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BRIEF REPORT



## Investigating social connection as a protective factor against exam stress in college students

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### ABSTRACT

**Objective:** To examine social connection as a protective factor against exam stress. **Participants:** 55 undergraduate students at two universities. **Methods:** Students were evaluated on an exam day for their hardest class and at baseline, a day in a week where they had no exams. Social connection, salivary cortisol, perceived stress, and cognitive control (measured with the Stroop test) were assessed. Exam scores were later reported. **Results:** Higher social connection was associated with lower perceived stress on exam day. At a small liberal arts school, higher levels of social connection were associated with higher Stroop scores. This correlation with cognitive control was not significant at a large public university. **Conclusions:** These findings indicate that social connection may be a protective factor in mitigating perceived stress and cognitive control capabilities may help facilitate reduced exam stress in some school environments.

### ARTICLE HISTORY

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college students; cortisol; exam stress; perceived stress; social connection

### Introduction

College is a critical developmental period for young adults, characterized by increased independence in addition to exposure to academic stress.<sup>1</sup> In contrast to high school, assessment in college courses is often characterized by few high stakes exams instead of many low stakes assignments. Studies have shown that during exam periods, many students experience both psychological and physiological stress responses, including increases in levels of the endocrine hormone, cortisol.<sup>2</sup> In addition, during an exam period, undergraduate students experience increases in negative mental health symptoms (i.e., poor daytime functioning, anxiety, depression), decreases in positive mental health symptoms (i.e., self-esteem, social and mental health, general well-being), and reduced sleep.<sup>3,4</sup> The combination of reduced sleep and increased cortisol production can disrupt memory consolidation and retrieval, suggesting a negative impact of exam stress on academic performance.<sup>4-6</sup> Thus, research that identifies factors that may buffer against exam stress is warranted in an effort to ultimately improve students' mental and physical health, and academic performance.

Social connection, or the extent to which college students feel attached to those around them and derive a sense of security within their environment, is a key component of feeling a sense of belonging on campus.<sup>7,8</sup> Individuals who feel connected to their campus community experience

several benefits, including greater well-being and higher academic motivation and success.<sup>9,10</sup> Conversely, several negative outcomes are associated with experiencing lower levels of social connection. People who feel that they do not belong are more likely to experience chronic loneliness, lower self-esteem, and anxiety and depression.<sup>9,11</sup> These findings suggest that high levels of social connection may serve as a buffer for high stress levels during college, a period of transition and academic stress, consequently promoting positive physical and mental health. Thus, the current study sought to examine if higher levels of social connection may be a protective factor against the negative consequences of exam stress.

Social connection may also differ by school type. One study found that colleges with an enrollment of less than 20,000 students reported a greater sense of community.<sup>12</sup> However, few other studies have examined how the type of school may influence students' ability to make social connections, and the role that plays in exam stress. Thus, an exploratory factor of interest is the influence of school type on social connection, comparing a large public university (>28,000 students) to a small liberal arts school (<2,000 students).

Another factor that may influence exam stress is cognitive control, or the ability to adapt to one's changing environment through mechanisms of inhibition and conflict monitoring.<sup>13</sup> Being able to exert cognitive control is associated

with better mental health outcomes, as individuals can use cognitive control to regulate their emotions and stop rumination.<sup>14,15</sup> Quinn and Joormann<sup>16</sup> found that college students whose cognitive control decreased the most by a lab-induced stressor were more likely to develop depression by the end of the semester relative to those who could continue to draw upon their cognitive control resources under stress. Fortunately, cognitive control can be improved,<sup>17</sup> so if cognitive control functions impact more naturalistic situations such as exam stress in college students, this could be a mechanism of possible intervention to help students succeed and improve their academic and health outcomes.

Thus, an important avenue for exploration is the influence of both social connection and cognitive control on exam stress and exam performance in college students. Since the interplay between social connection and cognitive control's influence on exam stress and exam performance has yet to be examined, we sought to examine these two factors by measuring cognitive control (Stroop task) and social connection (Social Connectedness Scale, SCS), as well as salivary cortisol levels and perceived stress (Perceived Stress Scale, PSS) both on an exam day and on a baseline control day in a week when no exams occurred. Because the dynamics of social connection may vary across schools,<sup>12</sup> we conducted this research at both a large public school and a small liberal arts school.

## Method

### Participants

101 undergraduate students between the ages of 18–25 participated in this study between Fall 2019 to Spring 2021. Exclusion criteria included chronic mental or physical illness, immune diseases, and pregnancy. 55 students ( $M_{\text{age}} = 20$ ,  $SD_{\text{age}} = 1.41$ ) completed both sessions and were used in the current analyses (see Table 1). Due to being sent home for COVID-19, 46 participants completed only one session (39 Control Session only, 8 Exam Session only). 50 participants completed a follow up survey to provide their exam score.

