – April 2018)

<table>
<thead>
<tr>
<th>Models</th>
<th>$a$</th>
<th>$b$</th>
<th>$c^*$</th>
<th>Indirect effect $\text{(a x b)}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Alcohol $\rightarrow$ Guilt)</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>(Guilt $\rightarrow$ PA)</td>
<td>n.a.</td>
<td>.27</td>
<td>n.a.</td>
<td>[-.19, .13]</td>
</tr>
<tr>
<td>(Alcohol$_{\text{Guilt}}$ $\rightarrow$ PA)</td>
<td>n.a.</td>
<td>-.03</td>
<td>n.a.</td>
<td>[-.12, .66]</td>
</tr>
</tbody>
</table>

**Binge Drinking $\rightarrow$ Frequency of Physical Activity**

**Cross-Sectional Analysis (n = 367)$^a$**

<table>
<thead>
<tr>
<th>Paths</th>
<th>$a$</th>
<th>$b$</th>
<th>$c^*$</th>
<th>Indirect effect $\text{(a x b)}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>n.a.</td>
<td>.27</td>
<td>n.a.</td>
<td>[-.19, .13]</td>
<td></td>
</tr>
</tbody>
</table>

**Longitudinal Analysis (n = 173)$^b$**

<table>
<thead>
<tr>
<th>Paths</th>
<th>$a$</th>
<th>$b$</th>
<th>$c^*$</th>
<th>Indirect effect $\text{(a x b)}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>n.a.</td>
<td>-.03</td>
<td>n.a.</td>
<td>[-.12, .66]</td>
<td></td>
</tr>
</tbody>
</table>

*Note. PA: Physical Activity (frequency of physical activity). $^a$Model adjusted for gender, Greek status, and extraversion. $^b$Model adjusted for gender, Greek status, extraversion, and intention toward physical activity. $^c$No path coefficient was reported because the Omnibus $F$ test was non statistically significant [Model $F(4,362) = .99$, $p = .41$]. $^d$No path coefficient was reported because the Omnibus $F$ test was non statistically significant [Model $F(5,361) = 2.08$, $p = .07$]. $^e$No path coefficient was reported because the Omnibus $F$ test was non statistically significant [Model $F(5,167) = .54$, $p = .75$]. Bca [95% CI]: Bias-corrected and-accelerated bootstrap estimates 95% confidence interval of the mediated effect (10,000 bootstrap samples).
Table 16. Mediation of the Effect of Binge Drinking on Leisure Score Index by Feelings of Guilt among Purdue University Students Aged 18-25 years (March – April 2018)

<table>
<thead>
<tr>
<th>Models</th>
<th>Path coefficients (unstandardized beta coefficient) [95%CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$a$ (Alcohol $\rightarrow$ Guilt)</td>
</tr>
<tr>
<td>Binge Drinking $\rightarrow$ Leisure Score Index</td>
<td></td>
</tr>
<tr>
<td>Cross-Sectional Analysis (n = 363)$^a$</td>
<td>n.a.$^c$</td>
</tr>
<tr>
<td>Longitudinal Analysis (n = 167)$^b$</td>
<td>n.a.$^c$</td>
</tr>
</tbody>
</table>

[-.32, .25] [-.87, .50]

Note. PA: Physical Activity (Leisure Score Index). A square root transformation was applied to leisure score index values, so that the residuals of the regression follow a normal distribution. $^a$Model adjusted for gender, Greek status, and extraversion. $^b$Model adjusted for gender, Greek status, extraversion, and intention toward physical activity. $^c$No path coefficient was reported because the Omnibus $F$ test was non statistically significant [Model $F(4,358) = .93$, $p = .44$]. $^d$No path coefficient was reported because the Omnibus $F$ test was non statistically significant [Model $F(5,357) = .98$, $p = .43$]. $^e$No path coefficient was reported because the Omnibus $F$ test was non statistically significant [Model $F(5,161) = .69$, $p = .63$]. Bca [95%CI]: Bias-corrected and-accelerated bootstrap estimates 95% confidence interval of the mediated effect (10,000 bootstrap samples).

Specific Aim #2

Results of the moderation analyses in the cross-sectional sample are reported in Table 17. Appearance evaluation was found to moderate the strength of the association between alcohol use frequency ($\Delta F = 4.85; p = .04; \Delta R^2 = .033$) and alcohol use quantity ($\Delta F = 4.92; p = .0001; \Delta R^2 = .035$) and frequency of physical activity participation. Simple slope analysis suggests that the strength of the concurrent association between alcohol use frequency and frequency of physical activity is stronger (beta = -.13) at lower levels of body image evaluation compared to higher levels of body image evaluation (see Figure 7). Similar interpretation can be made regarding the alcohol use quantity and frequency of physical activity association. No moderation effect was detected concerning the alcohol use behaviors and leisure score index (frequency $\times$ intensity of leisure-time physical activity). Appearance evaluation and appearance orientation did
not influence the strength and/or direction of mediated effect of the feeling of guilt related to alcohol consumption.

Table 17. Association between Alcohol Use Frequency and Frequency of Physical Activity among Purdue University Students Aged 18-25 years (Cross-Sectional Analysis).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Physical Activity Outcome: Frequency of Physical Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Step 1 ($n = 439$)</td>
</tr>
<tr>
<td></td>
<td>$B$</td>
</tr>
<tr>
<td>Gender</td>
<td>.38</td>
</tr>
<tr>
<td>Greek Status</td>
<td>.22</td>
</tr>
<tr>
<td>Extraversion</td>
<td>.19</td>
</tr>
<tr>
<td>Alcohol use frequency</td>
<td>.13</td>
</tr>
<tr>
<td>Alcohol use frequency $^2$</td>
<td>-.07</td>
</tr>
<tr>
<td>Appearance evaluation</td>
<td>.45</td>
</tr>
<tr>
<td>Appearance orientation</td>
<td>-.13</td>
</tr>
<tr>
<td>Appearance evaluation $\times$ Alcohol use frequency</td>
<td>.01</td>
</tr>
<tr>
<td>Appearance orientation $\times$ Alcohol use frequency</td>
<td>.01</td>
</tr>
</tbody>
</table>

$R^2$                 | .04  | .07
Model $F$            | 4.74***| 4.73***|
$\Delta R^2$         | -    | .03
$\Delta F$          | -    | 4.85***

*Note. B: Unstandardized beta weights. $\beta$: Standardized beta weights. All variables were mean-centered.
***$p < .001
Figure 7. Association between Frequency of Alcohol Use and Frequency of Physical Activity (past month)

Alcohol Use Frequency

Frequency of Physical Activity
Table 18. Association between Alcohol Use Quantity and Frequency of Physical Activity among Purdue University Students Aged 18-25 years (Cross-Sectional Analysis).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Physical Activity Outcome: Frequency of Physical Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Step 1 (n = 439)</td>
</tr>
<tr>
<td></td>
<td>B</td>
</tr>
<tr>
<td>Gender</td>
<td>.34</td>
</tr>
<tr>
<td>Greek Status</td>
<td>.21</td>
</tr>
<tr>
<td>Extraversion</td>
<td>.20</td>
</tr>
<tr>
<td>Alcohol use Quantity</td>
<td>.14</td>
</tr>
<tr>
<td>Alcohol use Quantity²</td>
<td>-.03</td>
</tr>
<tr>
<td>Appearance evaluation</td>
<td></td>
</tr>
<tr>
<td>Appearance orientation</td>
<td></td>
</tr>
<tr>
<td>Appearance evaluation ×</td>
<td></td>
</tr>
<tr>
<td>Alcohol use Quantity</td>
<td></td>
</tr>
<tr>
<td>Appearance orientation ×</td>
<td></td>
</tr>
</tbody>
</table>

| R²                          | .04  | .07  |
| Model F                     | 4.52*** | 4.92*** |
| ∆R²                         | -    | .03  |
| ∆F                          | -    | 4.90*** |

Note. B: Unstandardized beta weights. β: Standardized beta weights. All variables were mean-centered.

***p < .001
DISCUSSION

The purpose of this study was to investigate the relationship between alcohol consumption and physical activity in college students. Our two specific aims were (1) to determine whether the feeling of guilt related to alcohol use mediates the alcohol use - physical activity related-behaviors association, and (2) to determine whether body image (i.e., appearance evaluation and appearance orientation, two sub dimensions of body image) moderates the alcohol consumption - physical activity behavior association.

