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# When belongingness backfires: experienced discrimination predicts increased cardiometabolic risk among college students high in social belonging

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**Abstract** Research implicates experiences of discrimination in exacerbating cardiometabolic disease (CMD) risk. Belongingness has been suggested as a buffer against the adverse effects of discrimination. However, when discrimination occurs in an environment to which one feels they belong, then the potential benefits of belongingness may dissipate or even exacerbate the effects of discrimination. In the present study, we examined these competing hypotheses on how campus belonging might moderate the relationship between discrimination experienced on campus and CMD risk. College students ( $n = 160$ , 60.9% Latino/a/x) reported the frequency of on-campus discrimination and campus belongingness, and then completed items assessing risk for CMD. More frequent discrimination related to higher comparative CMD risk among those who reported high campus belongingness, even after adjusting for relevant covariates. These findings highlight the complicated nature of belongingness in the context of physical health. Future research is needed to better understand the role of environment when considering morbidity among college students.

**Keywords** Cardiometabolic disease risk · College students · Discrimination · Social belonging

## Introduction

Many college students engage in lifestyle choices that may put them at risk for future cardiometabolic disease risk (Irazusta et al., 2007). For instance, about half of college students do not meet food group guidelines for recommended daily dietary intake (Irazusta et al., 2007; Schweitzer et al., 2016), typically because they over-consume fats, and under-consume grains, fiber, fruits and vegetables (Irazusta et al., 2007). Longitudinal data tracking adolescents into early adulthood showed a 24% decrease in physical activity with the steepest decline occurring within the first year of college (Kwan et al., 2012). Furthermore, awareness of cardiometabolic disease risk is lower in younger adults, such as college students (Collins et al., 2004; Sarpong et al., 2017). These poor lifestyle choices pose serious health concerns: around one-third of college students are overweight, almost half have been told they have high blood pressure (Burke et al., 2009), and about one-fifth have low HDL cholesterol (Fernandes & Lofgren, 2011)—all of which put them at higher risk for future cardiometabolic disease.

One factor that contributes to why students engage in these risky lifestyle choices is psychosocial stress. A potent and prevalent form of this stress is discrimination—or the unequal treatment of people on the basis of group membership, such as race, ethnicity, gender, age, sexuality, or socioeconomic status (Pager & Shepherd, 2008)—with 37–97% of minority and underrepresented college students experiencing discrimination while in college (Hatzenbuehler et al., 2011; Juang et al., 2016). Discrimination is associated with poorer health behaviors and physical health among college students, including increased alcohol consumption (Hatzenbuehler et al., 2011; Unger et al., 2014), tobacco use (Horton & Loukas, 2013; Unger et al., 2014), and marijuana use (Unger et al., 2014). Furthermore, in the adult population

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discrimination is linked to increased risk for hypertension (Dolezsar et al., 2014; Hill et al., 2007). Thus, the first goal of this paper is to replicate and extend this work demonstrating discrimination on campus as a predictor of increased comparative cardiometabolic disease risk among college students.

Research on the need to belong highlights social belongingness as a basic human need (Hill et al., 2007) that people innately desire (Baumeister & Leary, 1995). One form of social belongingness that has been highlighted as vital to college students' health and well-being is the extent to which a student feels they belong on campus (Hurtado & Carter, 1997; Walton & Cohen, 2011). For example, college students with a greater sense of belonging to campus are less likely to be depressed and to attempt suicide (Backhaus et al., 2019). Moreover, sense of belonging can buffer against the adverse effects of stressors (Huynh & Gillen-O'Neel, 2016; Lewis et al., 2016). For example, among young adults, sense of belonging buffered against the deleterious effects of stressors on risky alcohol use (Torgerson et al., 2018), while amongst adolescents, sense of belonging mitigated the adverse effects of discrimination on sleep duration (Huynh & Gillen-O'Neel, 2016). Although sense of belonging has been indicated as a buffer against adverse psychological health and academic problems, it has hardly been examined as a buffer against physical health problems among college students. Nonetheless, research suggests that people who feel a sense of belonging to their school community may feel socially secure and function better where they feel a strong sense of fit (Lewis et al., 2016). Thus, the second goal of this paper is to test whether social belongingness to campus buffers the effects of discrimination on cardiometabolic health.

Although social belonging may be a resource, it is also possible that it is a barometer of the potential for discrimination to be an antagonist. That is, when discrimination occurs in an environment that had been rated as high in social belonging, the impact of that discrimination may be more severe and problematic. For instance, when discrimination occurs in the same environment to which one feels belongingness, it might signal ostracism from an essential group (Bernstein et al., 2010; Williams, 2002) or a threat to a person's social connections (MacDonald & Leary, 2005). Related to this idea, when social exclusion occurs in a place considered important, it can correlate to stronger negative feelings than if the exclusion occurred in a place that is less important to the person (Bernstein et al., 2010; Sacco et al., 2014). From this perspective, feelings of belongingness to the context in which one experiences discrimination might undercut the generally presumed positive effect of belongingness and exacerbate the effects of discrimination on cardiometabolic health.

