ABSTRACT

THOMAS, FANICE N. Health Mindsets and Obesity-Related Health Behaviors. (Under the direction of Dr. Jeni L. Burnette).

The rate of obesity in the United States has rapidly grown over the past 30 years, with the National Health and Nutrition Examination Survey indicating a 70% increase in adult obesity and an 85% increase in childhood obesity between the 1990s and 2010s (Fryar et al., 2016). Having obesity negatively impacts physical and mental health, contributes to lower quality of life and higher mortality rates, and it is economically costly both at the individual and societal level (Biener et al., 2017; Dixon, 2009; Fabricatore & Walden, 2006; Stein & Colditz, 2014; Taylor et. al., 2013). Considering the personal and societal toll of obesity, researchers often examine ways to prevent, reduce and treat it. Although the etiology of obesity is complex and multifactorial, a considerable amount of obesity prevention and reduction research focuses on individual's eating and exercise behaviors as these behaviors are heavily implicated as causes of obesity. Within this area of research, there is increasing focus on how mindsets, defined as beliefs regarding the fixed or changeable nature of traits and attributes, inform health attitudes and influence health-related behaviors in important ways. The three manuscripts included in this dissertation add to this growing field of research applying mindset theory to the health domain. The first manuscript examines the relationship between mindsets of health and intentions to engage in healthy eating, the second focuses on the implications of mindsets of weight and public health messages on well-being and stigma, and the final manuscript explores the relationship between health belief profiles, motivation, health behaviors, and health outcomes. The findings from this research point to the utility of a mindset-based approach for addressing obesity.

Health Mindsets and Obesity-Related Health Behaviors

by
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DEDICATION

To my mother, Jane M. Ombachi, a woman like no other. And to my beloved, Jamaine R. Thomas, whose support of my wildest dreams has always been unwavering- WE did it!

BIOGRAPHY

Fanice N Thomas was born in Nyamira, Kenya. She graduated from Asumbi Girls High School before moving to the United States to attend college. In 2015, she graduated with a Bachelor of Arts in Psychology from Metropolitan State University, and in 2016 joined North Carolina State University to pursue her Doctoral degree in Psychology.

In addition to being a graduate student, Fanice is a Robert Wood Johnson Foundation Health Policy Research Scholar and a community faculty member, teaching psychology, at Metropolitan State University.

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CHAPTER 1

Background

The United States adult obesity rate is 39.8%, with about 93.3 million adults meeting the criteria to be classified as having obesity (CDC, 2019). Furthermore, the current obesity rate for American children aged between 2 and 19 years is 18.5%, which translates to approximately 13.7 million children (CDC, 2019). The rate of obesity in the United States has rapidly grown over the past 30 years, with the National Health and Nutrition Examination Survey indicating a 70% increase in adult obesity and an 85% increase in childhood obesity between the 1990s and 2010s (Fryar et al., 2016). Worldwide, 39% of adults have obesity, representing a tripling of the obesity rate since the 1970s (WHO, 2020).

Obesity is defined as having excess body weight and is commonly assessed using the Body Mass Index (BMI) which is calculated by dividing weight in kilograms by the square of height in meters (Garrow & Webster, 1985). Adults are classified as having obesity if their BMI is above 30. Obesity negatively impacts physical health, with individuals with obesity being at greater risk for various non-communicable diseases, including heart disease, stroke, Type II diabetes, and various types of cancers, as well as mental health (Fabricatore & Walden, 2006; Dixon, 2009). Obesity is also associated with lower quality of life (Taylor et. al., 2013), greater individual and societal financial burden (Biener et al., 2017), and higher mortality rates (Stein & Colditz, 2014). Considering the personal and societal toll of obesity, researchers often examine ways to prevent, reduce and treat it. With a complex and multifactorial etiology, addressing the epidemic requires interventions at multiple levels, including public and institutional policies, community involvement and individual behavior change.