Study 1

The aim of study 1 was to provide reliability and validity evidence for the use of an online survey including all key variables needed to test the specific aims of study 2. We were able to recruit 129 participants (88 who fully completed the survey) out of 942 who received our emails, which met our recruitment aim of 50-100 participants (Baumgartner & Chung, 2001). Satisfactory Cronbach Alphas were found for all key variables. As expected, a significant positive correlation of moderate strength was seen between body image evaluation and self-esteem. A positive correlation was also seen between moral norm and guilt from drinking, but it was not found to be statistically significant at the .05 level. One possible reason we did not see a stronger correlation between these scores could be the low amount of variation in guilt and moral norm for drinking scores. With both scores remaining relatively stable throughout the sample, it is difficult to see how they change together. Overall, study 1 provided preliminary reliability and validity evidence for the use of the guilt from drinking and body image measures among Purdue University students age 18-25.

Study 2

Overall, the results of Study 2 suggest that across alcohol use and physical activity behavioral domains (frequency of alcohol use and frequency of physical activity in the past month, quantity of alcohol use and quantity of physical activity – Leisure Score Index, and binge drinking and sport participation), the association between these two behaviors in college students is weak, if not trivial.
The association between alcohol consumption and physical activity was found to be positive and somewhat stronger for alcohol use frequency (compared to alcohol use quantity and binge drinking), but only when alcohol use and physical activity behaviors are examined concurrently. Musselman et al., 2010 found that the association between alcohol use and physical activity related behaviors was the strongest for alcohol use frequency. The linear association between alcohol use (frequency and quantity) and physical activity was positive but weak in the cross-sectional sample, and this association was of trivial importance (non-statistically significant) in the longitudinal samples. Though statistically significant in some instances, effect sizes were small ($R^2 = .03$). Similar findings were reported in past research (Abrantes et al., 2017; Buchholz & Crowther, 2014; Dinger et al., 2014; Leasure & Neighbors, 2014). Similarly, Buchholz & Crowther (2014) detected a significant positive association between alcohol use quantity and physical activity frequency ($r = .16$), which is very similar to the findings of the present study. Leasure and Neighbors (2014) also found a significant correlation between alcohol use quantity and physical activity ($r = .19$). Similarly, Moore & Werch (2010) reflected the present study’s findings of a significant correlation between both alcohol frequency and alcohol quantity and physical activity frequency, separately. They found more frequent exercise to be associated with more drinking sessions and greater amount of alcohol consumed (Moore & Werch, 2008). Our results are contrary to recent findings by Davis and colleagues, who found that alcohol use frequency was negatively correlated with physical activity ($r = -.12$), and to Niedermeier (2018) who reported a null relationship between alcohol frequency, quantity, and binge drinking and physical activity (Davis et al, 2017; Niedermeier et al, 2018).

Alcohol use frequency and quantity associated with physical activity frequency in the cross-sectional sample, but the percentage of explained variance for both the linear and quadratic effect was small ($R^2 = .03$). When including quadratic alcohol use effect in the models for prediction of physical activity frequency, we saw significant increases in effect sizes ($R^2$). These results also suggest that the alcohol use – physical activity behavior association may not be, at least entirely, linear. In fact, for both alcohol use frequency and quantity, their respective association with frequency of physical activity may be consistent with an inverted U shape. The results align with Smothers & Bertolucci (2001), who found the shape of the association between alcohol consumption and physical activity participation to look like an inverted J (positive linear
trend and negative quadratic trend). It is possible that the association between alcohol consumption and physical activity is positive linear through low-moderate levels of drinking but starts to become negative at higher levels of alcohol consumption. Therefore, it is important for future studies investigating this association to examine the quadratic relationship between the variables. In order to do this, researchers should treat both alcohol consumption and physical activity as continuous variables.

The present study was the first to test guilt as a possible mediator in the relationship between alcohol consumption and physical activity. We found no support for the mediation effect of feelings of guilt on the relationship. We found that frequency of alcohol consumption was negatively related to guilt from drinking. A possible explanation for why we saw no effect could be that scores for feelings of guilt were too low. Although measurement error is a possibility, it’s likely that most college students in our population simply do not feel guilty from consuming alcohol. Therefore, contrary to our first hypothesis, guilt from drinking may not be the mechanism by which alcohol consumption is related to physical activity participation. This does not provide support for the use of the Compensatory Health Beliefs (CHBs) model for understanding this relationship. CHBs theorize that pleasurable but negative health impacting behaviors (e.g., alcohol consumption) may be followed by health promoting behaviors (e.g., physical activity) as compensation (Geller et al., 2017; Knäuper et al., 2004). Intention to perform compensatory behaviors (such as intention to exercise the day after binge drinking) may increase chances of engaging in risky behaviors because of a rationalization that compensatory behaviors can mitigate negative effects of risky behaviors (Geller et al., 2017). According to the model, if college students are not feeling guilty from consuming alcohol (pleasurable but negative health impacting behavior) then it is not serving as motivation to engage in physical activity (health promoting behavior).

The findings provide some support for the moderating effect of appearance evaluation. Specifically, among those reporting lower levels of appearance evaluation (i.e., higher levels of body dissatisfaction) the association between alcohol use frequency and quantity and frequency of physical activity was stronger than for those reporting higher levels of appearance evaluation. It is possible that those who are less satisfied with their body shape (low appearance evaluation) might be more concerned with additional calories consumed from drinking alcohol. In order to combat the excessive calories, those people may participate in physical activity. The effect of
appearance evaluation was seen in the cross-sectional analysis models. The moderation effect of body image (appearance evaluation and orientation) was not seen in the longitudinal sample.

The present study was also the first to test the possible moderation effect of body image (appearance orientation and appearance evaluation sub-dimensions, separately) on the relationship between alcohol consumption and physical activity. We hypothesized that those with higher body dissatisfaction will show a stronger positive association between physical activity and alcohol consumption. No effect from appearance orientation was found, but we did detect a moderation effect of appearance evaluation in that lower scores (meaning higher body dissatisfaction) resulted in a stronger association between alcohol consumption and physical activity. This means appearance orientation (extent to which a person cares about how they look) may not be as important as appearance evaluation (how satisfied a person is with their body shape). Future research should attempt to replicate this result, as well as test the role of other sub-dimensions of body image.

In both the cross-sectional and longitudinal sample, sports participation over the last 12-months was significantly correlated with binge drinking ($r$=.16 and .21). This is consistent with Wechsler et al (2001), who found college males and females involved in sports reported more binge drinking episodes than those not involved. Considering the conflicting results discussed earlier, it is possible that a positive linear association between alcohol consumption and physical activity may be mostly driven by the positive association of binge drinking and sport participation.

**Theoretical Implications and Future Directions**

In order to understand the association between alcohol consumption and physical activity in college students, information on mediators and moderators is necessary (Dodge et al., 2017; Leasure et al., 2015). Identifying mediators and moderators will help researchers understand how this possible relationship exists and for whom it is strongest.

Future studies should test other mechanisms that may be influencing this relationship. Two such hypotheses that should receive attention from future research come from Leasure and colleagues (2015); “work hard/play hard” and “celebration”. “Work hard/play hard” comes from the idea that people who are working hard during the week at their place of work and on their physical fitness may be consuming alcohol on the weekends to unwind. In regards to college
students, it’s possible that stress from school work creates the need for a temporary escape, or “play”, which may be acted out by drinking and physical activity. Perhaps students escape from school stress via physical activity when they have classes or other responsibilities the following day, but switch their coping method to drinking on the weekends. The “Celebration” hypothesis refers to when a person consumes alcohol after some sort of physical activity triumph such as a personal best, winning a game, reaching a fitness goal, or finishing a race. College students, especially those involved in sports, may achieve a positive affective state from physical activity related achievements, which could lead to celebrations that involve drinking. These hypotheses are similar on some levels but contain major differences. “Work hard/play hard” seems fit to understand the alcohol consumption-physical activity relationship among those participating in general physical activity settings, whereas “celebration” is more relevant to those involved in sports. As opposed to “work/hard play hard” which postulates drinking to combat stress (negative affective state), “celebration” theorizes underlying motivation for drinking comes from a desire to continue a positive feeling. However, the celebration hypothesis also considers the possibility that students (those involved in sports) could be motivated to drink in order to commiserate a loss. The “celebration” hypothesis postulates physical activity as the predictor of alcohol consumption. “Work hard/play hard”, on the other hand, does not specify which of the variables predicts the other, and instead hypothesizes that both behaviors co-occur. It is possible that neither behavior causes the other, and that they are occurring at the same time due to one or more undefined variables.

