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Health Mindsets as a Predictor of Physical Activity and Body Mass Index in American Indian College Students

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Abstract

American Indians are at increased risk for cardiovascular disease (CVD) in adulthood, and levels of physical activity and body mass index (BMI) associate with CVD risk. Recent research indicates that one's mindset may play a role in determining health behaviors and outcomes. In a sample of 105 American Indian college students, greater growth health mindset associated with lower BMI. Bootstrapping analyses revealed a significant indirect effect of health mindset on BMI through levels of physical activity. These findings suggest that interventions aiming to promote growth health mindsets may be successful in reducing risk for CVD for American Indian college students.

American Indian (AI) populations are at disproportionate risk for obesity and related diseases including cardiovascular disease (Espey et al., 2014), both of which are positively affected by engagement in physical activity (Slater et al., 2010). One's decision to engage in physical activity may be affected by their mindset about health. A "mindset" is a group of beliefs or assumptions held by an individual about the world which influences both their perceptions and actions. There are two unique types of mindsets: fixed and growth. These divergent mindsets can change the way in which different individuals respond to the same set of circumstances. An individual with a fixed mindset believes that certain attributes such as intelligence are not modifiable, whereas an individual with a growth mindset believes that intelligence can be changed through effort or behavior. Mindsets have been shown to be predictors of important outcomes across numerous domains including in the context of stress responses (Jamieson, Mendes, Blackstock & Schmader, 2010; Jamieson, Nock & Mendes, 2012; John-Henderson, Rheinschmidt, Mendoza-Denton & Francis, 2014), education (Yeager et al., 2019; Yeager et al., 2016), and personal relationships (Dweck, 2012; Van Tongeren & Burnett, 2018; Yeager et al., 2011). In all of these domains holding a "growth" mindset associated with more adaptive and productive outcomes, particularly in the face of difficulties or challenge, compared to holding a "fixed" mindset.

Mindsets themselves appear to be susceptible to intervention, and shifts towards growth mindsets have associated with positive changes in outcomes and behaviors (Halperin,

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Russell, Trzesniewski, & Dweck, 2011; Heyman & Dweck, 1992; Howe et al., 2019; Yeager et al., 2019). Positive changes from a growth mindset appear to help those who face well documented systematic disadvantages such as low socioeconomic status (Sisk et al., 2018) suggesting this cognitive tool may be particularly beneficial for disadvantaged or stigmatized groups. As noted previously, mindsets can also shape perceptions and behavior, and so interventions that aim to change behaviors, may increase their efficacy by promoting a growth orientation.

In the domain of health, findings from a growing body of work suggest that mindsets affect motivation and effort towards the initiation of health behaviors. For example, growth mindsets about fitness predict both self-reported previous exercise habits and future exercise intentions (Orvidas, Burnette, & Russell, 2018). Mindsets about weight have also shown to predict health-relevant outcomes. Individuals who believe weight is malleable exhibit better self-regulation following a dieting setback (Burnette, 2010), and inducing growth mindsets about weight experimentally associated with a positive change in dietary choices in a lab setting (Ehrlinger, Burnette, Park, Harrold, & Orvidas, 2017). Separately, there is initial evidence that individual differences in lay beliefs about the underlying cause of obesity may contribute to incidence of obesity and to differences in behavioral patterns related to risk for obesity. McFerran and Mukhopadhyay (2013) found that individuals who believed obesity was the result of lack of exercise, rather than a result of dietary choices, consumed more food in an experimental setting and were more likely to be overweight compared to individuals who believed that poor diet was the main cause of obesity.

In line with this, an individual's mindset about health as a broad construct, or the degree to which they believe that health is malleable and susceptible to change via effort and behavior, may affect the likelihood that they will engage in health behaviors that may improve health and reduce risk for disease. Health mindsets may be particularly important for populations who are at increased risk for future ill-health. Previous work found that the relationship between growth health mindsets and health relevant outcomes was stronger for African Americans compared to Non-Hispanic White Americans (Thomas, Burnette & Hoyt, 2019) and it has been suggested that individuals from more vulnerable populations may be more likely to adopt a fixed view of health because of their life circumstances (Mueller, Rowe & Zuckerman, 2017).

Based on this work, it is possible that the relationship between health mindsets and health-relevant outcomes may be particularly evident for health disparity populations. American Indians (AIs) are disproportionately affected by cardiovascular disease (Espey, Jim & Cobb, 2014), and risk for CVD is related to both physical activity levels and one's body mass index (BMI). Individuals who are overweight or obese early in the life-span are at increased risk for cardiovascular disease in adulthood (Baker, Olsen & Sorensen, 2007; Must, Jacques, Dallal, Bajema, & Dietz, 1995), and in adults increased body mass index (BMI) associates with an increase in various CVD risk factors (Loprinzi, Crespo, Andersen & Smit, 2015). Levels of physical activity are consistently associated with BMI (Levin et al., 2003), and previous work indicates an association between mindsets about health and exercise frequency (Orvidas, Burnette, Russell, 2018). As such, physical activity is one

health behavior that could decrease risk for CVD for AIs, acting as a mediator between mindsets about health and health-relevant outcomes such as BMI.

