

**Depression and the Role of Perceived Stress Controllability During the COVID-19**

**Pandemic**

by

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### **Abstract**

The learned helplessness theory of depression suggests that a perceived loss of control over stressful events is associated with depression. However, little research has tested this relationship in humans, and there has been little to no discussion of the possible effect of biological sex. The present study examined the relationship between perceived stress controllability and depression in a sample of college students during the COVID-19 pandemic, and whether biological sex moderated this relationship. Participants (ages 18-38,  $N = 295$ ) were university students who were enrolled in the study near the beginning of the COVID-19 pandemic and assessed across the subsequent eight weeks. Using remote surveys, we assessed stressors the participants had experienced as well as the amount of control they felt they had over each; we also assessed anhedonic depression via surveys. At baseline, there was a significant correlation between perceived stress controllability and depression. Biological sex was not a moderator of this relationship, but planned post hoc analyses revealed baseline perceived stress controllability was significantly associated with depression in females but not in males. Across the eight weeks of the study, there was not a significant relationship between change in perceived stress controllability and change in depression, and biological sex was not a moderator. Planned post hoc analyses, however, showed that there was a significant correlation between change in perceived stress controllability and change in depression in females but not in males. These results suggest a possible relationship between perceived stress controllability and depression in females. However, our results were mixed and therefore further research is necessary to elucidate the nature of the relationship between perceived stress controllability and depression, and the extent to which this is moderated by sex. If this relationship does exist, it could suggest a potential target for therapy, particularly in females.

Internalizing disorders such as depression and anxiety are highly prevalent, impairing, and debilitating. Thirty percent of individuals within the United States will develop major depressive disorder at some point in their lives (Fassett-Carmen et al., 2020). University students are at particular risk for depression. Specifically, rates of depression have been on the rise since the start of the COVID-19 pandemic, and it is currently estimated that one in three college students experience clinically significant depression (Druckenmiller, 2022). However, the factors that place an individual at heightened risk to develop depression, or experience sustained depression over time, remain unknown.

One potential factor that may contribute to risk is the perception of low controllability over life events, and especially negative events such as stressors. Indeed, there are several theoretical models, and related lines of research, that link perceived controllability to depression, including (a) learned helplessness, (b) hopelessness theory, and (c) locus of control. These models are briefly summarized below.

Learned helplessness is a phenomenon in which animals who are exposed to a harmful stimulus and are unable to escape will fail to try to escape the next time they are exposed to this stimulus even when escape is possible (Miller & Seligman, 1967). Furthermore, they found that having control over the stressor in one trial protected the animals from learned helplessness in future trials. The original research done by Seligman (1967) observed this behavior in dogs. Similar research designs have since been performed in a variety of other animals including humans and yielded similar results (Maier & Seligman, 1976; Seligman, 1975). Seligman (1975) brought attention to the similarities between the behavioral and emotional symptoms experienced in learned helplessness and the cognitive, emotional, and motivational deficits characteristic of clinical depression. For example, Seligman and colleagues (1976) showed that humans who were

given inescapable noise and unsolvable problems displayed instrumental and cognitive task deficits which parallel those found in naturally occurring clinical depression. For example, when given an unsolvable task, participants showed apathy and loss of motivation regarding new tasks. These findings prompted Seligman (1975) to propose a learned helplessness theory of depression. The learned helplessness theory of depression suggests that the cognitive, emotional, and motivational deficits observed in these models are a consequence of the subject learning that the outcomes are uncontrollable (Abramson & Seligman, 1978).

The learned helplessness theory of depression was later reformulated as the hopelessness theory of depression (Abramson & Metalsky, 1989). Hopelessness depression is proposed as a subtype of depression which can be explained by a feeling of loss of control and self-efficacy (Abramson & Metalsky, 1989). Since the development of the hopelessness theory of depression, there has been further research done regarding the relationship between hopelessness and depression. Notably, there was a recent study published on the mediation of resilience in the relationship between hopelessness and depression in healthcare workers during the COVID-19 pandemic (Pretorius, 2021). Pretorius (2021) found that hopelessness and depression had a significant positive correlation. Various other studies have shown similar results regarding the relationship between hopelessness and depression.