In my programmatic line of research, I focus on examining a set of individual level factors that contribute to obesity. At the individual level, obesity is attributed to, amongst other causes, poor eating habits and physical inactivity (Michie et al., 2009; Noble et al., 2015; Wright & Aronne, 2012). However, despite an awareness that healthier diets and more physical activity reduces obesity risk, many people fail to engage in such behaviors. Various psychological constructs, including self-efficacy, self-regulation, motivation, and attributions, have been identified as being important to promoting and sustaining health behavior engagement (Blotnicky et al., 2015; Burnette et al., 2013; Knerr et al., 2016; Michie, et al., 2009; Orvidas et al., 2018). In my work, I examine how mindsets, individuals' beliefs about the malleable versus stable nature of their health, inform important psychological constructs that play a role in health-related behaviors and outcomes.

Mindsets

Mindsets, also known as implicit theories, are individuals' beliefs about the malleability or stability of traits or attributes (Dweck & Leggett, 1988; Molden & Dweck, 2006). Mindsets exist along a continuum, anchored at one end by the beliefs that traits or attributes are static and unchangeable (fixed mindsets), and on the other end by beliefs that attributes or traits are malleable or changeable (growth mindsets) (Burnette et al., 2020; Dweck & Leggett, 1988; Molden & Dweck, 2006). It is important to note that mindsets are domain specific, meaning an individual can hold a growth mindset in one domain (e.g., weight) and a fixed mindset in another (e.g., intelligence). Mindsets impact behavior via their effects on motivation, self-regulation, and goal achievement orientation (Biddle et al., 2003; Burnette & Finkel, 2012; Burnette et al., 2013). For example, individuals with fixed mindsets set performance focused goals (i.e., trying to outdo their peers) and, when facing setbacks, they tend to experience more negative emotions

and respond with helplessness. This can contribute to poor performance, or even engagement avoidance when success is perceived to be unlikely. In contrast, individuals with a growth mindset set goals focused on learning, engage in mastery-oriented self-regulatory strategies and remain optimistic about the potential for future success even in the wake of setbacks. These factors are more likely to contribute to successful goal attainment (Burnette et al., 2013).

Mindsets and Health

Although mindset research originated, and has been extensively applied, within educational contexts (e.g., Blackwell et al., 2007; Degol et al., 2018; Paunesku et al., 2015), it has been quickly expanding into other domains, including health. Within the health domain, mindsets have been applied to various areas, including weight (e.g., Burnette, 2010), fitness (e.g., Orvidas et al., 2018), tobacco use and cessation (e.g., Thai et al., 2016), addiction (Burnette et al., 2019), and general health behaviors (Bunda & Busseri, 2017). Generally, individuals with growth mindsets report greater engagement, or intentions to engage in positive health behaviors. For example, individuals with growth, relative to fixed mindsets of weight, reported healthier eating and exercise behaviors (Parent & Alquist, 2015) and consumed fewer calories from unhealthy foods (Ehrlinger et al., 2017). Additionally, even when faced with severe setbacks (i.e., gaining weight), dieters who participated in a growth mindset of weight intervention reported less weight gain at the end of the 12-week study, compared to those in an attention-matched and a no treatment control condition (Burnette & Finkel, 2012). Furthermore, in a fitness context, individuals with a growth, relative to a fixed mindset of fitness, reported higher past exercise frequency and future exercise intentions (Orvidas et al., 2018).

Overview of Research Chapters

The work presented here adds to the growing field of research focused on utilizing mindset theory to understand how to promote engagement in health behaviors, namely healthy eating and physical activity. Across the three related manuscripts included in this dissertation, I investigate: 1) the relationship between mindsets of health and intentions to engage in healthy eating and identify the role of expectancy-value beliefs as a key mechanism linking the two (Thomas et al., 2019), 2) if growth mindsets are helpful or harmful by examining how mindsets of weight and public health messages regarding the nature of weight impact individuals' physical and mental health (Hoyt et al., 2019), and 3) investigate whether mindset beliefs combine with attributions to form an allied belief system that uniquely informs individual's engagement in healthy eating and exercise behaviors.