The purpose of this study is to test two social constructs—discrimination and social belongingness—that are

particularly salient on college campuses and essential to college students' health. This study will extend past work examining health and health behaviors that contribute to future cardiometabolic morbidity among college students (Burke et al., 2009; Irazusta et al., 2007; Kwan et al., 2012), by considering these unexplored social constructs and their interaction. That is, we aim to test a fit between a person and their environment to better understand when belongingness is a resource. We predict that more frequent discrimination would associate with higher cardiometabolic risk. We also expect that, consistent with the vast literature on belonging and health, a stronger sense of belongingness would buffer this effect, but recognize the potential that it might paradoxically exacerbate the effect.

## Method

### Participants and procedure

The data were from a larger study examining health and health behaviors of college students. For this study, we focus only on the data that were relevant to discrimination, social belonging, cardiometabolic risk factors, and the covariates used to adjust the models. We provide a full list of measures at the OSF link ([https://osf.io/myqkx/?view\\_only=43130e77a93a4feb8e5356a28977bcfa](https://osf.io/myqkx/?view_only=43130e77a93a4feb8e5356a28977bcfa)). We describe only the participants analyzed for this study. Participants were 160 undergraduate students (61.9% women; 59.4% Latino/a/Hispanic;  $M_{\text{age}} = 20.05$  years,  $SD_{\text{age}} = 1.40$  years) recruited to complete an online survey in exchange for research credit. To reduce participant burden, we programmed the survey to randomize participants to receive 80% of all measures. Only those who responded to the measures of discrimination, social belonging, cardiometabolic risk factors, and the relevant covariates were included in the sample reported here. Participant demographics appear in Table 1.

### Measures

A correlation matrix (Supplementary Table 1) of all participant demographics and measures used in the analyses can be found in the supplementary tables.

*On-Campus Discrimination* We adapted the five-item short form of the Everyday Discrimination Scale (Williams, 2002) to assess how often participants experienced discrimination *on campus* (1 = *never* to 6 = *almost every day*), such as being “treated with less courtesy or respect than other people on campus,” or “receiving poorer service than other people on campus.” We averaged across the five items to create a score of frequency of discrimination on campus ( $\alpha = 0.83$ ,  $M = 1.72$ ,  $SD = 1.40$ ); 70% responded to at least one item on the scale with more than a 1, indicating that they

**Table 1** Participant characteristics (N = 160)

Demographic variables		
	<i>M (SD)</i>	Range
Age (years)	20.05 (1.40)	18.00–25.00
	<i>n</i>	% (of total sample)
<i>Gender</i>		
Female	99	61.9%
Male	58	36.3%
Missing/Other	3	1.9%
<i>Race</i>		
Latino/a/Hispanic	95	59.4%
East Asian	18	11.3%
South Asian	12	7.5%
White	11	6.9%
African American	7	4.4%
Native Hawaiian	4	2.5%
American Indian	1	0.6%
Missing/Other	12	7.5%
<i>Year in School</i>		
1st	41	25.6%
2nd	46	28.8%
3rd	45	28.1%
4th	23	14.4%
5th or more	2	1.3%
Missing/Other	3	1.9%
<i>College generation status</i>		
1st	102	63.8%
2nd or more	52	32.5%
Missing/Other	6	3.8%

had experienced at least some everyday discrimination on campus. See the online Supplementary Appendix A for more details on attributions to discrimination that are not part of the current analyses; nonetheless, these details provide more context for how discrimination is experienced on campus. As a brief summary, at least 20% of the respondents indicated gender, race, and physical appearance as attributions of their discriminatory experiences. Whereas, less than 5% of the respondents indicated physical disability, religion, sexual orientation, and other as attributions.

**Campus Belongingness** We assessed the extent to which participants felt social belonging to the campus with two items. We adapted these items to assess campus belongingness from existing single-item measures of belongingness used for college students (Bollen & Hoyle, 1990; Hausmann et al., 2007; Williams et al., 2020). Participants reported how strongly they agreed with the statements “I feel a sense of belonging to [University]” and “I identify with the group: [University] students” (1 = *strongly disagree* to 7 = *strongly agree*). The two items were highly correlated,  $r(158) = 0.67$ ,  $p < 0.001$ , so we averaged them to create a score of social

belongingness, where higher values reflected a greater sense of belonging ( $M = 5.38$ ,  $SD = 1.48$ ).