As noted previously, previous work has examined the relationship between lay beliefs or mindsets about particular health outcomes or health-behaviors (i.e. obesity, fitness, weight, exercise). However, mindsets about health more broadly, have not been investigated as a predictor of objectively measured health behaviors outside of the laboratory and health-relevant outcomes. As such, the work described here, makes a theoretical contribution, by considering whether one's view of health broadly speaking, as fixed or modifiable through effort and behavior, predicts a health behavior in daily life- objective levels of physical activity over a week, and body mass index. The proposed conceptual model is displayed in Figure 1. The use of an objective measure of physical activity, in place of self-reported exercise, advances existing work methodologically since self-report measures may be biased and be more reflective of intentions rather than actual behavioral patterns. Further, to date, this is the first study to explore health mindsets and their role in shaping risk factors for disease in AIs, an at-risk population (Espey et al. 2014). Specifically, we examine the relationship between health mindsets and BMI in AIs, exploring the possibility that growth health mindsets may associate with lower BMI, in part by associating with a greater amount of physical activity.

Methods.

AI students were recruited through flyers placed across a large state university. All procedures were approved by the University Institutional Review Board. Participants were paid $30 for their participation in this research. The study was advertised as an investigation focused on understanding the experience of AI college students. Interested participants were invited to the lab for a one-hour session. After providing informed consent, they completed a screening questionnaire to determine eligibility for the study. Students with self-reported sleep or chronic health conditions were excluded from this research. A research assistant obtained measures of height and weight for calculation of body mass index. Participants then completed a demographic questionnaire and a health mindset scale. Finally, research assistants placed a wrist accelerometer (Actigraph GT9X link, Pensascola, FL) on the participants' non-dominant hand. Accelerometers were initialized using ActiLife (version 6, Penascola, FL) in 60 second epochs. The Actigraph GT9X link is a device that detects and records movement through the use of an accelerometer. Participants wore the watch continuously for 7 days, after which they returned to the lab to return the device and received compensation for their participation.

Measures

Health Mindsets.—To measure health mindsets, we used a modified version of previously used scales developed by Dweck and colleagues (Dweck, Chiu & Hong, 1995 & Dweck, 2006). Participants were instructed to report their agreement with each of the following statements on a 6-point Likert scale (1-strongly agree, 6- strongly disagree: "Your body has a certain amount of health, and you really can't do much to change it," "Your health is something about you that you can't change very much," and "You can try to make yourself

feel better, but you can't really change your basic health." Higher scores on the health mindset scale reflect growth health mindsets, while lower numbers reflect a fixed health mindset.

Actigraphy measured Physical Activity.—The sleep period was excluded and the levels of physical activity were defined according to the cut-off points outlined by Freedson et al, 1998. Light physical activity was defined as between 101 and 1951 counts per minute, and activity greater than or equal to 1952 counts per minute was defined as moderate to vigorous physical activity (MVPA) (Cain et al. 2013; Lindamer et al., 2008). Participants were excluded from analyses if the accelerometers were not worn for at least 10 hours per day (excluding the sleep period) for at least 5 days (n=3).

Body Mass Index.—A trained research assistant obtained a measure of height and weight in order to calculate participant Body Mass Index (BMI).

Current Depressive Symptoms.—Previous work documents a relationship between depressive symptoms and BMI (Noh, Kwon, Park & Kim, 2015; Xie, Chou, Johnson & Krailo, 2002). Based on this relationship, we used Beck's Depression Inventory (BDI-II) as a measure of current depressive symptoms to examine relationships between depressive symptoms and our outcomes of interest. The BDI-II is a 21-item questionnaire widely used to assess subclinical and clinical depression (Beck, Steer, Ball & Ranieri, 1996). Each item includes 4 response options. As an example, participants are asked to select which of the following 4 statements most accurately reflects how they have been feeling in the last 2 weeks, including today: (0) I am not particularly discouraged about the future, (2) I feel I have nothing to look forward to, and (3) I feel the future is hopeless and that things cannot improve. A total score is derived by summing all of the responses, and higher scores reflect more depressive symptoms (possible range = 0–63).