Our results have some implication for the design of health promotion programs. We found the association between these two behaviors to be positive through moderate levels of drinking frequency (peaking at approximately two sessions per week), yet negative at higher levels of alcohol use. This suggests that those who drink more than two days per week are less likely to engage in physical activity. It is possible there are aspects of higher drinking levels that interfere with a person’s ability or motivation to be physically active (i.e. hangovers, increased time spent drinking). Therefore, health programs designed to increase physical activity may also consider targeting participant’s level of alcohol use behaviors among those reporting higher levels of alcohol consumption.
Limitations and Strengths

The present study has a number of strengths and limitations. First, the two-study design allowed us to gather necessary reliability and validity evidence for the use of our questionnaire. Second, we filled key gaps identified by previous literature (Leasure et al., 2015; Dodge et al., 2017) by measuring multiple aspects of alcohol consumption (frequency, quantity, binge), testing the guilt and body image hypotheses, attempting to replicate results from Buscemi et al. with proper moderation analyses instead of sub group analyses, and controlling for extraversion and intention. Third, using the Compensatory Health Beliefs model provided additional theoretical grounding for our hypotheses. Although study design was mentioned as a strength, one limitation for our study was a short timeframe between measurement periods (30 days). Another limitation is that out of 596 participants who completed the survey at Time 1, only 239 participated at Time 2. The stability of measures over the one month timeframe and small sample size of those who completed surveys at both time points lead to changes in our analysis plan. A longer timeframe with more measurement points could have allowed us to see greater change in key variables. In addition, more frequent measures of physical activity and alcohol consumption (i.e. daily measurement) may have shown different patterns of findings. There is limited evidence for the use of self-report physical activity measures to capture change over time. A more objective measure of physical activity would be better suited to detect changes in behavior.

Conclusion

Consistent with previous literature, we found some support for a positive, albeit small, association between alcohol consumption and physical activity. The alcohol use – physical activity behavior association may not be, at least entirely, linear. This association may be consistent with an inverted U shape. Guilt and body image orientation do not appear to play a role, but we did find evidence supporting a moderating effect of body image evaluation in the cross-sectional analysis. Future research into the alcohol consumption-physical activity association should examine the linear and quadratic relationship between the two main variables, and test other hypothesis such as “work hard/play hard” and “celebration”. Ideal future studies will use daily objective measures over a longer timeframe in order to better see changes in alcohol consumption and physical activity behaviors.
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To: AMIREAULT, STEVE SPENCER, JONATHAN R
From: DICLEMENTI, JEANNIE D, Chair
Social Science IRB
Date: 02 / 20 / 2018
Committee Action: IRB Approval of Amendment, Expedited Category (7)
Approval Date: 02 / 20 / 2018
IRB Protocol #: 1708019582
Amendment Version: Amendment-001:
Study Title: Alcohol Consumption and Physical Activity in College Students: Investigating The Role of Guilt and Body Image
Expiration Date: 11 / 20 / 2018
Subjects Approved: 760

The above referenced protocol amendment has been approved by the Purdue IRB.
The expiration date for IRB approval has not been altered.
Approved study documents are in the Attachments section of this protocol in CoeusLite.
You are required to retain a copy of this letter for your records.

We appreciate your commitment towards ensuring the ethical conduct of human subject research and wish you well with your study.
APPENDIX B. INVITATION EMAIL

Subject of email: Follow-up questionnaire on alcohol consumption and physical activity

Dear [Name of the participant],

Earlier this week, we sent you an email asking for your participation in a survey about alcohol consumption and physical activity participation. If you have already completed this survey, we would like to thank you very much.

If you have not answered the questionnaire yet, we invite you to do so. We hope that providing you with a link to the survey website makes it easy for you to respond. To complete the survey, simply ctrl+click on this link:

https://purdue.ca1.qualtrics.com/jfe/form/SV_8nOVN6iSPOLxmVn

Your response is voluntary and we appreciate your consideration of our request.

Sincerely,

Steve Amireault, PhD
Assistant Professor
Department of Health and Kinesiology
Purdue University
APPENDIX C. QUESTIONNAIRES

Purdue Alcohol Consumption and Physical Activity Questionnaire

Start of Block: Confidentiality/alpha numeric

Q65 You are being invited to participate in a research study titled “Alcohol Consumption and Physical Activity in College Students: Investigating the Role of Guilt and Body Image”. This study is being conducted by Dr. Steve Amireault from Purdue University. You were selected to participate in this study because you are a Purdue Student between the ages of 18-25. We seek to recruit 70-100 Purdue Students. The purpose of this research study is to expand on the understanding of the relationship between alcohol consumption and physical activity in college students. If you agree to take part in this study, you will be asked to complete an online survey. This survey will ask about alcohol consumption, physical activity, guilt from drinking alcohol, body image, moral norm, self-esteem, personality characteristics, and socio-demographic characteristics. It will take you approximately 10 minutes to complete the survey. You may not directly benefit from this research; however, we hope that your participation in the study may help us to better understand the relationship between alcohol consumption and physical activity with a purpose to inform the development of future programs, policies, and interventions to promote responsible alcohol drinking behaviors while increasing physical activity participation among college-aged students. Your participation in this study is entirely voluntary. You may refuse to participate or withdraw from this study at any time, and without penalty or loss of benefits to which you are otherwise entitled. You may also skip any question that you choose. If you decide not to participate, or if you discontinue your participation, you will suffer no prejudice regarding health care or your participation in any other research studies. Participation in this study will not involve any additional costs to you. We believe there are no known risks associated with this research study that exceed those of daily life; however, as with any online related activity the risk of a breach of confidentiality is always possible. Although there is a risk that a participant could be identified due to his/her socio-demographic responses, this risk is minimal. We will minimize any risks by asking you to create an alpha numeric ID number rather than asking for identifying information. As a result, it will be impossible for anyone to link a participant's name to their study ID number, and no information identifying the participants could be transferred to anyone. To the best of our ability, your answers in this study will remain confidential. The project’s research records (i.e., your responses to the online survey) may be reviewed by departments at Purdue University responsible for regulatory and research oversight. We will not reveal your identity in any presentation or publication. We will store data in a non-identifiable form indefinitely. Electronic documents and data will be stored on password-protected Purdue University server. As
researchers we are not qualified to provide counseling services and we will not be following up with you after this study. If you feel upset after completing the study, or find that some questions or aspects of the study triggered distress, talking with a qualified clinician may help. If you feel you would like assistance please contact Purdue Counseling and Psychological services at (765) 494-6995 Monday-Friday, 8:00 a.m.-5:00 p.m. In the case of an emergency please call 911. If you have questions, comments, or concerns about this research project, you can talk to one of the researchers. Please contact Dr. Steve Amireault at 765-496-0568 or samireau@purdue.edu, or Jonathan Spencer at spenc107@purdue.edu. If you have questions about your rights while taking part in the study or have concerns about the treatment of research participants, please call the Human Research Protection Program at (765) 494-5942, email (irb@purdue.edu) or write to: Human Research Protection Program - Purdue University Ernest C. Young Hall, Room 1032 155 S. Grant St. West Lafayette, IN 47907-2114 By clicking “I agree” below you are indicating that you are a Purdue student aged between 18 to 25 years old, have read and understood this consent form and agree to participate in this research study. Please print a copy of this page for your records.

☐ I agree (1)

☐ I do not agree (2)

Skip To: End of Survey If You are being invited to participate in a research study titled “Alcohol Consumption and Physical... = I do not agree

Q66 In order to ensure confidentiality, We ask you to provide the following information in order to create an alpha numeric ID:

What is the first letter of your first name?

▼ A (1) ... Z (26)

Q69

What is the first letter of your last name?

▼ A (1) ... Z (26)
Q70 Gender: M=Male F=female O=other X=prefer not to answer

▼ M (1) ... X (4)

Q71 What is the number of your birth month?

▼ 01 (1) ... 12 (12)

Q72 On which day of the month were you born?

▼ 01 (1) ... 31 (31)

End of Block: Confidentiality/alpha numeric

Start of Block: Age

Q50 What is your age?

▼ 18 (1) ... 25 (8)
Q97 Here are some questions about your physical activity level:

Q67 Considering **A TYPICAL WEEK** (7-day period), how many times on average do you do the following kinds of exercise for **more than fifteen minutes** during your free time?

Write the appropriate **number of occasions** in the box.

Q1 **Strenuous Exercise** (Heart Beats rapidly)
(examples: running, jogging, hockey, soccer, basketball, vigorous swimming (lap swimming), vigorous biking, cross-country skiing)

Q2 **Moderate Exercise** (Not exhausting)
(examples: fast walking, golf without a cart, tennis doubles, easy bicycling, easy swimming, alpine skiing, weight lifting, hiking)

Q3 **Mild Exercise** (minimal effort)
(examples: easy walking, gentle yoga/stretching, fishing, bowling, golf with a cart)
Q52 During the **past 12 months**, on how many sports teams did you play? (Include any teams run by Purdue University or community groups)

- No team participation  (1)
- 1  (2)
- 2  (3)
- 3 or more  (4)

Q96 How often have you participated in one or more physical activities for 20-30 minutes per session during your free time in the **past month**?

- Never  (1)
- About once  (2)
- 2 to 3 times  (3)
- About once per week  (4)
- About 2 times per week  (5)
- About 3 times per week  (6)
- 4 or more times per week  (7)
Q5 In the **past week** (the last 7 days), on how many days have you done a total of **30 minutes or more** physical activity which has done enough to raise your breathing rate. This may include sports, running, jogging, aerobics, bicycling, and fast walking, but **should not include housework or physical activity that is part of your job**.