**Relative Cardiometabolic Risk** Participants self-reported on family history of heart disease and diabetes, personal biomarkers (e.g., waist size, total and HDL cholesterol, hypertension), dietary and exercise behaviors, alcohol use, and exposure to smoke using items from the *Your Disease Risk* calculator from the Siteman Cancer Center (Barnes-Jewish Hospital & of M. Your Disease Risk, 2019). This risk calculator has been validated among a variety of populations, including young adults, who may not have access to their medical and/or laboratory records, as an early indicator of relative risk (Colditz & Commentary, 2020). We used the relative risk estimates (Barnes-Jewish Hospital & of M. Your Disease Risk, 2019) to calculate separate relative risk scores for type 2 diabetes and heart disease. If a participant had missing data for a risk factor (i.e., responded “choose not to answer” or “do not know”), they were given the ‘at average relative risk’ score. This approach allowed us to conservatively estimate cardiometabolic relative risk—that is, we did not assign more or less than an average risk for any health or health behavior risk factor. Except for two items regarding cholesterol values and one item on alcohol consumption, most participants responded with a definitive answer, rather than “do not know” or “choose not to answer.” See the online Supplementary Appendix B for a full list of the items, missing responses, and the risk score from the calculator.

The total relative risk scores for type 2 diabetes and heart disease were moderately correlated,  $r(158) = 0.51$ ,  $p < 0.001$ , indicating justification for a combined total cardiometabolic risk (Afifi et al., 2003) (see supplemental Tables 1 and 2 for results broken out separately for cardiovascular and diabetes risk). Beyond the moderate correlation between type 2 diabetes and heart disease in this study sample, people at risk for type 2 diabetes have a higher heart disease morbidity and mortality. Furthermore, diabetic people are disproportionately affected by heart disease compared to non-diabetic people. Indeed, the two illnesses share many of the same behavioral and family risk factors, such as poor diet, sedentary lifestyle, and hypertension (Dunlay et al., 2017). According to the American Diabetes Association and American Heart Association, type 2 diabetes and heart disease should be examined as both independent and coexisting illnesses (Boer et al., 2017).

**Covariates** In our aim to test the fit between a person and their environment to better understand for whom belongingness is a resource, we adjusted for academic year and whether the participant was a first-generation in college student. The university where the study was conducted requires that students live on campus for their first two academic years. Participants responded to an item asking how long they had been at the university (1 = *1 academic*

year; 2 = 2 academic years; 3 = 3 academic years; 4 = 4 academic years; 5 = 5 or more academic years). Since our main research questions focus on discrimination on campus and sense of belonging to campus, we effect coded for academic year based on the requirement to reside on campus ( $-0.5 = \text{academic year 1 or 2}$ ;  $0.5 = \text{academic year 3 or higher}$ ).

Furthermore, students who are first-generation to college (i.e., they are the first in their families to pursue higher education) often experience lower sense of belonging and greater psychological stress than students who are not the first in their families to attend college (Stebleton et al., 2014). Participants responded to an item asking if they were the first person in their family to attend college (1 = *yes*, 2 = *no*). Thus, we effect coded for first-generation college student, such that  $no = -0.5$  (*not first-generation*) and  $yes = 0.5$  (*first-generation*).

Additionally, we explored adjusting for personality traits to be consistent with health behavior models that link personality traits to cardiometabolic disease risk (e.g., poor diet and physical inactivity). We explored openness to experience, which has been shown to predict lower cardiometabolic risk even after adjusting for other personality traits (e.g., agreeableness, neuroticism) (Dermody et al., 2016). We used the two items on openness to experiences from the Ten-Item Personality Inventory (TIPI), a valid short version to measure the Five-Factor Model (Ehrhart et al., 2009). Participants indicated the extent to which they agreed (1 = *disagree strongly*, 7 = *agree strongly*) with the statements on being “Open to new experiences, complex” and “Conventional, uncreative”. After reverse-coding the second item, we averaged the responses and then mean-centered the score.

## Results

All data analysis was conducted using SPSS, version 26 (Cor, 2019). Cut-off scores ( $< 1 = \text{below average risk}$ ,  $1 = \text{average risk}$ ,  $1.01 \text{ to } 1.2 = \text{weak increased risk}$ ,  $1.2 \text{ to } 1.5 = \text{weak to moderate increased risk}$ ,  $1.5 \text{ and higher} = \text{moderate to strong increased risk}$ ) of the possible range of relative risk scores indicated that, on average, college students in our study had a weak-to-moderate relative risk for type 2 diabetes ( $M = 1.22$ ,  $SD = 0.22$ ) and weak relative risk for heart disease ( $M = 1.02$ ,  $SD = 0.07$ ).