Socioeconomic status.—Past work indicates a relationship between a socioeconomic status (SES) and BMI (Bradshaw, Kent, Henderson & Setar, 2017) and SES was one of the strongest moderators of the effects of a growth mindset intervention (Sisk et al., 2018). Based on these relationships, we collected a measure of subjective socioeconomic status using the MacArthur's scale of subjective socioeconomic status (Adler, Epel, Castellazzo, & Ickovics, 2000) to investigate relationships between SES and our measures of interest. Participants were asked to place an "X" on a nine-rung ladder to indicate their perception of their Socioeconomic Status (SES) relative to the rest of the United States. Participants were told that those at the top of the ladder had the most money, the most education, and the most respected jobs, whereas those at the bottom were the worst off, with the least money, the least education, and the least respected job or no job (M(SD)= 5.85[1.83]).

Statistical Analyses

Statistical analyses were conducted using SPSS (IBM: Version 24). Linear regression models were used to conduct the main analyses. Continuous covariates were centered prior to use in statistical models.

Health mindset was modeled as a continuous predictor. We tested our primary hypotheses using a linear regression with health mindset predicting BMI. Next, to test for indirect effects of health mindsets on BMI through levels of measured physical activity, we used a bootstrapping approach (Preacher & Hayes, 2004). Specifically, a point estimate of the indirect effect was derived from the mean of 5000 estimates of the indirect pathways, and 95% confidence intervals (CIs) were computed using the cutoffs for the 2.5% highest and lowest scores of the distribution. Indirect effects were considered significant when the CI did not include 0.

Results

Participants were 105 AI college students ranging in age from 18–38 years of age (M[SD]=21.56[4.04]). Fifty-eight percent of the participants identified as female. Our reported analyses include participants with all of the predictors. Descriptive statistics for the sample are listed in Table 1. We examined bivariate relationship between our variables of interest. Our outcome variable, BMI, was significantly related to depressive symptoms, health mindsets, light physical activity, and moderate to vigorous physical activity. Bivariate correlations between main variables of interest are reported in Table 2.

Health mindset and levels of physical activity

In a linear regression model, participants' health mindset predicted levels of both light and moderate to vigorous physical activity ($\beta = .36$ $t(97) = 3.74$, $p < .001$, $R^2 = 0.13$) and ($\beta = .47$, $t(97) = 5.34$, $p < .001$, $R^2 = 0.23$) respectively. Specifically, growth mindset was related to higher levels of both light and moderate to vigorous physical activity.

Health mindset and BMI

In a separate linear regression, participants' health mindset associated with BMI ($\beta = -.58$, $t(97) = -6.94$, $p < .001$, $R^2 = 0.33$), with growth mindset associating with lower BMI.

Role of Physical activity levels in relationship between health mindset and BMI

Using the previously described method (Preacher & Hayes, 2004), we found a significant indirect effect of health mindset on BMI through levels of both light and moderate to vigorous activity (indirect effect (SE)=−.21 (.05), 95% CI = [−.31, −.11]) and (indirect effect (SE)=−.36(.07), 95% CI = [−.50, −.23]) respectively.

Discussion

To our knowledge, the findings reported here represent the first investigation of the relationship between general views of health as fixed or modifiable (i.e. health mindsets), an objective measure of physical activity outside of the lab, and a marker of disease risk, BMI, in a health disparity population, American Indians. By examining mindsets about the plasticity of health broadly speaking, this work is focused on a predictor that is upstream from the focus of previous investigations in this area (i.e. mindsets or lay beliefs about specific health behaviors or health outcomes). This novel focus is important since engagement in a health behavior may not depend specifically on their beliefs or mindsets

about a particular health behavior or condition, but instead may be driven by the degree to which an individual believes that their general health is fixed or modifiable.

The findings from this research provide initial evidence that for AI college students, differences in health mindset (i.e. the degree to which one views health as fixed) are associated with differences in BMI, and this relationship is in part accounted for by differences in actigraphy derived measures of physical activity. Specifically, a “growth” mindset of health is linked to lower BMI and higher levels of physical activity. The pattern of our findings are in line with relationships observed previously indicating that mindset shapes behaviors and effort (Dweck, 2006; Mangels, Butterfield, Lamb, Good & Dweck, 2006; Meppelder, Hodes, Kef & Schuengel, 2014; Mueller & Dweck, 1998), physiological and psychological responses (Jamieson, Mendes, Blackstock, & Schmader, 2010; John-Henderson et al., 2014; John-Henderson et al., 2015) and measures of academic performance (Broda et al., 2018).