A third model that addresses perceived control and mood is research regarding locus of control and depression. Locus of control can be defined as the extent to which people believe that they have control over the outcome of events in their lives. One can be said to have an internal locus of control if they believe that they, as opposed to external factors, have control over events in their life. Having greater internal locus of control has been shown to be correlated with lower depression levels when compared to those who have greater external locus of control

(Benassi et al., 1988). There is an argument to be made that in some circumstances having external locus of control can be protective against depression because you do not turn inward and blame yourself for issues that arise in your life (Peterson, 1979). This argument, however, has been largely overshadowed by research findings repeatedly showing that external locus of control correlates positively with depression (Aiken & Baucom, 1982; Yu & Fan, 2016). When considered in combination, locus of control and learned helplessness and hopelessness theories of depression have demonstrated that feeling you have a lack of control over your situation is positively correlated with depression.

The research reviewed above provides strong support for the general theory that perceived (un)controllability is associated with depression, but there are also several gaps in this work. First, although there is a large body of research on general perceptions of control (i.e., the locus of control research described above) or perceived controllability of experimental stress, there is comparatively less research on how perceived controllability over stressful life events correlates with depression. More specifically, previous research in animals and humans has administered a stressor such that researchers can then measure/manipulate the control that the animal has over this stressor. This approach, however, is experimentally designed and does not fully represent a real-world stressor. Fassett-Carmen et al., (2019) found that appraisals of controllability and severity of stressors were associated with depression. Although this study provides promising evidence to support that perceived controllability over real-world stressors is relevant to depression, the present study seeks to replicate and extend these findings to a time in which people are experiencing a real world, significant stressor (COVID-19 pandemic).

A second gap in prior work on controllability and depression is the lack of research investigating potential sex differences. The research that was done on learned helplessness in the

1900s and early 2000s studied male animals only. However, a Nature editorial (2020) set a new standard in which accounting for sex and gender in research is imperative for responsible science. Notably, Baratta et al. (2018) sought to replicate learned helplessness in female rats and, contrary to their hypotheses found that they could not. Furthermore, they found that having control over the stressor in one trial did not protect the females from learned helplessness in future trials, as had been previously demonstrated in males. Baratta et al. (2019) further found that male and female rats show different brain activity particularly in the context of dorsal raphe nucleus serotonin response during controllable stress.

Considering the relatively recent research investigating the effect of biological sex on learned helplessness in the animal model, there has been very little research looking at the effect of biological sex and gender on the relationship between perceived control and depression in humans. Bullers (2001) suggested that women are more likely to have demanding social ties than men and that these demanding social ties increase depression in women. They found a significant association between demanding social ties and depression and further found that this association is stronger in women than in men. In addition, they found that perceived control mediates that relationship between demanding social ties and depression, suggesting that due to more demanding social ties in females, perceived control may influence depression more in females than it does in males. In a more recent study, Fassett-Carmen et al., 2019 found that gender moderated the relationship between the total number of stressors experienced and both depression and anxiety symptoms such that the effects in females were larger than that of males. While this research did not directly show a moderation of gender on the relationship between perceived control and depression/anxiety, it did show that increased number of stressors and perhaps increased perceived loss of control was moderated by the gender of the participant.

Addressing the above gaps, this study will investigate the correlation between perceived lack of control and depression in college students during the COVID-19 pandemic. The COVID-19 pandemic was a time of elevated lack of control over stressors and other events in one's life. During the pandemic there was found to be significantly elevated rates of depression (Salari et al., 2020). This study attempts to show that lack of control may be one mechanism by which depression rates increased during the pandemic. In the present study, we have three core hypotheses. Our first hypothesis is that greater depression scores will correlate with lower perceived controllability over stressful life events at baseline of the study. Our second hypothesis is that change in depression scores will be correlated with change in perceived controllability over stressful events across the eight-week study. Our third and final hypothesis is that biological sex will moderate the relationship between depression and perceived controllability such that males will have a stronger negative correlation between perceived control and depression than will females.