We used multivariate multiple regression analyses to examine cardiometabolic disease risk as a function of discrimination and social belongingness. Pillai's trace (V), the test statistic for multivariate regressions when sample sizes are not large, ranges from 0 to 1 to reflect increasing effects (Seber, 2009). Because a unit change in the independent variable does not correspond with a unit change in the dependent variables (taken together), the parameter

estimates (b coefficients) in multivariate regressions are not interpreted in the same way as they are in ordinary least squares regression (Tabachnick et al. 2019). Based on these guidelines, we provide the *F* statistic and V for the multivariate effect, and the unstandardized beta coefficients and standard errors for the univariate effects.

We conducted a multivariate multiple regression analysis predicting type 2 diabetes and heart disease relative risk from mean-centered discrimination, mean-centered social belongingness, and their interaction. Table 2 shows the results of this the multivariate regression noting in particular a significant interaction between discrimination and social belonging,  $F(2, 155) = 3.37$ ,  $p = 0.037$ ,  $V = 0.04$ , on cardiometabolic disease risk.

Next, to probe the interaction, we examined the simple main effect of discrimination at high (re-centered to +1 SD) and low (re-centered to -1 SD) levels of social belongingness and plotted those results in Fig. 1. Among those high in social belonging, discrimination related to increased cardiometabolic disease risk,  $F(1, 155) = 4.15$ ,  $p = 0.018$ ,  $V = 0.05$ . By contrast, discrimination was unrelated to cardiometabolic disease risk among those low in social belonging,  $F(1, 155) = 2.66$ ,  $p = 0.073$ ,  $V = 0.03$ .

Then, we adjusted the interaction probing models for academic year and first-generation in college. After adjusting for these covariates, among those high in social belonging, discrimination remained related to increased cardiometabolic disease risk,  $F(1, 147) = 3.91$ ,  $p = 0.022$ ,  $V = 0.05$ . Furthermore, among those low in social belonging, discrimination remained unrelated to cardiometabolic disease risk,  $F(1, 147) = 2.79$ ,  $p = 0.064$ ,  $V = 0.04$ . We plotted the interaction of discrimination and sense of belonging, adjusted for covariates, using the interActive tool created by McCabe and colleagues (McCabe et al., 2018) (see Supplementary Figure 1 and Figure 2).

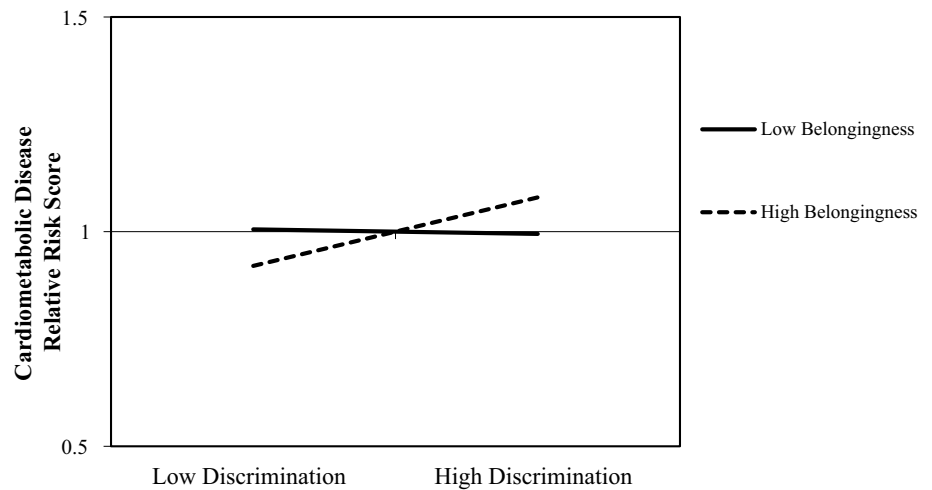
Finally, our exploratory approach to controlling for openness to experience showed no changes in the interaction effects (see Supplementary Table 4).