While there is considerable existing research on the ability for mindsets to shape outcomes across multiple domains, these findings add to a relatively new focus on mindsets about health. Our data indicates that in AI college students, one’s mindset about health (i.e. fixed or modifiable) associates with differences in a risk factor for future CVD, body mass index (BMI). Importantly, our findings point to a potential behavioral pathway that contributes to this association. By objectively measuring levels of physical activity over the course of a week, we found evidence that a growth health mindset associated with higher levels of light and moderate to vigorous physical activity over the monitoring period. Given previous work indicating that brief interventions aiming to shift mindsets towards a growth orientation associated with positive changes in outcomes that persisted over time (Walton & Cohen, 2011;Yeager et al., 2019; Yeager et al., 2016), it is possible that similar interventions designed to promote growth health mindsets may positively affect levels of physical activity, and in doing so may reduce disease risk for at-risk populations. For example, based on the accessibility and demonstrated feasibility of mindset interventions (Walton & Cohen, 2011), researchers have highlighted the potential for health mindset interventions (i.e. promoting growth health mindsets) to be used by health care providers to improve health outcomes and have identified health mindset research as an important avenue of future research (Mueller, Rowe & Zuckerman, 2017; Sujka, St Peter & Mueller, 2018).

While there are significant strengths to this research including use of actigraphy-derived measure of physical activity and focus on a health disparity population, there are also important limitations to note. First, while the American Indian sample is a strength of this research given the disproportionate incidence of CVD in this population, it is unknown whether similar relationships would be observed across other racial or ethnic groups. Further, participants in this sample were relatively young. Future research should investigate these relationships later in the life-span when risk for CVD increases. At the same time, identification of individuals who are at risk early in life would allow for prevention before disease is present. Additionally, our sample was comprised of American Indians in a college setting. As such it remains unknown whether these relationships would be affected by environmental context such as whether individuals are living in an urban environment or whether they live in a tribal community on a reservation. It is also important to note that

modelling mediation analyses with cross-sectional data could provide biased and misleading results (Maxwell & Cole, 2007). Future research should investigate these relationships using a longitudinal design to better understand causal relationships between mindset and health behavior. Finally, future work should aim for a larger sample size. In spite of these limitations, these findings provide support for the development of interventions focused on shifting mindsets as an upstream factor that may precede health behaviors, which in turn shape markers associated with disease risk.

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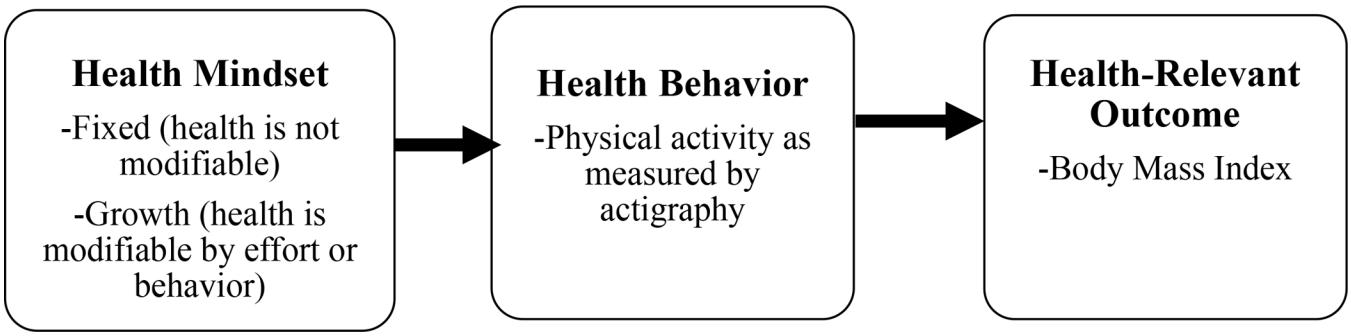

Figure 1.
Full conceptual model

Table 1

Descriptive Statistics (N=105).

	Mean	SD	%
Age	21.56	4.04	
Sex (% female)			58%
Subjective SES (range:1–10)	5.05	2.03	
Current depressive symptoms	11.75	8.29	
Health Mindset (range:3–18)	10.03	4.57	
Light Physical Activity (min/day)	160.32	63.18	
Moderate to Vigorous Physical Activity (min/day)	55.33	33.82	
Body Mass Index	26.43	5.17	

Note: SES: Socioeconomic Status

Table 2

Correlation Matrix for Key Variables

Variable	1	2	3	4	5	6	7	8
1.Age	--	.06	−.03	.03	.01	.02	−.01	−.07
2.Gender		--	.01	−.04	−.03	−.10	−.07	−.05
3.Subjective SES			--	−.10	.10	−.18	.05	−.10
4. Depressive symptoms				--	−.22*	.12	.25*	.20*
5. Body Mass Index					--	−.58**	−.66**	−.75**
6.Health Mindset						--	.36**	.48**
7. LPA/week							--	.65**
8. MVPA /week								--

Note: Gender: Male=1, Female=2, SES= Socioeconomic Status, LPA= Light Physical Activity, MVPA= Moderate to Vigorous Physical Activity

* $p < .05$ (two-tailed).

** $p < .01$ (two-tailed).