## **Method**

### **Participants**

The sample for this study included 300 undergraduate and graduate students at University of Colorado Boulder. Participants were recruited via electronic postings on the internet, through email, and through social media. Former participants from other studies in our research lab who met the criteria of this study were also contacted (if they had indicated that they wanted to be contacted for future studies). Five participants were excluded from the final analysis due to incomplete survey responses. The final dataset consisted of 295 participants who each completed surveys at baseline and at the end of the eight-week period of participation. Each participant, therefore, had two timepoints of data collection. Sixty participants reported their biological sex

to be male and 235 participants identified their biological sex to be female. The age of participants ranged from 18-38 ( $M=21.3$ ,  $SD=3.0$ ). Further demographic information is displayed in Table 1.

### **Procedure**

Before participants could begin the study, they had to complete an over the phone consent meeting in which a researcher explained the study procedures in detail. At this time, the researcher also completed a brief screening to ensure that the participant was eligible to participate in the study.

After the consent meeting the participant was sent electronic consent materials which they had to sign to continue further with the study. Upon receiving the signed consent materials back from the participant, the researcher then sent the participant a link to their first (baseline) online survey. Surveys were made on a secure data collection platform (REDCap, <https://www.project-redcap.org/>). Participants had 48 hours to complete the survey before the link was disabled. Notably, no personally identifiable information was collected via these online surveys.

The baseline survey collected demographic information as well as two questionnaires used in the following analyses - the Mood and Anxiety Symptom Questionnaire loss of interest subscale and the Adolescent Perceived Events Scale (see below). Following the baseline survey, the participants were sent follow-up surveys with the MASQ loss of interest and APES every two weeks until the end of the study at eight weeks. Only the baseline and eight-week time points were utilized in order to investigate the overall, longer-term change that occurred throughout the course of the study.



After completion of the eight-week survey, participants were contacted via phone call by a researcher to debrief. The participant was then paid via the form of an electronic gift card. The amount of money paid to the participant depended upon the number of completed surveys throughout the course of the eight-week study.

## Surveys

*Demographics.* The RedCap survey at baseline asked participants about demographics including age, year at University of Colorado Boulder, biological sex, and ethnicity.

*Adolescent Perceived Events Scale (APES)* (Compas et al., 1987). The APES is a psychological scale which is used to measure the major and daily stressful events during the developmental period of adolescence. The scale was established in 1987 by Compas et al., (1987). Three studies were utilized to develop the APES such that the scale provided consistent, reliable, and robust results. The APES used in this experiment was modified to be specific to the COVID-19 pandemic. Participants were given twelve situations such as “stress related to moving” or “loss of interaction with friends”. For each of these twelve situations, the participants responded to indicate whether the event had happened to them or not in the past two months. The participants were then directed to rank on a scale of one to five how much control they felt they had over that situation where one was equivalent to the participant feeling they had no control over the situation and five was equivalent to the participant feeling they had complete control over the situation. This scale was scored by averaging the twelve individual controllability scores for each participant at baseline and then averaging the twelve individual controllability scores for each participant at the eight-week timepoint.

*Mood and Anxiety Symptom Questionnaire (MASQ) loss of interest subscale* (Watson et al., 1995a; 1995b). The MASQ was developed by Watson et al., (1995a; 1995b), and contains several subscales. The loss of interest subscale specifically measures anhedonia, which was used as the measure of depression in the present study. When completing this survey, the participants were given seven items, such as “felt really bored”. For each item they had to indicate whether they had felt that way by ranking each item on a scale of one to five. A response of one indicated that a participant did not experience the item at all in the past two months and a response of five indicated that a participant had been experiencing the item to an extreme extent in the past two months. This scale was scored by summing the scores on the seven items for each participant (Watson et al., 1995a: 1995b). Possible MASQ loss of interest scores for each participant ranged from seven to thirty-five.