CHAPTER 2

Introduction

In 2018, the Center for Disease Control and Prevention (CDC) reported 39.8% of adults in the United States met the criteria to be classified as obese, (i.e., their Body Mass Index is at or above 25). This high obesity rate is a cause for concern because obesity related illnesses, including Type II diabetes, high cholesterol, strokes, and heart attacks (Fabricatore & Walden, 2006) are amongst the leading causes of mortality in the US (WHO, 2016). Furthermore, with an approximate annual medical care cost of $147 billion, these illnesses have a large personal and societal economic impact (Mastellos et al., 2014).

High obesity rates are attributed, amongst other causes, to poor diet and eating habits (NIH, 2012; Wright & Aronne, 2012). Thus, a possible way to reduce current obesity rates is via a change in eating habits. Previous research highlights psychological, situational, environmental, cultural, and economic factors that influence individuals' eating habits (e.g. Pliner & Mann, 2004; Popkin et al., 2005; Torres & Nowson, 2007). In the current research, we home in on psychological aspects, with a focus on how individuals' beliefs about the malleable (growth mindsets) versus stable nature (fixed mindsets) of their health inform their intentions to engage in healthy eating behaviors. Further, we explore whether these mindsets matter more for some groups than others.

Mindsets

Mindsets, originally referred to as implicit theories, are lay beliefs regarding the stability or malleability of a trait or attribute (Dweck & Leggett, 1988; Molden & Dweck, 2006). Broadly, individuals' mindsets fall into one of two categories: individuals who hold a fixed mindset believe that attributes are not changeable, whereas those with a growth mindset believe that

attributes are changeable (Dweck, 2000). It is important to note that mindsets are domain specific and thus one can have a growth mindset in one domain (e.g., health) but a fixed mindset in another (e.g., musical ability). Across domains or attributes, individuals' mindsets inform self-regulatory strategies. For example, individuals with fixed mindsets set performance focused goals—trying to outdo their peers—and when facing setbacks, they tend to feel more negative emotions and respond with helplessness. In contrast, individuals with a growth mindset set goals focused on learning, engage in mastery-oriented self-regulatory strategies and remain optimistic about the potential for future success even in the wake of setbacks (Burnette et al., 2013).

Mindsets, although extensively applied within educational contexts (e.g., Blackwell et al., 2007; Degol et al., 2018; Paunesku et al., 2015) are also relevant in health domains including weight (e.g., Burnette, 2010), fitness (e.g., Orvidas et al., 2018), tobacco use and cessation (e.g., Thai et al., 2016), and health behaviors (Bunda & Busseri, 2017). For example, individuals with growth, relative to fixed, mindsets of weight reported healthier eating and exercise behaviors (Parent & Alquist, 2015) and consumed fewer calories from unhealthy foods (Ehrlinger et al., 2017). Additionally, dieters who participated in a growth mindset of weight intervention, who faced severe setbacks, reported less weight gain at the end of the 12-week study, compared to those in an attention-matched and a no treatment control condition (Burnette & Finkel, 2012). Furthermore, in a fitness context, individuals with a growth, relative to a fixed, mindset of fitness reported higher past exercise frequency and future exercise intentions (Orvidas et al., 2018). Also, within the context of changing unhealthy smoking habits, individuals with a growth, relative to a fixed, mindset of smoking were more likely to report being former smokers rather than current smokers (Thai et al., 2016). Finally, within the context of general health, individuals

with a growth mindset, compared to a fixed mindset, of health reported stronger intentions to engage in positive health behaviors (Bunda & Busseri, 2017).

We extend this work on mindsets and health in important ways. First, rather than examining distinctive attributes associated with health (i.e., weight, fitness, smoking), we examine more general mindsets of health and their relation to healthy intentions. A meta-analysis of implicit theories revealed that growth mindsets are particularly useful for promoting self-regulatory behaviors, such as goal setting and achievement, and intentions to engage in healthy behaviors are critical for achieving health goals (Burnette et al., 2013).

In this work, we focus on the relationship between mindsets of health and healthy eating intentions. In addition, we examine the psychological process driving this relationship by focusing on expectancy-value beliefs. Finally, we explore for whom mindsets matter most. Understanding how mindsets work to inform health behavior and under what conditions effects are strongest can help inform future intervention work.