- 0 days  (1)
- 1  (2)
- 2  (3)
- 3  (4)
- 4  (5)
- 5  (6)
- 6  (7)
- 7 days  (8)
End of Block: Physical Activity

Start of Block: Alcohol consumption

Q98 Here are some questions about your alcohol consumption:

Q58 During the last month (i.e. 30 days), how often did you usually have any kind of drink containing alcohol?  

By a drink we mean half an ounce of absolute alcohol (e.g. a 12 ounce can or glass of beer or cooler, a 5 ounce glass of wine, or a drink containing 1 shot of liquor). Choose only one.

- Every day (1)
- 5-6 times per week (2)
- 3-4 times per week (3)
- twice per week (4)
- once per week (5)
- 2-3 times per month (6)
- once per month (7)
- I did not drink any alcohol in the past month, but I have drank in the past (10)
- I have never drank alcohol in my life (11)

Skip To: Q59 If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... = I did not drink any alcohol in the past month, but I have drank in the past
Q60 So you have never had a drink of alcohol in your entire life?

☐ Yes, never (1)

☐ no, I have (if selected, please return to the first question and change your answer) (2)
Q61 During the last month (i.e. 30 days), how many alcoholic drinks did you have on a typical day when you drank alcohol?  

By a drink we mean half an ounce of absolute alcohol (e.g. a 12 ounce can or glass of beer or cooler, a 5 ounce glass of wine, or a drink containing 1 shot of liquor).  

Choose only one.

- 25 or more (1)
- 19-24 (2)
- 16-18 (3)
- 12-15 (4)
- 9-11 (5)
- 7-8 (6)
- 5-6 (7)
- 3-4 (8)
- 2 (9)
- 1 (10)
Q62 During the last month (i.e. 30 days), how often (on average) did you have 5 or more (males) or 4 or more (females) drinks containing alcohol **within a two-hour period**?

(That would be equivalent of at least 5 (males) or 4 (female) 5-oz glasses of wine, 12-oz beers, or one drink containing one shot of liquor)

Choose only one.

- Every day (1)
- 5-6 times per week (2)
- 3-4 times per week (3)
- 2 times per week (4)
- once per week (5)
- 2-3 times per month (6)
- once per month (7)
- never (8)

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Page Break
Q59 During the last month (i.e. 30 days), what is the maximum number of drinks containing alcohol you have had in a 24-hour period?

By a drink we mean half an ounce of absolute alcohol (e.g. a 12 ounce can or glass of beer or cooler, a 5 ounce glass of wine, or a drink containing 1 shot of liquor).

○ 36 or more (1)
○ 24-35 (2)
○ 18-23 (3)
○ 12-17 (4)
○ 8-11 (5)
○ 5-7 (6)
○ 4 (7)
○ 3 (8)
○ 2 (9)
○ 1 (10)
Q58 NOTE: To regularly engage in physical activity refers to accumulating at least 150 minutes/week of at least moderate intensity activity, every week. Physical activity should be performed at least 3 days/week (if vigorous intensity) to 5 days/week (if moderate intensity), and spread throughout the week. (Free time refers to time that can be spent on one’s own activities rather than work or domestic chores)

Q73 I intend to regularly engage in physical activity during my free time in the next month.

- Definitely disagree (1)
- Mostly disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Mostly agree (6)
- Definitely agree (9)
Q9 I will regularly engage in physical activity during my free time in the next month.

- Definitely disagree (1)
- Mostly disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Mostly agree (6)
- Definitely agree (7)

Q10 I plan to regularly engage in physical activity during my free time in the next month.

- Definitely disagree (1)
- Mostly disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Mostly agree (6)
- Definitely agree (7)
End of Block: Intention

Start of Block: Guilt from Drinking

Q95 The following are some statements which may or may not describe how you are feeling when you have had at least one drink of alcohol (i.e., the very next day after your last drink). Please rate each statement using the 7-point scale below. Remember to rate each statement based on how you are feeling the very next day after having consumed alcohol.

By a drink we mean half an ounce of absolute alcohol (e.g. a 12 ounce can or glass of beer or cooler, a 5 ounce glass of wine, or a drink containing 1 shot of liquor).

Display This Question:
If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... != I have never drank alcohol in my life

Q42 When I have at least one drink,  I experience feelings of guilt later on.

- Disagree completely (1)
- Disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Agree (6)
- Agree completely (7)

Display This Question:
If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... != I have never drank alcohol in my life
Q14 When I have at least one drink, the following day I get distressed by the feeling that I did something wrong.

- Disagree completely (1)
- Disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Agree (6)
- Agree completely (7)

Display This Question:
If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... != I have never drank alcohol in my life

Q12 When I have at least one drink, I have feelings of remorse, regret.

- Disagree completely (1)
- Disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Agree (6)
- Agree completely (7)

Display This Question:
If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... != I have never drank alcohol in my life
Q37 When I have at least one drink, later on I feel like I have done something bad.

- Disagree completely (1)
- Disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Agree (6)
- Agree completely (7)

Display This Question:
If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... != I have never drank alcohol in my life

Q11 When I have at least one drink, the next day I cannot stop thinking about my drinking behavior.

- Disagree completely (1)
- Disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Agree (6)
- Agree completely (7)
End of Block: Guilt from Drinking

Start of Block: Extraversion

Q64 Please indicate to which degree the following words describe you.

Q26 Outgoing

- Very inaccurate (1)
- Slightly inaccurate (2)
- Neutral (3)
- Slightly accurate (4)
- Very accurate (5)

Q27 Untalkative

- Very Inaccurate (1)
- Slightly inaccurate (2)
- Neutral (3)
- Slightly accurate (4)
- Very accurate (5)
Q28 Extroverted

- Very Inaccurate (1)
- Slightly inaccurate (2)
- Neutral (3)
- Slightly accurate (4)
- Very accurate (5)

Q30 Quiet

- Very Inaccurate (1)
- Slightly inaccurate (2)
- Neutral (3)
- Slightly accurate (4)
- Very accurate (5)

Q31 Talkative

- Very Inaccurate (1)
- Slightly inaccurate (2)
- Neutral (3)
- Slightly accurate (4)
- Very accurate (5)
Q32 Shy

- Very Inaccurate (1)
- Slightly inaccurate (2)
- Neutral (3)
- Slightly accurate (4)
- Very accurate (5)

Q33 Energetic

- Very Inaccurate (1)
- Slightly inaccurate (2)
- Neutral (3)
- Slightly accurate (4)
- Very accurate (5)

Q34 Reserved

- Very Inaccurate (1)
- Slightly inaccurate (2)
- Neutral (3)
- Slightly accurate (4)
- Very accurate (5)
End of Block: Extraversion

Start of Block: Body Image

Q93 The following pages contain a series of statements about how people might think, feel, or behave. You are asked to indicate the extent to which each statement pertains to you personally. Your answers to the items in the questionnaire are anonymous. In order to complete the questionnaire, read each statement carefully and decide how much it pertains to you personally. There are no right or wrong answers. Just give the answer that is most accurate for you. Remember, your responses are confidential, so please be completely honest and answer all items.

Q35 Before going out in public I always notice how I look.

☐ Definitely disagree (1)

☐ Mostly disagree (2)

☐ Neither agree nor disagree (3)

☐ Mostly agree (4)

☐ Definitely agree (5)

Q74 I am careful to buy clothes that make me look my best.

☐ Definitely disagree (1)

☐ Mostly disagree (2)

☐ Neither agree nor disagree (3)

☐ Mostly agree (4)

☐ Definitely agree (5)
Q75 My body is sexually appealing.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q76 I like my looks just the way they are.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q77 I check my appearance in the mirror whenever I can.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)
Q100 Remember, your responses are confidential, so please be completely honest and answer all items.

-----------------------------------------------------------------------------------

Q78 Before going out, I usually spend a lot of time getting ready.

☐ Definitely disagree (1)
☐ Mostly disagree (2)
☐ Neither agree nor disagree (3)
☐ Mostly agree (4)
☐ Definitely agree (5)

-----------------------------------------------------------------------------------

Q79 Most people would consider me good looking.

☐ Definitely disagree (1)
☐ Mostly disagree (2)
☐ Neither agree nor disagree (3)
☐ Mostly agree (4)
☐ Definitely agree (5)

-----------------------------------------------------------------------------------
Q80 It is important that I always look good.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q81 I use very few grooming products.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q82 I like the way I look without my clothes on.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)
Q101 Remember, your responses are confidential, so please be completely honest and answer all items.