### **Analysis**

The first hypothesis was that greater depression scores will correlate with lower perceived controllability over stressful events within university students at baseline of the study. Hypothesis 1 was performed as a simple linear regression in which controllability scores on the APES were correlated with depression scores on the MASQ loss of interest subscale at the baseline timepoint.

The second hypothesis was that changes in anhedonic depression will correlate with changes in perceived controllability over stressful events over the eight-week study. To test hypothesis two, we performed a multiple linear regression between the change in APES controllability and change in MASQ loss of interest scores from baseline to eight weeks. The covariate was the number of stressful life events because some participants may have reported zero stressors and no controllability scores whereas others reported all stressors and many

controllability scores. This could affect their average APES scores; including the number of stressful life events reported as a covariate controlled for in our analyses.

The final hypothesis was that biological sex is a moderator in the relationship between depression and perceived controllability such that males have a stronger negative correlation between perceived control and depression than that of females. To determine whether sex moderates the associations of hypothesis one and two, sex was added as a moderator in the prior multiple linear regressions. Planned post-hoc tests were performed to determine the degree of the relationship between perceived stress controllability and depression and *change* in perceived stress controllability and depression within each biological sex, separately.

## Results

### Controllability and Depression at Baseline

To test hypothesis one, a simple linear regression evaluated the extent to which perceived controllability over stressful life events was associated with severity of anhedonic depression at baseline. Baseline Adolescent Perceived Events Scale controllability scores were significantly associated with Mood and Anxiety Symptom Questionnaire Loss of Interest scores at baseline,  $t(287) = -3.02$ ,  $p = .003$ ,  $\eta_p^2 = 0.03$ . For every one point lower on perceived stress controllability, participants reported an average of 1.07 points higher anhedonic depression scores. This relationship is graphed in Figure 1a.

To determine if biological sex was a moderator in the relationship between perceived stress controllability and anhedonic depression at baseline (hypothesis three part one), an interaction with biological sex was added to the linear regression model, thereby making it a multiple regression. In this multiple regression, the main effect of sex on anhedonic depression was significant, and the association between perceived stress controllability and anhedonic

depression continued to be significant. Averaging across sex, for every one point higher participants reported Adolescent Perceived Events Scale controllability at baseline, they reported an average of 0.90 points lower Mood and Anxiety Symptom Questionnaire Loss of Interest scores,  $t(285) = -2.50, p = .013, \eta_p^2 = 0.02$ . Females on average reported loss of interest scores that were 1.78 points higher than those of males,  $t(285) = 1.98, p = .049, \eta_p^2 = 0.01$ . The interaction between the effect of controllability and the effect of sex was not significant,  $t(285) = -0.72, p = .473, \eta_p^2 = 0.002$ .

Post-hoc analyses were performed to evaluate the magnitude of the association between controllability and depressive symptoms for females and males separately. In females, the association between perceived stress controllability and depressive symptoms was significant. For every one standard deviation higher in Adolescent Perceived Events Scale controllability scores at baseline, females reported an average of 1.16 points lower Mood and Anxiety Symptom Questionnaire Loss of Interest scores,  $t(228) = -2.37, p = .019, \eta_p^2 = 0.02$ . The relationship between perceived stress controllability and anhedonic depression was not significant in males. Males showed for every one point higher in perceived stress controllability at baseline, these participants reported an average of 0.64 points lower anhedonic depression scores, which was not significantly different than zero,  $t(57) = -1.33, p = .190, \eta_p^2 = 0.03$ . These relationships are graphed in Figures 1b and 1c.