Expectancy-Value

We propose that the extent to which an individual expects a successful outcome and thinks it is important (expectancy-value) is one underlying mechanism linking growth mindsets to healthy behaviors. Expectancy is how well the individual thinks or believes they will perform on the task (Eccles & Wigfield, 2002). Value is based on evaluations regarding the importance (attainment value), enjoyment (intrinsic value) and/or usefulness (utility value) of the task to the individual (Eccles, 2009). We suggest that mindsets of health come earlier in the psychological chain and inform expectancy-value beliefs. For instance, in a study on the role of mindsets in overcoming dieting related setbacks, individuals' expectations regarding dieting success mediated the relationship between weight mindsets and regulatory efforts (Burnette, 2010).

Similarly, findings from research on the role of mindsets of fitness on exercise behaviors indicated that the extent to which the individual values fitness as a part of their identity influenced both their past exercise habits and future exercise intentions (Orvidas et al., 2018). In the current research, we merge the mindsets perspective with achievement motivation theory and suggest that mindsets matter for eating intentions, at least in part, because they inform individuals' expectancy-value beliefs.

Expectancy-value beliefs are core concepts in achievement motivation theory for understanding an individual's likelihood of engaging, persisting, and succeeding on a particular goal or task and have important implications for engaging in healthy behaviors (Wigfield & Eccless, 2000). Overall, an individual is more motivated to undertake a task based on the extent to which they see themselves as efficacious and competent in ways relevant to the task, and evaluate it as having intrinsic, utility and/or attainment value (Wigfield & Eccless 2000). For example, research on the role of expectancy theory on healthy eating behaviors indicates that individuals who value a nutritious diet, understand the impact of nutrition on health, and expect healthy eating to positively impact their health were more likely to engage in healthy eating behavior (Blotnicky et al., 2015). Similarly, the extent to which individuals perceived themselves as having the ability to engage in exercise and eat healthy influenced their engagement in exercise and healthy eating (Sabiston & Crocker, 2008). Finally, in a study on implicit theories of fitness, participants' self-efficacy and self-value regarding fitness predicted past exercise habits and future exercise intentions (Orvidas et al., 2018).

Moderators

In addition to examining the questions of do mindsets matter for healthy eating and why do they matter, we are also interested in *for whom* they matter most. Considerable research has

shown that mindsets matter the most for those who are most at-risk in the relevant domain. For example, in a large-scale mindset intervention aimed at increasing academic achievement, the intervention had the strongest effects for students at the greatest risk of dropping out of school (Paunesku et al., 2015). It is prudent to note that other work has shown that mindset interventions only had positive achievement outcomes for high achieving but not underperforming students (Chao et al., 2017). In a recent meta-analysis of growth mindset interventions in academics, Sisk et al., (2018) found a weak relationship between mindset interventions and academic achievement. Moreover, their findings show mixed support for the idea that growth mindsets can buffer those at risk from declines in academic performance; for example, their analyses revealed that mindset interventions were effective for low income students and students at risk of failing but not for students facing situational challenges. Furthermore, the meta-analysis of implicit theories and self-regulation (Burnette et al., 2013) indicates that growth mindsets are particularly useful especially in instances of ego threat, defined as threats to self-identity that can arise from experiences such as negative feedback, setbacks, or stereotype threat.

In the current study we are interested in whether growth mindsets can help groups at risk for less healthy eating. We specifically focus on African Americans as a group at risk based on previous research findings that generally African Americans report less healthy eating habits compared to White Americans (e.g. Cockerham et al., 2017; Delva et al., 2013). African Americans have an obesity rate of 46.8%, compared to 37.9% in non-Hispanic Whites (CDC 2018), indicating that, to the extent that poor eating habits are a contributing factor in developing obesity, it's important to address this risk factor in the groups for whom it exists.

In summary, we address three main questions in the current research. First, do mindsets of health matter for intentions to engage in healthy behaviors? Second, why do they matter?