Q83 I am self-conscious if my grooming isn't right.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q84 I usually wear whatever is handy without caring how it looks.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)
Q85 I like the way my clothes fit me.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q86 I don't care what people think about my appearance.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q87 I take special care with my hair grooming.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)
Q102 Remember, your responses are confidential, so please be completely honest and answer all items.

Q88 I dislike my physique.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q89 I am physically unattractive.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)
Q90 I never think about my appearance.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q91 I am always trying to improve my physical appearance.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)
End of Block: Body Image

Start of Block: Self-Esteem

Q63 Below is a list of statements dealing with your general feelings about yourself. Please indicate how strongly you agree or disagree with each statement.

Q16

On the whole, I am satisfied with myself.

- Strongly disagree (1)
- Disagree (2)
- Agree (3)
- Strongly agree (4)

Q17 At times I think I am no good at all.

- Strongly disagree (1)
- Disagree (2)
- Agree (3)
- Strongly agree (4)
Q18 I feel that I have a number of good qualities.

- Strongly disagree (1)
- Disagree (2)
- Agree (3)
- Strongly agree (4)

Q19 I am able to do things as well as most other people.

- Strongly disagree (1)
- Disagree (2)
- Agree (3)
- Strongly agree (4)

Q20 I feel I do **NOT** have much to be proud of.

- Strongly disagree (1)
- Disagree (2)
- Agree (3)
- Strongly agree (4)
Q103 Below is a list of statements dealing with your general feelings about yourself. Please indicate how strongly you agree or disagree with each statement.

Q21 I certainly feel useless at times.

- Strongly disagree (1)
- Disagree (2)
- Agree (3)
- Strongly agree (4)

Q22 I feel that I am a person of worth, at least on an equal plane with others.

- Strongly disagree (1)
- Disagree (2)
- Agree (3)
- Strongly agree (4)

Q23 I wish I could have more respect for myself.

- Strongly disagree (1)
- Disagree (2)
- Agree (3)
- Strongly agree (4)
Q24 All in all, I am inclined to feel that I am a failure.

- Strongly disagree (1)
- Disagree (2)
- Agree (3)
- Strongly agree (4)

Q25 I take a positive attitude toward myself.

- Strongly disagree (1)
- Disagree (2)
- Agree (3)
- Strongly agree (4)
End of Block: Self-Esteem

Start of Block: Moral norm

Display This Question:
If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... != I have never drank alcohol in my life

Q54 Here are some more questions about alcohol consumption. Please note: to drink alcohol responsibly means (1) not getting drunk, (2) taking safety precautions while drinking alcohol, and (3) not letting alcohol control your life or your relationships. While you are drinking alcohol, you should: - Make sure you are safe - Make sure other people are safe - Minimize the risks to yourself and others - Drink in moderation - Not too much and not too fast - Have a good time

Display This Question:
If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... != I have never drank alcohol in my life

Q45 It is in accordance with my principles to drink alcohol responsibly.

☐ Definitely disagree (1)

☐ Mostly disagree (2)

☐ Somewhat disagree (3)

☐ Neither agree nor disagree (4)

☐ Somewhat agree (5)

☐ Mostly agree (6)

☐ Definitely Agree (7)
Q44 Drinking alcohol responsibly would be acting according to my moral values.

○ Definitely disagree (1)
○ Mostly disagree (2)
○ Somewhat disagree (3)
○ Neither agree nor disagree (4)
○ Somewhat agree (5)
○ Mostly agree (6)
○ Definitely agree (7)

Display This Question:
If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... != I have never drank alcohol in my life

Q48 It is against my personal values to drink alcohol irresponsibly.

○ Definitely disagree (1)
○ Mostly disagree (2)
○ Somewhat disagree (3)
○ Neither agree nor disagree (4)
○ Somewhat agree (5)
○ Mostly agree (6)
○ Definitely agree (7)
End of Block: Moral norm

Start of Block: Demographics

Q49 What is your gender identity?

▼ Male (1) ... Prefer not to answer (6)

---

Q94 You selected 'Other' for gender identity. Please specify:

---

Q51 What is your ethnicity?

- White (1)
- Black (2)
- Asian (3)
- Hispanic (4)
- Native Hawaiian or Pacific Islander (5)
- American Indian or Inuit (6)
- Other (7)

---

Q92 You answered "other" for your ethnicity. Please specify:

---
Q52 Are you a member of a fraternity or sorority?

- Yes (1)
- No (2)

Q53 What is your height?

- 4' (44) ... 8' (43)

Q54 What is your weight in pounds (lbs)? If you do not know exactly, please approximate.

Q55 Which College are you a part of?

- Agriculture (1) ... -None of the above- (14)

Q56 Are you a graduate student?

- Yes (1)
- No (2)

Q57 Do you participate in organized sports? (intramurals, club, Purdue athletics, local leagues)

- Yes (1)
- No (2)

End of Block: Demographics

Start of Block: Closing statements
Q68 As researchers we are not qualified to provide counseling services and we will not be following up with you after this study. If you feel upset after completing the study, or find that some questions or aspects of the study triggered distress, talking with a qualified clinician may help. If you feel you would like assistance please contact Purdue Counseling and Psychological services at (765) 494-6995 Monday-Friday, 8:00a.m.-5:00p.m. In the case of an emergency please call 911.

Q99 Thank you for completing our survey. If you have any comments, please write them in the box below.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

End of Block: Closing statements
Alcohol Consumption and Physical Activity Survey

Q65 You are being invited to participate in a research study titled “Alcohol Consumption and Physical Activity in College Students: Investigating the Role of Guilt and Body Image”. This study is being conducted by Dr. Steve Amireault from Purdue University. You were selected to participate in this study because you are a Purdue Student between the ages of 18-25. We seek to recruit at least 660 Purdue students.

The purpose of this research study is to expand on the understanding of the relationship between alcohol consumption and physical activity in college students. If you agree to take part in this study, you will be asked to complete two online surveys approximately 30 days apart. This survey will ask about alcohol consumption, physical activity, guilt from drinking alcohol, body image, personality characteristics and socio-demographic characteristics. It will take you approximately 5-10 minutes to complete each survey.

You may not directly benefit from this research; however, we hope that your participation in the study may help us to better understand the relationship between alcohol consumption and physical activity with a purpose to inform the development of future programs, policies, and interventions to promote responsible alcohol drinking behaviors while increasing physical activity participation among college-aged students.

Your participation in this study is entirely voluntary. You may refuse to participate or withdraw from this study at any time, and without penalty or loss of benefits to which you are otherwise entitled. You may also skip any question that you choose. If you decide not to participate, or if you discontinue your participation, you will suffer no prejudice regarding health care or your participation in any other research studies. Participation in this study will not involve any additional costs to you. We believe there are no known risks associated with this research study that exceed those of daily life; however, as with any online related activity, there is always a risk for a confidentiality breach. Although there is a risk that a participant could be identified due to his/her socio-demographic responses, this risk is minimal. We will minimize any risks by asking you to create an alpha numeric ID number rather than asking for identifying information. As a result, it will be impossible for anyone to link a participant's name to their study ID number, and no information identifying the participants could be transferred to anyone.

To the best of our ability, your answers in this study will remain confidential. The project’s research records (i.e., your responses to the online survey) may be reviewed by departments at Purdue University responsible for regulatory and research oversight. We will not reveal your identity in any presentation or publication. We will store data in a non-identifiable form indefinitely. Electronic documents and data will be stored on a password-protected Purdue
University
As researchers we are not qualified to provide counseling services and we will not be following up with you after this study. If you feel upset after completing the study, or find that some questions or aspects of the study triggered distress, talking with a qualified clinician may help. If you feel you would like assistance please contact Purdue Counseling and Psychological services at (765) 494-6995 Monday-Friday, 8:00a.m.-5:00p.m. In the case of an emergency please call 911.

If you have questions, comments, or concerns about this research project, you can talk to one of the researchers. Please contact Dr. Steve Amireault at 765-496-0568 or samireau@purdue.edu, or Jonathan Spencer at spenc107@purdue.edu.

If you have questions about your rights while taking part in the study or have concerns about the treatment of research participants, please call the Human Research Protection Program at (765) 494-5942, email (irb@purdue.edu) or write to: Human Research Protection Program - Purdue University

Ernest C. Young Hall, Room 1032
155 S. Grant St.
West Lafayette, IN 47907-2114

By clicking “I agree” below you are indicating that you are a Purdue student aged between 18 to 25 years old, have read and understood this consent form and agree to participate in this research study. Please print a copy of this page for your records.

☐ I agree (1)

☐ I do not agree (2)

Skip To: End of Survey If You are being invited to participate in a research study titled “Alcohol Consumption and Physical... = I do not agree

Q66 In order to ensure confidentiality, We ask you to provide the following information in order to create an alpha numeric ID:

What is the first letter of your first name?

▼ A (1) ... Z (26)

Q69
What is the first letter of your last name?