**Table 1.** Participant demographic information.

		N	%
<b>Gender</b>	<b>Male</b>	18	32.7%
	<b>Female</b>	37	67.3%
<b>Race</b>	<b>White</b>	39	70.9%
	<b>Asian</b>	10	18.2%
	<b>Black/African American</b>	2	3.6%
	<b>Other</b>	1	1.8%
	<b>Bi/Multicultural</b>	2	3.6%
	<b>Declined to Answer</b>	1	1.8%
<b>Ethnicity</b>	<b>Hispanic/Latino</b>	8	14.5%
	<b>Non-Hispanic/Latino</b>	47	85.5%
<b>Generation in College</b>	<b>First Generation</b>	10	18.2%
	<b>Continuing Generation</b>	45	81.8%
<b>School</b>	<b>Small Liberal Arts</b>	25	45.5%
	<b>Large Public University</b>	30	54.5%
<b>Class Year</b>	<b>First</b>	8	14.5%
	<b>Second</b>	11	20.0%
	<b>Third</b>	13	23.6%
	<b>Fourth</b>	23	41.8%

## Measures and procedure

The control session (no exams that week) included survey collection (including the Social Connectedness Scale (SCS),<sup>1</sup> Perceived Stress Scale (PSS),<sup>2</sup> Stroop task,<sup>18</sup> and saliva collection via passive drool and stored at  $-80^{\circ}\text{C}$  until assayed. PSS, Stroop, and saliva were collected again during the exam session (administered on an exam day in the students' perceived hardest class). To quantify salivary cortisol in participants who completed both sessions, samples were assayed in duplicate using an ELISA Parameter Cortisol Assay from R&D systems, following the manufacturer's instructions. Cortisol data from participants that had too little saliva to pipette,  $\text{CV} > 30$ , or were missing, were excluded ( $N=7$ ), and PSS scores were missing at the exam session for  $N=2$ . At the end of the semester, a follow-up survey was completed in which participants reported their exam score.

## Results

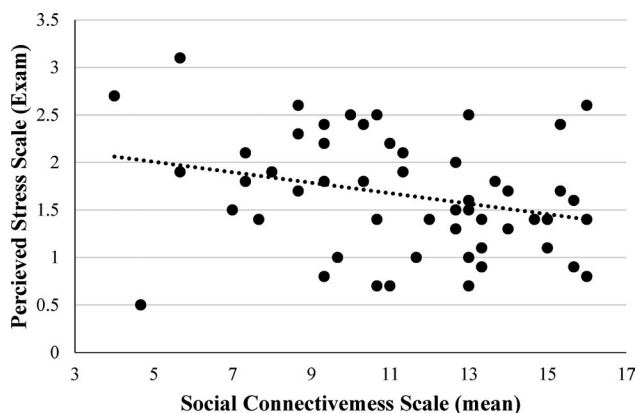
### Social connection

A linear regression indicated that higher levels of social connection predicted lower levels of perceived stress on exam day,  $r(51)=-.276$ ,  $F(1,52)=4.211$ ,  $p=.045$ .<sup>1</sup> See Figure 1. Separate linear regression analyses indicated that social connection did not predict Stroop on exam day ( $r(53)=-.013$ ,  $F(1, 54)=0.009$ ,  $p=.927$ ), cortisol level on exam day ( $r(45)=-.124$ ,  $F(1,46)=0.702$ ,  $p=.407$ ), or the exam grade ( $r(42)=.136$ ,  $F(1, 43)=0.797$ ,  $p=.377$ ).

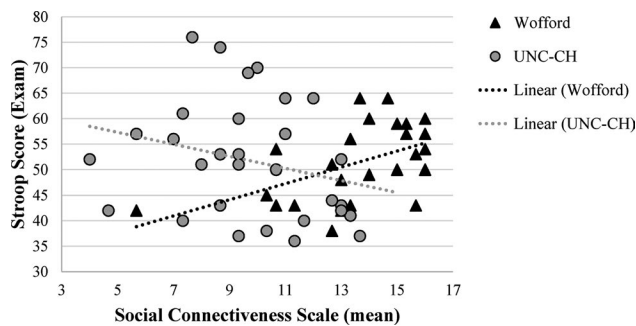
### Exploratory analysis considering school

#### Small liberal arts school

At Wofford College, the small liberal arts school, a linear regression indicated that higher levels of social connection predicted higher Stroop scores on exam day,  $r(23)=.507$ ,  $F(1, 24)=7.969$ ,  $p=.010$ . See Figure 2. Social connection did not predict Perceived Stress on Exam Day ( $r(21)=-.321$ ,  $F(1,22)=2.406$ ,  $p=.136$ ), cortisol level on exam day ( $r(20)=.030$ ,  $F(1,21)=0.018$ ,  $p=.894$ ), or the exam grade ( $r(22)=.359$ ,  $F(1,23)=3.260$ ,  $p=.085$ ).