Third, for whom do they matter? We hypothesize that growth mindsets will predict healthier eating intentions and this relation will be mediated by expectancy-value. And, the link between mindsets and outcomes will be stronger for subgroups (i.e., African Americans) who generally report less healthy eating in the past. We test these hypotheses across two studies. The first is a correlational study and the second is an experimental study.

Study 1

Methods and Materials

We recruited 200 participants from Amazon's Mechanical Turk (MTurk) to participate in the study. We paid the participants $.50 to complete an online Qualtrics survey which contained measures of mindsets of health, expectancy-value beliefs, healthy eating intentions and past eating behaviors. Because we were specifically interested in the possible moderation effects of race and in African Americans as an at-risk population, we used MTurk panels to recruit equal numbers of African American and White participants. The institutional review board approved all procedures. We excluded some participants for completing the study in an unreasonably long or short amount of time, n= 34, and we also excluded participants who failed attention checks, n= 8, (e.g., selected the wrong option on the item: "For this item select option 4/ Neutral"). This left a final sample of N= 158 participants, 61% female aged 20 to 70 years (M= 36.77, SD= 11.83). The final sample of participants contained n= 79 participants who identified as African American, n= 74 who identified as White and n= 5 who did not provide information on race/ethnicity.

Measures

Mindsets of Health

We adapted the Implicit Theories of Weight scale (Burnette, 2010) by replacing the word "weight" with the word "health." Our 4-item scale assessed mindsets of health (e.g., "No matter who you are, you can significantly change your health"). We recoded such that higher scores on this measure indicate a stronger growth mindset of health [1= "*Strongly disagree*" to 7= "*Strongly agree*"; α= .79].

Expectancy-Value

We created a 14-item measure assessing efficacy expectations and value beliefs based on Wigfield and Eccles' (2008) expectancy-value theory of achievement motivation. The scale measures expectancy (e.g., "I'm sure I can learn new information related to healthy eating"), utility value (e.g., "Learning how to make healthy food choices is important to me"), intrinsic value (e.g., "I like eating healthy foods") and attainment value (e.g., "Making healthy food choices makes me feel good about myself"). Higher scores on the measure indicate stronger expectancy-value beliefs [1= "*Strongly disagree*" to 7= "*Strongly agree*"; α= .91].

Healthy Eating Intentions Scale

To assess individuals' future eating intentions, we adapted the 7-item Dieting Intentions Scale (Cruwys et al., 2013). Specifically, we replaced the phrases "go on a diet" with "change my eating behaviors" and "reduce my calorie intake" with "consume more healthy foods." We coded such that higher scores represent healthier eating intentions [e.g. 1= "*Harmful*" to 7= "*Beneficial*"; α= .86].

Past Eating Habits

We created a 5-item measure to examine past eating habits. Participants responded to 5 items (e.g., "How often do you monitor the portions of food you're consuming?"). Higher scores indicated healthier past eating habits [1= "*Never*" to 7= "*Always*"; α=.92].

Demographics

We asked participants to report their age, gender, and race/ethnicity.

We randomized all measures within the survey to avoid order effects.

Results

We used Hayes' (2013) PROCESS macro, an add-on for SPSS, to test all hypotheses. The PROCESS macro is an SPSS observed variable analysis tool used to analyze statistical models involving mediation, moderation, and their combination, i.e., conditional process modeling. In this analysis, we used Model 4 (Figure 1) to assess if there is an indirect effect of mindsets on eating intentions via expectancy-value beliefs. We used Model 1 to examine moderation. See Table 1 for means, standard deviations, alpha scores and correlations between the scales.

Mediation

First, stronger growth mindsets of health predicted healthier eating intentions, b= .36, $t(156)= 3.78$, $p<.001$, 95% CI [0.17, 0.54]. Stronger growth mindsets of health also predicted expectancy-value beliefs, b= .39, $t(156)= 6.85$, $p< .001$, 95% CI [0.28, 0.51] and expectancy-value significantly predicted healthy eating intentions, b= .66, $t(156)= 5.48$, $p<.001$, 95% CI [0.42, 0.90]. There is a significant indirect effect, b= .26, 95% CI [0.14, 0.41]. With the inclusion of expectancy-value beliefs in the model, there is no direct effect of mindsets of health on healthy eating intentions, b= .10, $t(156)= .99$, $p= .32$, 95% CI [-0.10, 0.29].