### **Change in Controllability and Depression Across the Study**

To test hypothesis two, a simple linear regression was performed to predict change in anhedonic depression scores (change score calculated as eight-week Mood and Anxiety Symptom Questionnaire Loss of Interest scores minus baseline Mood and Anxiety Symptom Questionnaire Loss of Interest scores) with change in perceived stress controllability scores

(change score calculated as eight-week Adolescent Perceived Events Scale scores minus baseline Adolescent Perceived Events Scale scores) controlling for number of stressful events reported at baseline and eight weeks (Adolescent Perceived Events Scale- Number of Event scores at eight-weeks, and at baseline). Across the full group, change in perceived stress controllability did not significantly predict the change in anhedonic depression,  $t(233) = -1.57, p = .117, \eta_p^2 = 0.01$ . This relationship is graphed in Figure 2a.

To determine if biological sex was a moderator in the relationship between changes in Adolescent Perceived Events Scale Controllability scores and changes in Mood and Anxiety Symptom Questionnaire Loss of Interest scores across the study period (hypothesis three part two), a second multiple regression was performed. In this multiple regression, change in anhedonic depression scores (eight-week scores minus baseline scores) was regressed on change in perceived stress controllability scores (eight-week scores minus baseline scores), biological sex, and the interaction between change in perceived stress controllability scores and biological sex, while controlling for number of stressful events reported at baseline and at eight weeks.

The model showed that the main effect of sex was not significant,  $t(231) = -0.35, p = .726, \eta_p^2 < 0.001$ , nor was the main effect of change in Adolescent Perceived Events Scale controllability,  $t(231) = -1.01, p = .315, \eta_p^2 = 0.01$ . Thus, neither sex nor change in perceived stress controllability significantly predicted change in anhedonic depression. The interaction between the effect of change in controllability and sex was also not significant,  $t(231) = -1.00, p = .318, \eta_p^2 = 0.004$ .

Planned post-hoc analyses were performed to evaluate the magnitude of the association between change in controllability and change in depressive symptoms for females and for males separately. In females, the association between change in controllability and change anhedonic

depression was significant. In females, for every one point higher in perceived controllability at baseline, participants reported an average of 1.81 points lower anhedonic depression scores,  $t(186) = -1.98, p = .049, \eta_p^2 = 0.02$ . In contrast, this relationship in males was not significant. Males showed for every one point higher in change of perceived controllability, participants reported an average of 0.43 points lower anhedonic depression scores, which was not significantly different than zero,  $t(41) = 0.34, p = .735, \eta_p^2 < 0.001$ . These relationships are graphed in Figures 2b and 2c.

## Discussion

This present study investigated the cross-sectional and longitudinal associations between perceived controllability over stressful life events and anhedonic depression over eight weeks, during a time of acute stress for college students (the beginning of the COVID-19 pandemic). We further analyzed the effects of biological sex on these relationships. Broadly, we hypothesized that there would be relationships between perceived stress controllability and depression both at baseline and over time, and that sex would moderate these relationships. Our results partially replicated the findings of past studies and pose additional questions for future research.

### Depression and Perceived Stress Controllability

There was a significant negative correlation between anhedonic depression and perceived stress controllability at baseline, supporting hypothesis one. This indicates that across people, those who felt more control were less depressed during a time of acute stress. This is also consistent with work by Fassett-Carmen (2019), in which a similar relationship was observed.

Biological sex did not significantly moderate the relationship between depression and perceived stress controllability at baseline, although planned post-hoc analyses conducted in

females and males separately showed that the relationship between perceived stress controllability and depression was significant in females at baseline, and not in males. The effect sizes for these associations were similar between the post hoc tests conducted separately in males and females, and therefore this may indicate that there was simply not enough power to detect the effect in the relatively smaller sample of males.