**Table 2** Summary of general multivariate regression predicting cardiometabolic disease risk

	Pillai's trace	<i>F</i> (2, 155)	<i>p</i>
Intercept	0.99	16,373.64	<0.001
Discrimination	0.05	3.70	0.027
Social Belonging	0.00	0.01	0.990
Discrimination x Social Belonging	0.04	3.37	0.037

Pillai's trace (in-text notation V) indicates the effect of the model

**Fig. 1** Interaction of discrimination and belongingness on cardiometabolic disease relative risk score. *Note.* The horizontal line at y-axis value ‘1’ represents average relative risk



**Discussion**

This study aimed to test the association between on-campus discrimination and cardiometabolic disease risk among college students, and whether social belonging on campus moderated this relationship. Due to the correlational nature of the data, we also adjusted the multivariate regression model for academic year and first-generation in college. Findings showed that, consistent with previous research implicating discrimination in poorer health outcomes (Dolezsar et al., 2014; Hill et al., 2007), more frequently experienced discrimination on campus predicted increased relative risk of cardiometabolic disease among college students. Furthermore, this relationship was stronger to the extent that students felt greater belongingness to the university, even after adjusting for the covariates. These findings suggest that social belonging is unlikely to be a universal buffer against discrimination.

Indeed, a more nuanced understanding of the context of discrimination might be warranted. Consistent with work suggesting ostracism is particularly painful when it comes from important social groups (Bernstein et al., 2010; Sacco et al., 2014) and may threaten a person’s social connections (MacDonald & Leary, 2005), it appears that discrimination occurring in a context to which one feels a strong sense of belonging, might actually be associated with exacerbating negative health consequences, regardless of relevant individual differences. Interestingly, neither discrimination nor belonging correlated with individual health behavior risk factors that may be easily visible to others (e.g., dietary behaviors, exercise, smoking, alcohol use, waist size). See Supplementary Table 2. As such, we interpret the results to suggest no evidence that participants who are already deemed at higher risk (i.e., engage in poor healthy behaviors) are also those who experience greater levels of mistreatment. Rather, discrimination and

belonging have a comprehensive effect on total cardiometabolic disease relative risk.

Furthermore, our univariate findings indicated that the interaction effect of discrimination and belonging was really present only for type 2 diabetes risk. We interpret this finding to suggest that the exacerbating effects of high belongingness for people who experience high discrimination most immediately impact or are visible for type 2 diabetes risk among young adults. Indeed, type 2 diabetes and the poor health behaviors connected to diabetes is more prevalent among this age group than is heart disease, which tends to take longer to develop (CDC. Type 2 Diabetes. Centers for Disease Control & Prevention, 2019; Saydah et al., 2019). Nonetheless, type 2 diabetes risk is inextricably connected to heart disease risk (Dunlay et al., 2017). As such, although discrete heart disease (i.e., vascular events, stroke, myocardial infarctions) may be less prevalent among college-aged adults, having higher risk for pre-diabetes and diabetes is connected to higher risk for other cardiovascular events (Saydah et al., 2019). Thus, it is imperative to examine both type 2 diabetes and heart disease risk as coexisting illnesses (Boer et al., 2017) when examining them as a function of discrimination and belonging.

To our knowledge, this is the first study to examine cardiometabolic disease risk as a function of discrimination and social belonging in a young adult population. Though this study was not conducted in a sample that had confirmed heart disease and type 2 diabetes, these results suggest experiencing on-campus discrimination may be associated with implications for college students’ cardiometabolic health regardless of academic year or generation in college. Thus, we urge college on-campus health promoters to develop comprehensive programs that actively work to reduce instances and experiences of discrimination for all college students. For example, tailoring existing and effective anti-bullying and anti-harassment campus campaigns

(e.g., Gay-Straight Alliance) (Saewyc et al., 2014) to create explicit anti-discrimination policies and programs could be a fruitful step toward reducing the harmful effects of discrimination on both psychological and physical health.

Moreover, the cardiometabolic health of students who reported higher levels of belongingness appears to be more affected by the level of discrimination perceived in their environment. Thus, one aspect of the on-campus programs should be to understand the tenuous nature of belonging among their students. In trying to understand health behaviors and risks, it is imperative to simultaneously learn more about who the students are who may be more sensitive to feeling threatened in an environment to which they strongly feel they belong.

### Limitations and future directions

The present study had three noteworthy limitations. First, we calculated relative risk of cardiometabolic disease from self-reported measures of health. Although it is common practice to use self-reports in calculating risk, and self-reported health strongly correlates with clinically assessed health, college students may have limited health knowledge (Benjamins et al., 2004; Kuhn et al., 2006) and literacy (Fernandez et al., 2016) leading them to misreport risk factors. Thus, future research should obtain clinical measurements of cholesterol, blood pressure, and other cardiometabolic risk factors to complement self-reported data. Relatedly, objective clinical measurements would allow for testing of the effects of discrimination and social belonging among students who have confirmed cardiometabolic disease versus those who are at risk.

Second, we did not measure the source of the discrimination as it relates to in-group versus out-group. Indeed, past research shows that peers constitute a significant source of on-campus discrimination (Robnett, 2016). Thus, being able to discern in-group and out-group discrimination from peers would allow us to better understand relative cardiometabolic disease risk as a function of social exclusion and belonging from the same source, especially within the college-campus environment.