Moderation

To explore whether mindsets matter more for African Americans than White Americans, we examined whether race moderated the relationship between mindset of health and outcomes. First, we were interested in whether race moderated the relationship between mindsets of health and healthy eating intentions. Before conducting this analysis, we conducted an independent samples t-test see whether there were differences in past healthy eating habits. Results show significant differences in past eating habits based on race, $t(151)= 2.77$, $p = .006$, whereby African Americans reported less healthy past eating habits ($M= 4.01$, $SD= 1.08$) compared to White Americans ($M= 4.52$, $SD= 1.18$). We used Hayes' Process Model 1 (Figure 2) for the moderation analysis. Results indicate that race moderated the relationship between growth mindsets of health and healthy eating intentions, b= .43, $t(153) = 2.22$, $p= .03$, 95% CI [0.05, 0.81], such that effects of growth mindsets on eating intentions are significantly stronger for African Americans b= .57, 95% CI [0.14, 0.41], compared to White participants b= .15, 95% CI [0.13, 0.42].

Next, we examined whether race moderated the relationship between mindsets of health and expectancy-value beliefs. While the effects of growth mindsets on expectancy-value beliefs are significant for both groups, they are stronger for African Americans, b= .55, 95% CI [0.39, 0.71] than for White participants b= .23, 95% CI [0.07, 0.40].

Discussion

Study 1 provided initial evidence that stronger growth mindsets of health predict individuals' intentions to engage in healthier eating habits, and that this relationship is mediated by expectancy-value beliefs regarding healthy eating. Further, this study indicates that growth mindsets of health might matter more for individuals at greater risk for less healthy eating habits.

In the next study, we used an experimental design both in an attempt to replicate these findings and to examine the feasibility of manipulating mindsets of health.

Study 2

Methods and Materials

We preregistered the hypotheses, procedures and analyses for this study on the Open Science Framework prior to data collection. We recruited 224 participants on Amazon's Mechanical Turk to participate in the study. They were paid $.75. At the beginning of the survey, we used Qualtrics to randomly assign the participants to read either a growth mindset or a fixed mindset article. We formatted these articles to look like popular psychological news articles and they contained information that either portrayed one's health as fixed and unchangeable, or as changeable through effort and hard work. Similar articles have been previously used and shown to be effective at temporarily manipulating the mindsets of research participants (e.g., Burnette, 2010; Chiu et al., 1997).

Following our pre-registration plan, before analysis, we excluded participants who completed the study in an unreasonable amount of time, n= 5, failed embedded attention checks, n= 14, or provided irrelevant information for the article summary and evidence (e.g., writing "learning" for the article summary and "none" as the evidence provided in the article). This left a final sample of 205 participants, 51% Black, 60% female aged 18 to 76 years (M= 37.16, SD= 12.21).

Measures

After we manipulated mindsets of health, participants answered questions regarding the comprehensibility and clarity of the article and then completed the same measures as Study 1:

mindsets of health, expectancy-value beliefs, healthy eating intentions and past eating behaviors. Analyses indicated that measures are reliable (see Table 2 for alpha values).

Results

We conducted the following analyses in accordance with our pre-registered plan. See Table 2 for means, standard deviations, alphas, and bi-variate correlations of all study variables.

Manipulation Check (H1)

An independent samples t-test confirmed that the mindset manipulation was successful. Individuals in the growth mindset condition (M=6.10, SD= .85) reported significantly stronger growth mindsets of health compared to those in fixed mindset condition (M=5.21, SD= 1.34), $t(203) = -5.64$, $p < .001$, $\eta^2 = .14$. While those in the fixed mindset condition reported lower average scores than those in the growth mindset condition, we note that the score is relatively high on a 1-7 scale. As such, we propose that individuals in this group have a "weaker growth mindset", rather than a true fixed mindset, of health. Consequently, in analyses using these self-reports, we discuss findings in terms of strong versus weak growth mindsets of health.