### **Association Between *Change* in Depression and Perceived Stress Controllability**

Over the full sample, changes in anhedonic depression scores did not significantly correlate with changes in perceived stress controllability over the eight weeks of the study, failing to support hypothesis 2. Biological sex did not significantly moderate the association between changes in depression and changes in perceived stress controllability, but, planned post-hoc analyses showed that this association reached significance in *females* but not in males. Of note, the effect size for this association in females was twenty times higher than the effect size in males. Together, it may be that changes in controllability within a female over time correlate with changes in their depression over time.

### **Understanding the Role of Biological Sex**

Interestingly, while sex interactions in the baseline and change models were not significant, planned post-hoc analyses found that associations between perceived controllability and depression (at baseline or changes over time) were only significant in females. These findings differ somewhat from early results of sex differences reported in the learned helplessness animal literature. Notably, a recent study found a key sex difference in learned helplessness, such that in females, control did not protect against future learned helplessness whereas in males, control did protect against future learned helplessness (Baratta et al., 2018). This may suggest that loss of control is not associated with helplessness in female rodents, but it

does in male rodents; in contrast, in this present study we found that loss of control *was* associated with depression in female humans but not in male humans. Together, both this prior preclinical research and results of this study indicate potential sex differences, but the nature of those differences were inconsistent. However, we emphasize that caution is warranted in interpreting sex-specific associations in this study, as there were no significant moderating effects of sex in the full models.

### **Strengths and Limitations**

The present study had several strengths as well as limitations. First, our focus on controllability and depression in a student sample is a strength, given the prevalence and urgency of mental health difficulties in university students. In fact, university students experience depression at greater rates than that of the general population (Druckenmiller, 2022). Studies of mental health within this particular population are thus critical. A second strength is our evaluation of controllability and depression during a period of acute stress (pandemic), in which there was an enormous, universal loss of perceived control as well as an increase in depression (World Health Organization, 2022). This was therefore a uniquely interesting time to examine these variables in this population.

There are also several important limitations in the present study. First, demographic characteristics of our sample limited generalizability to the broader population. This was not a clinical sample and was restricted in age range; different effects could be seen in younger or older samples, or those with more significant mental health problems. Further, this study was a sample of convenience from a predominantly white, high-income university, with females overrepresented in the present sample. It is unknown whether or how these results would generalize to students with different demographic characteristics. Second, while testing



longitudinally was a strength, the time period was very limited. Capturing a longer period could capture greater fluctuations in controllability or mood and help us better understand the broader relationship between these two constructs.

### **Future Directions**

Future studies investigating the associations between perceived controllability and anhedonic depression, and the moderating effects of sex on such associations, should be performed in independent, large samples that are balanced on sex. Further studies should also include clinical samples, to understand how perceived stress controllability may impact depressive symptoms in those diagnosed with depression. Finally, to address whether perceived controllability and depression fluctuate together over time or are instead stable and instead vary between individuals, participants should be tracked for longer periods of time.

### **Conclusion**

This study supports that those who have greater perceived controllability over stressful life events are also likely to have lower anhedonic depression. Across the full sample (collapsing across males and females) changes in perceived controllability were not associated with changes in depression within a person, although this association was significant for females. Mixed evidence for sex differences in the associations between controllability and depression suggest that future work is necessary to further test this question. The presence (or absence) of sex differences would have implications for clinical practice and public health outreach during and following catastrophic times such as a pandemic.



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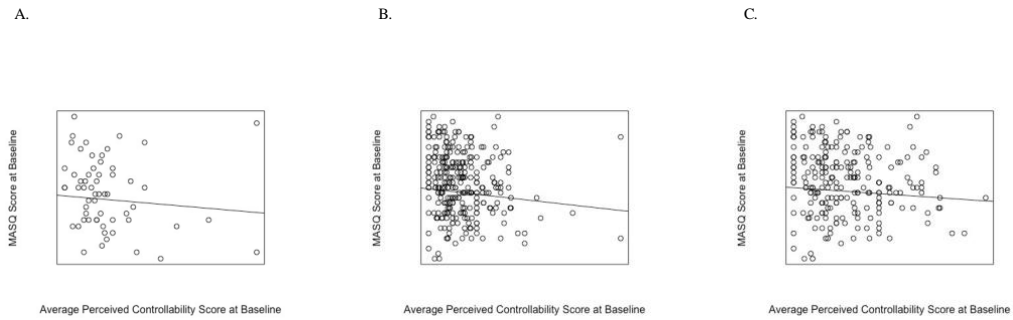
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**Table 1.** Demographics