**Figure 1.** The relationship between social connection and perceived stress on exam day.



**Figure 2.** The relationship between social connection and Stroop scores on exam day separated by school. *Note.* Higher Stroop scores indicate that more words were read in the allotted time which indicates less interference from the color/word mismatch. Wofford is the small liberal arts school and UNC-CH is the large public university.

### Large public university

At UNC-Chapel Hill, the large public university, linear regression analyses indicated that social connection did not predict Perceived Stress on Exam Day ( $r(28) = -.072$ ,  $F(1,29) = 0.147$ ,  $p = .704$ ), Stroop on exam day ( $r(28) = -.260$ ,  $F(1,29) = 2.029$ ,  $p = .166$ ), cortisol level on exam day ( $r(23) = .018$ ,  $F(1,24) = 0.008$ ,  $p = .931$ ), or the exam grade ( $r(18) = -.233$ ,  $F(1,19) = 1.037$ ,  $p = .322$ ).

### Comments

Students with high social connection exhibited lower levels of perceived stress overall than those with moderate levels of social connection. This makes sense in light of studies which have focused on the detrimental effects of loneliness, finding that students who felt that they didn't belong on campus report higher levels of perceived stress.<sup>10,19</sup> Despite this connection between social connection and perceived stress, social connection was not related to lower levels of salivary cortisol. Interestingly, perceived stress and cortisol are not always directly correlated,<sup>20</sup> perhaps due to individual differences in the use of different coping strategies.<sup>21</sup> In addition, the relationship between social support and cortisol has been mixed. Heinrichs and colleagues<sup>22</sup> found that social support decreased cortisol response to a lab-based stressor. However, other studies have not found a significant relationship between social connection and cortisol in response to a stressor.<sup>23,24</sup> Thus, the association between high levels of social connection and lower levels of perceived stress cannot be explained by changes in cortisol alone.

At Wofford College, a small liberal arts school, social connection level was very high and those who had higher social connection also had higher Stroop scores. This is consistent with studies showing that people who feel socially excluded exhibit impaired regulation, give up more easily on frustrating tasks, and do worse on complex tasks, perhaps because the negative emotions evoked by exclusion drain cognitive control resources.<sup>25,26</sup> Conversely, students who feel like they belong at their school are less likely to procrastinate.<sup>10</sup> Thus, a sense of social connectiveness may free up cognitive control resources, leading to higher Stroop scores. In addition, a sense of social connection is often paired with the need to navigate social networks, which has been

associated with increased global cognition and cognitive control.<sup>27</sup> Therefore, students who regularly navigate their social networks may be receiving regular cognitive control practice, which may benefit them in their ability to regulate their emotions and manage their perceived stress.<sup>14,15</sup> However, due to the correlational nature of the present work we don't know for certain if higher levels of cognitive control facilitate social connection, or if social connection leads to higher levels of cognitive control. Future experimental research is needed to test this question.

As very little research has been done on the influence of type of school on social connection and exam stress, the fact that higher social connection levels were associated with higher Stroop scores at the small liberal arts school, but not the large public university is fodder for speculation. For example, socioeconomic status (SES) was significantly higher at the small liberal arts school as compared to the large public university. Students with a lower socioeconomic background may experience more chronic stress, and less access to cognitive enrichment opportunities.<sup>28,29</sup> Thus, it is possible that economic stressors outside of school may dampen the relationship between social connection and cognitive control in the midst of preparing for a stressful exam. However, the two schools differ on a number of different factors. Thus, these results suggest that the implications of school size on social connection, exam stress, and cognitive control may be an important factor to consider in future studies.

One limitation of the current study was that some participants' data were collected before the COVID-19 pandemic and some participants were tested after the pandemic began. However, analyses suggested that all the reported results did not differ based on when participants were tested.

In conclusion, our data suggest that fostering a sense of belonging and social connection may help mitigate stress in students, perhaps in part by increasing cognitive control abilities, but this may differ based on the school environment.

### Note

1. A survey was sent to all participants that had participated before students were sent home due to COVID-19 asking them to rate levels of perceived stress "during the past few weeks (i.e., since your school reduced operations and transitioned to remote instruction)." 65 participants filled out the survey. Results indicated that higher levels of social connection also predicted lower levels of perceived stress after COVID disruption,  $r(63) = -.273$ ,  $F(1, 64) = 5.088$ ,  $p = .028$ .

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## Conflict of interest disclosure

The authors have no conflicts of interest to report. The authors confirm that the research presented in this article met the ethical guidelines, including adherence to the legal requirements, of the United States and received approval from the Institutional Review Board (IRB) of the University of North Carolina, Chapel Hill.

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## Data availability statement

Data are available at the center for open science website: <https://osf.io/u4bde/>

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