Finally, we used cross-sectional retrospective surveys to assess discrimination and belongingness. Given that experiences of discrimination and social connections are dynamic and change daily and momentarily, future research should incorporate repeated measurements of experienced discrimination and belongingness within the naturally occurring environments to examine within-person variability of cardiometabolic health. Doing so will also help to better establish the temporal pattern through which the present effects operate. Relatedly, due to the correlational nature of the data, we adjusted for several individual differences

to account for between-person variability. Although the covariates (e.g., openness to experiences) did not impact the model, other individual differences that account for within-person variability of cardiometabolic health, such as negative perceptions of oneself or others or other personality traits (e.g., neuroticism, hostility) (Weston et al., 2015) should be included in future analyses within the context of disease risk as a function of discrimination and belonging.

### Conclusion

Building upon past work linking discrimination to adverse health effects, the present study examined the link between experiences of on-campus discrimination, social belongingness, and cardiometabolic health among a group of college students. The results suggest that discrimination may be particularly salient for cardiometabolic health when it occurs within an important in-group environment—that is, when a sense of belongingness to the campus community is high but discrimination on campus is also high.

### Declarations

**Conflict of interest** No potential conflict of interest was reported by authors.

**Informed consent** The institutional review board at the study institution approved the protocol, and informed consent was obtained from all study participants.

### References

- Afifi, A., May, S., & Clark, V. A. (2003). *Computer-aided multivariate analysis*. (4th ed.). Chapman and Hall/CRC.
- Backhaus, I., Lipson, S. K., Fisher, L. B., Kawachi, I., & Pedrelli, P. (2019). Sexual assault, sense of belonging, depression and suicidality among LGBTQ and heterosexual college students. *Journal of American College Health*. <https://doi.org/10.1080/07448481.2019.1679155>
- Barnes-Jewish Hospital WUS of M. Your Disease Risk - Prevention. Siteman Cancer Center. Accessed November 25, 2019. <https://siteman.wustl.edu/prevention/ydr/>
- Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, *117*, 497–529. <https://doi.org/10.1037/0033-2909.117.3.497>
- Benjamins, M. R., Hummer, R. A., Eberstein, I. W., & Nam, C. B. (2004). Self-reported health and adult mortality risk: An analysis of cause-specific mortality. *Social Science and Medicine*, *59*, 1297–1306. <https://doi.org/10.1016/j.socscimed.2003.01.001>
- Bernstein, M. J., Sacco, D. F., Young, S. G., Hugenberg, K., & Cook, E. (2010). Being, “In” with the in-crowd: The effects of social exclusion and inclusion are enhanced by the perceived essentialism of ingroups and outgroups. *Personality and Social Psychology*