▼ A (1) ... Z (26)
Q70 Gender: M=male F=female O=other X=prefer not to answer

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Q71 What is the number of your birth month?

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Q72 On which day of the month were you born?

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<tr>
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<td>1</td>
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End of Block: Confidentiality/alpha numeric

Start of Block: Age

Q50 In what year were you born?

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Page Break
Start of Block: Physical Activity

Q97
Here are some questions about your physical activity level:

Q52 During the **past 12 months**, on how many sports teams did you play? (Include any teams run by Purdue University or community groups)

- No team participation (1)
- 1 team (2)
- 2 teams (3)
- 3 or more teams (4)
Q96 In the past month, how often have you participated in one or more physical activities for 20-30 minutes per session during your free time?

- Never (1)
- About once (2)
- 2 to 3 times (3)
- About once per week (4)
- About 2 times per week (5)
- About 3 times per week (6)
- 4 or more times per week (7)
Q67 Considering **A TYPICAL WEEK** (7-day period), how many times on average do you do the following kinds of exercise for **more than fifteen minutes** during your free time?

Write the appropriate **number of occasions** in the box.

---

**Q1**

**Strenuous Exercise** (Heart Beats rapidly)
(examples: running, jogging, hockey, soccer, basketball, vigorous swimming (lap swimming), vigorous biking, cross-country skiing)

---

**Q2**

**Moderate Exercise** (Not exhausting)
(examples: fast walking, golf without a cart, tennis doubles, easy bicycling, easy swimming, alpine skiing, weight lifting, hiking)

---

**Q3**

**Mild Exercise** (minimal effort)
(examples: easy walking, gentle yoga/stretching, fishing, bowling, golf with a cart)

---

Page Break
Q5 In the past week (the last 7 days), on how many days have you done a total of 30 minutes or more physical activity which has done enough to raise your breathing rate. This may include sports, running, jogging, aerobics, bicycling, and fast walking, but should not include housework or physical activity that is part of your job.

- 0 day (1)
- 1 day (2)
- 2 days (3)
- 3 days (4)
- 4 days (5)
- 5 days (6)
- 6 days (7)
- 7 days (8)
End of Block: Physical Activity

Start of Block: Intention

Q58 NOTE: To regularly engage in physical activity refers to accumulating at least 150 minutes/week of at least moderate intensity activity, every week. Physical activity should be performed at least 3 days/week (if vigorous intensity) to 5 days/week (if moderate intensity), and spread throughout the week. Free time refers to time that can be spent on one’s own activities rather than work or domestic chores.

Q73 I intend to regularly engage in physical activity during my free time in the next month.

- Definitely disagree (1)
- Mostly disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Mostly agree (6)
- Definitely agree (9)
Q9 I will regularly engage in physical activity during my free time in the next month.

- Definitely disagree (1)
- Mostly disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Mostly agree (6)
- Definitely agree (7)

Q10 I plan to regularly engage in physical activity during my free time in the next month.

- Definitely disagree (1)
- Mostly disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Mostly agree (6)
- Definitely agree (7)
Q58 During the **last month** (i.e. 30 days), **how often** did you usually have any kind of drink containing alcohol? By a drink we mean half an ounce of absolute alcohol (e.g. a 12 ounce can or glass of beer or cooler, a 5 ounce glass of wine, or a drink containing 1 shot of liquor). Choose only one.

- Every day (1)
- 5-6 times per week (2)
- 3-4 times per week (3)
- twice per week (4)
- once per week (5)
- 2-3 times per month (6)
- once per month (7)
- I did not drink any alcohol in the past month, but I have drank in the past (10)
- I have never drank alcohol in my life (11)
Q60 So you have never had a drink of alcohol in your entire life?

○ Yes, never (1)

○ no, I have (if selected, please return to the first question and change your answer) (2)
Q61 During the last month (i.e. 30 days), how many alcoholic drinks did you have on a typical day when you drank alcohol? By a drink we mean half an ounce of absolute alcohol (e.g. a 12 ounce can or glass of beer or cooler, a 5 ounce glass of wine, or a drink containing 1 shot of liquor).

- 25 or more (1)
- 19-24 (2)
- 16-18 (3)
- 12-15 (4)
- 9-11 (5)
- 7-8 (6)
- 5-6 (7)
- 3-4 (8)
- 2 (9)
- 1 (10)
Q62 During the **last month** (i.e. 30 days), how often on average did you have 5 or more (males) or 4 or more (females) drinks containing alcohol **within a two-hour period**?

That would be equivalent of at least 5 (males) or 4 (female) 5-oz glasses of wine, 12-oz beers, or one drink containing one shot of liquor.

- Every day (1)
- 5-6 times per week (2)
- 3-4 times per week (3)
- 2 times per week (4)
- once per week (5)
- 2-3 times per month (6)
- once per month (7)
- never (8)
Q59 During the **last month** (i.e. 30 days), what is the maximum number of drinks containing alcohol you have had in a **24-hour period**?

By a drink we mean half an ounce of absolute alcohol (e.g. a 12 ounce can or glass of beer or cooler, a 5 ounce glass of wine, or a drink containing 1 shot of liquor).

- 36 or more (1)
- 24-35 (2)
- 18-23 (3)
- 12-17 (4)
- 8-11 (5)
- 5-7 (6)
- 4 (7)
- 3 (8)
- 2 (9)
- 1 (10)
End of Block: Alcohol consumption

Start of Block: Guilt from Drinking

Q95 The following are some statements which may or may not describe how you are feeling when you have had at least one drink of alcohol (i.e., the very next day after your last drink). Please rate each statement using the 7-point scale below. Remember to rate each statement based on how you are feeling the very next day after having consumed alcohol.

By a drink we mean half an ounce of absolute alcohol (e.g. a 12 ounce can or glass of beer or cooler, a 5 ounce glass of wine, or a drink containing 1 shot of liquor).

---

**Display This Question:**

If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... ! = I have never drank alcohol in my life

---

Q42 When I have at least one drink, I experience feelings of guilt later on.

- ○ Disagree completely (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Agree completely (7)

---

**Display This Question:**

If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... ! = I have never drank alcohol in my life
Q14 When I have at least one drink, the following day I get distressed by the feeling that I did something wrong.

☐ Disagree completely (1)

☐ Disagree (2)

☐ Somewhat disagree (3)

☐ Neither agree nor disagree (4)

☐ Somewhat agree (5)

☐ Agree (6)

☐ Agree completely (7)

Display This Question:
If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... != I have never drank alcohol in my life

Q12 When I have at least one drink, I have feelings of remorse, regret.

☐ Disagree completely (1)

☐ Disagree (2)

☐ Somewhat disagree (3)

☐ Neither agree nor disagree (4)

☐ Somewhat agree (5)

☐ Agree (6)

☐ Agree completely (7)

Display This Question:
If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... != I have never drank alcohol in my life
Q37 When I have at least one drink, later on I feel like I have done something bad.

- Disagree completely (1)
- Disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Agree (6)
- Agree completely (7)

Display This Question:
If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... != I have never drank alcohol in my life

Q11 When I have at least one drink, the next day I cannot stop thinking about my drinking behavior.

- Disagree completely (1)
- Disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Agree (6)
- Agree completely (7)

Page Break

End of Block: Guilt from Drinking

Start of Block: Extraversion
Q64 Please indicate to which degree the following words describe you.

---

Q26
Outgoing

- Very inaccurate (1)
- Slightly inaccurate (2)
- Neutral (3)
- Slightly accurate (4)
- Very accurate (5)

---

Q27 Untalkative

- Very Inaccurate (1)
- Slightly inaccurate (2)
- Neutral (3)
- Slightly accurate (4)
- Very accurate (5)
Q28 Extroverted

- Very Inaccurate (1)
- Slightly inaccurate (2)
- Neutral (3)
- Slightly accurate (4)
- Very accurate (5)

Q30 Quiet

- Very Inaccurate (1)
- Slightly inaccurate (2)
- Neutral (3)
- Slightly accurate (4)
- Very accurate (5)

Q31 Talkative

- Very Inaccurate (1)
- Slightly inaccurate (2)
- Neutral (3)
- Slightly accurate (4)
- Very accurate (5)
Q32 Shy

- Very Inaccurate (1)
- Slightly inaccurate (2)
- Neutral (3)
- Slightly accurate (4)
- Very accurate (5)

Q33 Energetic

- Very Inaccurate (1)
- Slightly inaccurate (2)
- Neutral (3)
- Slightly accurate (4)
- Very accurate (5)

Q34 Reserved

- Very Inaccurate (1)
- Slightly inaccurate (2)
- Neutral (3)
- Slightly accurate (4)
- Very accurate (5)
End of Block: Extraversion

Start of Block: Body Image

Q93 The following pages contain a series of statements about how people might think, feel, or behave. You are asked to indicate the extent to which each statement pertains to you personally. Your answers to the items in the questionnaire are anonymous. In order to complete the questionnaire, read each statement carefully and decide how much it pertains to you personally. There are no right or wrong answers. Just give the answer that is most accurate for you. Remember, your responses are confidential, so please be completely honest and answer all items.