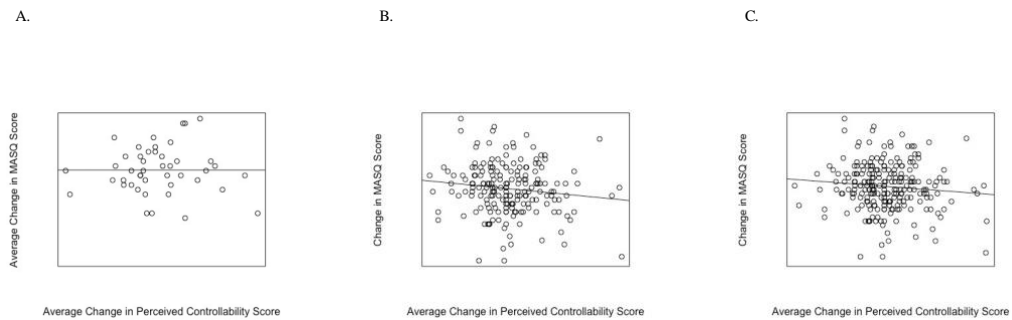
	<b>Total</b>
	<b><i>N</i> = 295</b>
	<i>M</i> ( <i>SD</i> )
Age (years)	21.29 (3.06)
	%
<b>Sex</b>	
Assigned female at birth	79.66%
Assigned male at birth	20.34%
<b>Gender</b>	
Woman	77.63%
Man	20.34%
Non-binary, fluid, or dynamic	2.03%
<b>Ethnicity</b>	
Hispanic or Latine	12.88%
Non-Hispanic and Non-Latine	87.12%
<b>Race</b>	
American Indian/Alaskan Native	0.34%
Asian	8.48%
Black or African American	0.34%
Native Hawaiian or Other Pacific Islander	0.00%
White	82.37%
More than one race	8.47%
<b>Class year</b>	
First year undergraduate	15.93%
Second year undergraduate	23.05%
Third year undergraduate	23.39%
Fourth year undergraduate	27.80%
Fifth year undergraduate	1.69%
Sixth year undergraduate	0.68%
Graduate student	6.78%
Unknown	0.68%
<b>Parent Education (Highest Completed)</b>	
8 <sup>th</sup> Grade or Less	0.68%
Partial High School	0.34%
High School/GED	4.41%
Vocational/Trade	1.47%
Partial College or 2-year Degree	6.10%
College or 4-year Degree	28.14%
Graduate Degree	58.86%
<b>Family Income (yr)</b>	
<10,000	17.29%
~10,000-25,000	10.17%
~25,000-50,000	6.78%
~50,000-75,000	14.24%
~75,000-100,000	10.51%
>100,000	41.01%



**Figure 1:** *APES Controllability Score Predicts MASQ Loss of Interest Score.*

In A, APES controllability score predicts MASQ loss of interest score in males only. In B, APES controllability score predicts MASQ loss of interest score in females only. In C, APES controllability score predicts MASQ loss of interest score in all participants.





**Figure 2** *Change in APES Controllability Score Predicts Change in MASQ Loss of Interest Score between Baseline and Eight weeks.*

In A, change in APES controllability score predicts change in MASQ loss of interest score between baseline and eight weeks in males only. In B, change in APES controllability score predicts change in MASQ loss of interest score between baseline and eight weeks in females only. In C, change in APES controllability score predicts change in MASQ loss of interest score between baseline and eight weeks in all participants.