- Bulletin*, 36, 999–1009. <https://doi.org/10.1177/0146167210376059>
- Bollen, K. A., & Hoyle, R. H. (1990). Perceived cohesion: A conceptual and empirical examination. *Social Forces*, 69, 479–504. <https://doi.org/10.1093/sf/69.2.479>
- Burke, J. D., Reilly, R. A., Morrell, J. S., & Lofgren, I. E. (2009). The university of new hampshire’s young adult health risk screening initiative. *Journal of the American Dietetic Association*, 109, 1751–1758. <https://doi.org/10.1016/j.jada.2009.07.005>
- CDC. Type 2 Diabetes. Centers for Disease Control and Prevention. Published May 30, 2019. Accessed April 10, 2021. <https://www.cdc.gov/diabetes/basics/type2.html>
- Colditz GA, Dart H. Commentary: 20 years online with “Your Disease Risk.” *Cancer Causes Control*. Published online October 17, 2020. <https://doi.org/10.1007/s10552-020-01356-3>
- Collins, K. M., Dantico, M., Shearer, N. B. C., & Mossman, K. L. (2004). Heart disease awareness among college students. *Journal of Community Health*, 29, 405–420. <https://doi.org/10.1023/B:JOHE.0000038655.19448.b2>
- Cor IS. IBM SPSS Statistics for Windows, version 26.0. *IBM Corp Armonk NY USA*. Published online 2019.
- de Boer, I. H., Bangalore, S., Benetos, A., et al. (2017). Diabetes and hypertension: A position statement by the American Diabetes Association. *Diabetes Care*, 40, 1273–1284. <https://doi.org/10.2337/dci17-0026>
- Dermody, S. S., Wright, A. G. C., Cheong, J., et al. (2016). Personality correlates of midlife cardiometabolic risk: The explanatory role of higher-order factors of the five-factor model. *Journal of Personality*, 84, 765–776. <https://doi.org/10.1111/jopy.12216>
- Dolezsar, C. M., McGrath, J. J., Herzig, A. J. M., & Miller, S. B. (2014). Perceived racial discrimination and hypertension: A comprehensive systematic review. *Health Psychol Off J Div Health Psychol Am Psychol Assoc.*, 33, 20–34. <https://doi.org/10.1037/a0033718>
- Dunlay, S. M., Givertz, M. M., Aguilar, D., Allen, L. A., Chan, M., Desai, A. S., Deswal, A., Dickson, V. V., Kosiborod, M. N., Lekavich, C. L., McCoy, R. G., Mentz, R. J., & Piña, I. L. (2019). Type 2 diabetes mellitus and heart failure: A scientific statement from the American Heart Association and the Heart Failure Society of America: This statement does not represent an update of the 2017 ACC/AHA/HFSA heart failure guideline update. *Circulation*, 140, e294–e324. <https://doi.org/10.1161/CIR.0000000000000691>
- Ehrhart, M. G., Ehrhart, K. H., Roesch, S. C., Chung-Herrera, B. G., Nadler, K., & Bradshaw, K. (2009). Testing the latent factor structure and construct validity of the ten-item personality inventory. *Personality and Individual Differences*, 4, 900–905. <https://doi.org/10.1016/j.paid.2009.07.012>
- Fernandez, J., Hyers, L., & O’Brien, K. (2016). Health literacy: A cross-disciplinary study in American undergraduate college students. *Journal of Information Literacy*, 10, 26–39. <https://doi.org/10.11645/10.2.2103>
- Fernandes, J., & Lofgren, I. E. (2011). Prevalence of metabolic syndrome and individual criteria in college students. *J Am Coll Health*, 59, 313–321. <https://doi.org/10.1080/07448481.2010.508084>
- Hatzenbuehler, M. L., Corbin, W. R., & Fromme, K. (2011). Discrimination and alcohol-related problems among college students: A prospective examination of mediating effects. *Drug and Alcohol Dependence*, 115, 213–220. <https://doi.org/10.1016/j.drugalcdep.2010.11.002>
- Hausmann, L. R. M., Schofield, J. W., & Woods, R. L. (2007). Sense of belonging as a predictor of intentions to persist among African American and white first-year college students. *Research in Higher Education*, 48, 803–839. <https://doi.org/10.1007/s11162-007-9052-9>
- Hill, L. K., Kobayashi, I., & Hughes, J. W. (2007). Perceived racism and ambulatory blood pressure in African American college students. *Journal of Black Psychology*, 33, 404–421. <https://doi.org/10.1177/0095798407307042>
- Horton, K. D., & Loukas, A. (2013). Discrimination, religious coping, and tobacco use among white, African American, and Mexican American vocational school students. *Journal of Religion and Health*, 52, 169–183. <https://doi.org/10.1007/s10943-011-9462-z>
- Hurtado, S., & Carter, D. F. (1997). Effects of college transition and perceptions of the campus racial climate on latino college students’ sense of belonging. *Sociology of Education*, 70, 324–345. <https://doi.org/10.2307/2673270>
- Huynh, V. W., & Gillen-O’Neel, C. (2016). Discrimination and sleep: The protective role of school belonging. *Youth Soc*, 48, 649–672. <https://doi.org/10.1177/0044118X13506720>
- Irazusta, A., Hoyos, I., Irazusta, J., Ruiz, F., Díaz, E., & Gil, J. (2007). Increased cardiovascular risk associated with poor nutritional habits in first-year university students. *Nutrition Research*, 27, 387–394. <https://doi.org/10.1016/j.nutres.2007.05.007>
- Juang, L., Ittel, A., Hoferichter, F., & Miriam, G. M. (2016). Perceived racial/ethnic discrimination and adjustment among ethnically diverse college students: Family and peer support as protective factors. *Journal of College Student Development*, 57, 380–394. <https://doi.org/10.1353/csd.2016.0048>
- Kuhn R, Rahman O, Menken J. *Survey Measures of Health: How Well Do Self-Reported and Observed Indicators Measure Health and Predict Mortality?* National Academies Press (US); 2006. Accessed November 25, 2019. <https://www.ncbi.nlm.nih.gov/books/NBK20307/>
- Kwan, M. Y., Cairney, J., Faulkner, G. E., & Pullenayegum, E. E. (2012). Physical activity and other health-risk behaviors during the transition into early adulthood: A longitudinal cohort study. *American Journal of Preventive Medicine*, 42, 14–20. <https://doi.org/10.1016/j.amepre.2011.08.026>
- Lewis, K. L., Stout, J. G., Pollock, S. J., Finkelstein, N. D., & Ito, T. A. (2016). Fitting in or opting out: A review of key social-psychological factors influencing a sense of belonging for women in physics. *Phys Rev Phys Educ Res*, 12, 020110. <https://doi.org/10.1103/PhysRevPhysEducRes.12.020110>
- MacDonald, G., & Leary, M. R. (2005). Why does social exclusion hurt? The relationship between social and physical pain. *Psychological Bulletin*, 131, 202–223. <https://doi.org/10.1037/0033-2909.131.2.202>
- McCabe, C. J., Kim, D. S., & King, K. M. (2018). Improving present practices in the visual display of interactions. *Advances in Methods and Practices in Psychological Science*, 1, 147–165. <https://doi.org/10.1177/2515245917746792>
- Pager, D., & Shepherd, H. (2008). The sociology of discrimination: Racial discrimination in employment, housing, credit, and consumer markets. *Annual Review of Sociology*, 34, 181–209. <https://doi.org/10.1146/annurev.soc.33.040406.131740>
- Robnett, R. D. (2016). Gender bias in STEM fields: Variation in prevalence and links to STEM self-concept. *Psychology of Women Quarterly*, 40, 65–79. <https://doi.org/10.1177/0361684315596162>
- Sacco, D. F., Bernstein, M. J., Young, S. G., & Hugenberg, K. (2014). Reactions to social inclusion and ostracism as a function of perceived in-group similarity. *Group Dynamics: Theory, Research, and Practice*, 18, 129–137. <https://doi.org/10.1037/gdn0000002>
- Saewyc, E. M., Konishi, C., Rose, H. A., & Homma, Y. (2014). School-based strategies to reduce suicidal ideation, suicide attempts, and discrimination among sexual minority and heterosexual adolescents in Western Canada. *Int J Child Youth Fam Stud IJCYFS.*, 5, 89–112
- Sarpong, D. F., Curry, I. Y., & Williams, M. (2017). Assessment of knowledge of critical cardiovascular risk indicators among college students: Does stage of education matter? *International Journal*