Q35 Before going out in public I always notice how I look.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q74 I am careful to buy clothes that make me look my best.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)
Q75 My body is sexually appealing.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q76 I like my looks just the way they are.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q77 I check my appearance in the mirror whenever I can.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)
Q78 Before going out, I usually spend a lot of time getting ready.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q79 Most people would consider me good looking.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q80 It is important that I always look good.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)
Q81 I use very few grooming products.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q82 I like the way I look without my clothes on.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Page Break
Q83 I am self-conscious if my grooming isn't right.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q84 I usually wear whatever is handy without caring how it looks.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q85 I like the way my clothes fit me.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)
Q86 I don't care what people think about my appearance.

☐ Definitely disagree (1)

☐ Mostly disagree (2)

☐ Neither agree nor disagree (3)

☐ Mostly agree (4)

☐ Definitely agree (5)

-----------------------------------------------

Q87 I take special care with my hair grooming.

☐ Definitely disagree (1)

☐ Mostly disagree (2)

☐ Neither agree nor disagree (3)

☐ Mostly agree (4)

☐ Definitely agree (5)

-----------------------------------------------
Q88 I dislike my physque.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q89 I am physically unattractive.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q90 I never think about my appearance.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)
Q91 I am always trying to improve my physical appearance.

○ Definitely disagree (1)

○ Mostly disagree (2)

○ Neither agree nor disagree (3)

○ Mostly agree (4)

○ Definitely agree (5)
End of Block: Body Image

Start of Block: Demographics

Q49 What is your gender identity?

▼ Male (1) ... Prefer not to answer (6)

Display This Question:
If What is your gender identity? = Other

Q94 You selected 'Other' for gender identity. Please specify:

Q51 What is your ethnicity?

☐ White (1)

☐ Black (2)

☐ Asian (3)

☐ Hispanic (4)

☐ Native Hawaiian or Pacific Islander (5)

☐ American Indian or Inuit (6)

☐ Other (7)

Display This Question:
If What is your ethnicity? = Other

Q92 You answered "other" for your ethnicity. Please specify:

Q53 What is your height?

▼ 4' (44) ... 8' (43)
Q54 What is your weight in pounds (lbs)? If you do not know exactly, please approximate.

Q55 Which college are you a part of?

▼ Agriculture (1) ... -None of the above- (14)

Display This Question:
If Which college are you a part of? = -None of the above-

Q104 You answered "none of the above" for "which college are you a part of?". Please specify:

Q56 Are you a graduate student?

○ Yes (1)

○ No (2)

Q57 Do you participate in organized sports? (intramurals, club, Purdue athletics, local leagues)

○ Yes (1)

○ No (2)

Q52 Are you a member of a fraternity or sorority?

○ Yes (1)

○ No (2)

End of Block: Demographics
Start of Block: Closing statements

Q68 As researchers we are not qualified to provide counseling services and we will not be following up with you after this study. If you feel upset after completing the study, or find that some questions or aspects of the study triggered distress, talking with a qualified clinician may help. If you feel you would like assistance please contact Purdue Counseling and Psychological services at (765) 494-6995 Monday-Friday, 8:00a.m.-5:00p.m. In the case of an emergency please call 911.

End of Block: Closing statements

T2 Alcohol Consumption and Physical Activity Survey

Start of Block: Confidentiality/alpha numeric

Q65 You are being invited to participate in a research study titled “Alcohol Consumption and Physical Activity in College Students: Investigating the Role of Guilt and Body Image”. This study is being conducted by Dr. Steve Amireault from Purdue University. You were selected to participate in this study because you are a Purdue Student between the ages of 18-25. We seek to recruit at least 660 Purdue students.

The purpose of this research study is to expand on the understanding of the relationship between alcohol consumption and physical activity in college students. If you agree to take part in this study, you will be asked to complete two online surveys approximately 30 days apart. This survey will ask about alcohol consumption, physical activity, guilt from drinking alcohol, body image, personality characteristics and socio-demographic characteristics. It will take you approximately 5-10 minutes to complete each survey.

You may not directly benefit from this research; however, we hope that your participation in the
study may help us to better understand the relationship between alcohol consumption and physical activity with a purpose to inform the development of future programs, policies, and interventions to promote responsible alcohol drinking behaviors while increasing physical activity participation among college-aged students.

**Your participation in this study is entirely voluntary.** You may refuse to participate or withdraw from this study at any time, and without penalty or loss of benefits to which you are otherwise entitled. You may also skip any question that you choose. If you decide not to participate, or if you discontinue your participation, you will suffer no prejudice regarding health care or your participation in any other research studies. Participation in this study will not involve any additional costs to you. We believe there are no known risks associated with this research study that exceed those of daily life; however, as with any online related activity, there is always a risk for a confidentiality breach. Although there is a risk that a participant could be identified due to his/her socio-demographic responses, this risk is minimal. We will minimize any risks by asking you to create an alpha numeric ID number rather than asking for identifying information. As a result, it will be impossible for anyone to link a participant's name to their study ID number, and no information identifying the participants could be transferred to anyone.

**To the best of our ability, your answers in this study will remain confidential.** The project’s research records (i.e., your responses to the online survey) may be reviewed by departments at Purdue University responsible for regulatory and research oversight. We will not reveal your identity in any presentation or publication. We will store data in a non-identifiable form indefinitely. Electronic documents and data will be stored on a password-protected Purdue University server.

As researchers we are not qualified to provide counseling services and we will not be following up with you after this study. If you feel upset after completing the study, or find that some questions or aspects of the study triggered distress, talking with a qualified clinician may help. If you feel you would like assistance please contact Purdue Counseling and Psychological services at (765) 494-6995 Monday-Friday, 8:00a.m.-5:00p.m. In the case of an emergency please call 911.

If you have questions, comments, or concerns about this research project, you can talk to one of the researchers. Please contact Dr. Steve Amireault at 765-496-0568 or samireau@purdue.edu, or Jonathan Spencer at spenc107@purdue.edu.

If you have questions about your rights while taking part in the study or have concerns about the treatment of research participants, please call the Human Research Protection Program at (765) 494-5942, email (irb@purdue.edu) or write to: Human Research Protection Program - Purdue University

Ernest C. Young Hall, Room 1032
155 S. Grant St.
West Lafayette, IN 47907-2114

By clicking “I agree” below you are indicating that you are a
Purdue student aged between 18 to 25 years old, have read and understood this consent form and agree to participate in this research study. Please print a copy of this page for your records.

☐ I agree (1)

☐ I do not agree (2)

Skip To: End of Survey If You are being invited to participate in a research study titled “Alcohol Consumption and Physical... = I do not agree

Q66 In order to ensure confidentiality, We ask you to provide the following information in order to create an alpha numeric ID:

What is the first letter of your first name?

▼ A (1) ... Z (26)

Q69

What is the first letter of your last name?

▼ A (1) ... Z (26)

Q70 Gender: M=male F=female O=other X=prefer not to answer

▼ M (1) ... X (4)

Q71 What is the number of your birth month?

▼ 01 (1) ... 12 (12)

Q72 On which day of the month were you born?

▼ 01 (1) ... 31 (31)

End of Block: Confidentiality/alpha numeric
Start of Block: Age
Q50 In what year were you born?

| ▼ | 2001 (2) ... 1992 (11) |
Q97
Here are some questions about your physical activity level:

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Q52 During the **past 12 months**, on how many sports teams did you play? (Include any teams run by Purdue University or community groups)

- [ ] No team participation (1)
- [ ] 1 team (2)
- [ ] 2 teams (3)
- [ ] 3 or more teams (4)

---

Page Break
Q96 In the **past month**, how often have you participated in one or more physical activities for 20-30 minutes per session during your free time?

- Never  (1)
- About once  (2)
- 2 to 3 times  (3)
- About once per week  (4)
- About 2 times per week  (5)
- About 3 times per week  (6)
- 4 or more times per week  (7)
Q67 Considering **A TYPICAL WEEK** (7-day period), how many times on average do you do the following kinds of exercise for **more than fifteen minutes** during your free time?

Write the appropriate **number of occasions** in the box.