- of *Environmental Research and Public Health*, 14, 250. <https://doi.org/10.3390/ijerph14030250>
- Saydah, S. H., Siegel, K. R., Imperatore, G., Mercado, C., & Gregg, E. W. (2019). The cardiometabolic risk profile of young adults with diabetes in the US. *Diabetes Care*, 42, 1895–1902. <https://doi.org/10.2337/dc19-0707>
- Schweitzer, A. L., Ross, J. T., Klein, C. J., Lei, K. Y., & Mackey, E. R. (2016). An electronic wellness program to improve diet and exercise in college students: a pilot study. *JMIR Res Protoc*, 5, e29. <https://doi.org/10.2196/resprot.4855>
- Seber, G. A. F. (2009). *Multivariate observations*. John Wiley.
- Stebbleton, M. J., Soria, K. M., & Huesman, R. L. (2014). First-generation students' sense of belonging, mental health, and use of counseling services at public research universities. *Journal of College Counseling*, 17, 6–20. <https://doi.org/10.1002/j.2161-1882.2014.00044.x>
- Tabachnick, B. G., Fidell, L. S., & Ullman, J. B. (2019). *Using multivariate statistics*. (7th ed.). Pearson.
- Torgerson, C. N., Love, H. A., & Vennum, A. (2018). The buffering effect of belonging on the negative association of childhood trauma with adult mental health and risky alcohol use. *Journal of Substance Abuse Treatment*, 88, 44–50. <https://doi.org/10.1016/j.jsat.2018.02.005>
- Unger, J. B., Schwartz, S. J., Huh, J., Soto, D. W., & Baezconde-Garbanati, L. (2014). Acculturation and perceived discrimination: Predictors of substance use trajectories from adolescence to emerging adulthood among hispanics. *Addictive Behaviors*, 39, 1293–1296. <https://doi.org/10.1016/j.addbeh.2014.04.014>
- Walton, G. M., & Cohen, G. L. (2011). A brief social-belonging intervention improves academic and health outcomes of minority students. *Science*, 331, 1447–1451. <https://doi.org/10.1126/science.1198364>
- Weston, S. J., Hill, P. L., & Jackson, J. J. (2015). Personality traits predict the onset of disease. *Social Psychological and Personality Science*, 6, 309–317. <https://doi.org/10.1177/1948550614553248>
- Williams, J. S., Farrugia, M., & Bates, G. W. The initial development of the higher education belonging scale (HEBS). Accessed March 27, 2020. <https://unistars.org/papers/STARS2018/03A.pdf>
- Williams, K. D. (2002). *Ostracism: The power of silence*. Guilford Press.

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