* * *

Q1 **Strenuous Exercise** *(Heart Beats rapidly)*
(examples: running, jogging, hockey, soccer, basketball, vigorous swimming (lap swimming), vigorous biking, cross-country skiing)

* * *

Q2 **Moderate Exercise** *(Not exhausting)*
(examples: fast walking, golf without a cart, tennis doubles, easy bicycling, easy swimming, alpine skiing, weight lifting, hiking)

* * *

Q3 **Mild Exercise** *(minimal effort)*
(examples: easy walking, gentle yoga/stretching, fishing, bowling, golf with a cart)
Q5 In the past week (the last 7 days), on how many days have you done a total of 30 minutes or more physical activity which has done enough to raise your breathing rate. This may include sports, running, jogging, aerobics, bicycling, and fast walking, but should not include housework or physical activity that is part of your job.

- 0 day (1)
- 1 day (2)
- 2 days (3)
- 3 days (4)
- 4 days (5)
- 5 days (6)
- 6 days (7)
- 7 days (8)
End of Block: Physical Activity

Start of Block: Intention

Q58 NOTE: To regularly engage in physical activity refers to accumulating at least 150 minutes/week of at least moderate intensity activity, every week. Physical activity should be performed at least 3 days/week (if vigorous intensity) to 5 days/week (if moderate intensity), and spread throughout the week. Free time refers to time that can be spent on one’s own activities rather than work or domestic chores.

Q73 I **intend** to regularly engage in physical activity during my free time in the **next month**.

- Definitely disagree (1)
- Mostly disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Mostly agree (6)
- Definitely agree (9)
Q9 I **will** regularly engage in physical activity during my free time in the **next month**.

- Definitely disagree (1)
- Mostly disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Mostly agree (6)
- Definitely agree (7)

Q10 I **plan** to regularly engage in physical activity during my free time in the **next month**.

- Definitely disagree (1)
- Mostly disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Mostly agree (6)
- Definitely agree (7)
End of Block: Intention

Start of Block: Alcohol consumption

Q98 Here are some questions about your alcohol consumption:

Q58 During the last month (i.e. 30 days), how often did you usually have any kind of drink containing alcohol? By a drink we mean half an ounce of absolute alcohol (e.g. a 12 ounce can or glass of beer or cooler, a 5 ounce glass of wine, or a drink containing 1 shot of liquor). Choose only one.

- Every day (1)
- 5-6 times per week (2)
- 3-4 times per week (3)
- twice per week (4)
- once per week (5)
- 2-3 times per month (6)
- once per month (7)
- I did not drink any alcohol in the past month, but I have drank in the past (10)
- I have never drank alcohol in my life (11)

Skip To: End of Block If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... = I did not drink any alcohol in the past month, but I have drank in the past

Page Break
Display This Question:
If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... = I have never drank alcohol in my life

Q60 So you have never had a drink of alcohol in your entire life?

☐ Yes, never (1)

☐ no, I have (if selected, please return to the first question and change your answer) (2)

Skip To: End of Block If So you have never had a drink of alcohol in your entire life? = Yes, never

Page Break
Q61 During the **last month** (i.e. 30 days), how many alcoholic drinks did you have on a typical day when you drank alcohol? By a drink we mean half an ounce of absolute alcohol (e.g. a 12 ounce can or glass of beer or cooler, a 5 ounce glass of wine, or a drink containing 1 shot of liquor).

- 25 or more (1)
- 19-24 (2)
- 16-18 (3)
- 12-15 (4)
- 9-11 (5)
- 7-8 (6)
- 5-6 (7)
- 3-4 (8)
- 2 (9)
- 1 (10)
- 0 (11)
Q62 During the **last month** (i.e. 30 days), how often on average did you have 5 or more (males) or 4 or more (females) drinks containing alcohol **within a two-hour period**?

That would be equivalent of at least 5 (males) or 4 (female) 5-oz glasses of wine, 12-oz beers, or one drink containing one shot of liquor.

- Every day (1)
- 5-6 times per week (2)
- 3-4 times per week (3)
- 2 times per week (4)
- once per week (5)
- 2-3 times per month (6)
- once per month (7)
- never (8)
Q59 During the **last month** (i.e. 30 days), what is the maximum number of drinks containing alcohol you have had in a **24-hour period**?

By a drink we mean half an ounce of absolute alcohol (e.g. a 12 ounce can or glass of beer or cooler, a 5 ounce glass of wine, or a drink containing 1 shot of liquor).

- [ ] 36 or more (1)
- [ ] 24-35 (2)
- [ ] 18-23 (3)
- [ ] 12-17 (4)
- [ ] 8-11 (5)
- [ ] 5-7 (6)
- [ ] 4 (7)
- [ ] 3 (8)
- [ ] 2 (9)
- [ ] 1 (10)
- [ ] 0 (11)
End of Block: Alcohol consumption

Start of Block: Guilt from Drinking

Display This Question:
If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... != I have never drank alcohol in my life

Q95 The following are some statements which may or may not describe how you are feeling when you have had at least one drink of alcohol (i.e., the very next day after your last drink). Please rate each statement using the 7-point scale below. Remember to rate each statement based on how you are feeling the very next day after having consumed alcohol.

By a drink we mean half an ounce of absolute alcohol (e.g. a 12 ounce can or glass of beer or cooler, a 5 ounce glass of wine, or a drink containing 1 shot of liquor).

Display This Question:
If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... != I have never drank alcohol in my life

Q42 When I have at least one drink, I experience feelings of guilt later on.

- Disagree completely (1)
- Disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Agree (6)
- Agree completely (7)
Q14 When I have at least one drink, the following day I get distressed by the feeling that I did something wrong.

- Disagree completely (1)
- Disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Agree (6)
- Agree completely (7)

*Display This Question:*
If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... != I have never drank alcohol in my life

Q12 When I have at least one drink, I have feelings of remorse, regret.

- Disagree completely (1)
- Disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Agree (6)
- Agree completely (7)

*Display This Question:*
If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... != I have never drank alcohol in my life
Q37 When I have at least one drink, later on I feel like I have done something bad.

- Disagree completely (1)
- Disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Agree (6)
- Agree completely (7)

Display This Question:
If During the last month (i.e. 30 days), how often did you usually have any kind of drink containing... != I have never drank alcohol in my life

Q11 When I have at least one drink, the next day I cannot stop thinking about my drinking behavior.

- Disagree completely (1)
- Disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Agree (6)
- Agree completely (7)
Q93 The following pages contain a series of statements about how people might think, feel, or behave. You are asked to indicate the extent to which each statement pertains to you personally. Your answers to the items in the questionnaire are anonymous. In order to complete the questionnaire, read each statement carefully and decide how much it pertains to you personally. There are no right or wrong answers. Just give the answer that is most accurate for you. Remember, your responses are confidential, so please be completely honest and answer all items.

---

Q35 Before going out in public I always notice how I look.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

---

Q74 I am careful to buy clothes that make me look my best.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)
Q75 My body is sexually appealing.

- Definitely disagree (1)
- Mostly disagree (2)
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Q76 I like my looks just the way they are.

- Definitely disagree (1)
- Mostly disagree (2)
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Q77 I check my appearance in the mirror whenever I can.

- Definitely disagree (1)
- Mostly disagree (2)
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- Mostly agree (4)
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Q78 Before going out, I usually spend a lot of time getting ready.

- Definitely disagree (1)
- Mostly disagree (2)
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- Mostly agree (4)
- Definitely agree (5)

Q79 Most people would consider me good looking.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q80 It is important that I always look good.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)
Q81 I use very few grooming products.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)

Q82 I like the way I look without my clothes on.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
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- Definitely agree (5)
Q83 I am self-conscious if my grooming isn't right.

- Definitely disagree (1)
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- Definitely disagree (1)
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- Neither agree nor disagree (3)
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Q86 I don't care what people think about my appearance.

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Q89 I am physically unattractive.

- Definitely disagree (1)
- Mostly disagree (2)
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- Mostly agree (4)
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Q90 I never think about my appearance.

- Definitely disagree (1)
- Mostly disagree (2)
- Neither agree nor disagree (3)
- Mostly agree (4)
- Definitely agree (5)
Q91 I am always trying to improve my physical appearance.

○ Definitely disagree (1)

○ Mostly disagree (2)

○ Neither agree nor disagree (3)

○ Mostly agree (4)

○ Definitely agree (5)
Q57 Do you participate in organized sports? (intramurals, club, Purdue athletics, local leagues)

☐ Yes (1)

☐ No (2)

Q54 What is your weight in pounds (lbs)? If you do not know exactly, please approximate.

Q53 What is your height?

▼ 4’ (44) ... 8’ (43)

Q68 As researchers we are not qualified to provide counseling services and we will not be following up with you after this study. If you feel upset after completing the study, or find that some questions or aspects of the study triggered distress, talking with a qualified clinician may help. If you feel you would like assistance please contact Purdue Counseling and Psychological services at (765) 494-6995 Monday-Friday, 8:00a.m.-5:00p.m. In the case of an emergency please call 911.

Q99 Thank you for completing our survey. If you have any comments, please write them in the box below.

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

End of Block: Closing statements/Height and Weight