Mediation (H2-H5)

We used the same Hayes' (2013) PROCESS Model 4 (Figure 1) used for Study 1. Participants in the growth mindset condition, relative to the fixed mindset condition reported healthier eating intentions b = .38, $t(203) = 2.84$, p= .005; 95% CI [0.12, 0.64] and stronger expectancy-value beliefs of health, b = .26, $t(203) = 2.11$, p = .04; 95% CI [0.02, 0.50]. Additionally, individuals reporting stronger expectancy-value beliefs also reported healthier eating intentions, b = .75, $t(202) = 13.51$, $p < .001$; 95% CI [0.64, 0.86]. Finally, there is an indirect effect of the mindset condition on healthy eating intentions via expectancy-value beliefs b=.19, 95% CI [.03, .39]. There was no significant direct effect of growth mindsets on healthy

eating intentions when expectancy-value beliefs are included in the model, b= .18, *t*(202) = 1.89, *p* = .06; 95% CI [-0.01, 0.37].

Moderation (H6)

Although not a pre-registered analysis, we were once again interested in whether the African American participants in our sample reported less healthy eating habits compared to White participants. Similar to Study 1 we conducted analysis examining the relationship between race and past eating behaviors. However, this study failed to replicate the relation between race and past healthy eating, *t*(199)= -1.16, *p*= .25.

Next, for hypothesis 6, we conducted a two-way ANOVA with condition (growth vs. fixed mindset) and Race (Black vs. White) as the independent variables, and healthy eating intention and expectancy-value beliefs as the outcome variables. While Levene's test for equality of variances was violated, ANOVA is robust with large sample sizes (Norman, 2010), and because we wanted to adhere to pre-registered analyses, the ANOVA results are reported. There is no condition by race interaction for healthy eating intention *F*(200) = .31, *p*= .58 or for expectancy-value beliefs *F*(200) = .04, *p*= .84.

Exploratory analyses

Since the analysis based on participants' assigned condition failed to replicate the moderation findings from Study 1, we were curious to know whether this would be different if we conducted the analysis based on individuals' self-reported mindsets of health. To conduct this analysis, we used Hayes' PROCESS Model 1 (Figure 2). Results from this analysis indicated that, unlike Study 1, race did not moderate the relationship between mindsets of health and healthy eating intentions, b= .12, *t*(197) = 1.20, *p*= .23, 95% CI [-.08, .31] or expectancy-value beliefs, b= .09, *t*(197) = .95, *p*= .34, 95% CI [-.09, .27]

Discussion

Consistent with previous experimental work on mindsets, we were able to successfully manipulate mindsets of health using simple articles. Further, this study confirmed the mediation findings from Study 1 indicating that higher growth mindsets of health promote stronger expectancy-value beliefs and healthier eating intentions. Since we manipulated mindsets of health, the findings suggest that growth mindsets of health can cause an increase in expectancy-value beliefs regarding healthy eating. However, we failed to replicate the moderation effects of race found in Study 1.

General Discussion

Across two studies, we demonstrated that mindsets of health matter for healthy eating intentions and that this relationship is mediated by expectancy-value beliefs. In Study 1, we found that the relationships between growth mindsets of health and both eating intentions and expectancy-value beliefs are strongest for a population at risk of unhealthy eating behaviors, namely, African Americans. In Study 2, these moderation findings failed to replicate. Further, in Study 2 we also showed that mindsets of health can be successfully manipulated - information that might be useful for the development of mindset interventions that address healthy eating.

Overall, the findings from these studies contribute to the existing mindset-related research on various health behaviors including exercise (Orvidas et al, 2018), weight-loss (Burnette & Finkel, 2012), and smoking cessation (Thai et al., 2016). Further, this research adds to literature by delineating one mechanism, expectancy-value beliefs, by which growth mindsets inform healthy behaviors. Understanding this mechanism provides important insights for theory development and application.

Finally, this research adds to the existing literature on the utility of growth mindsets for improving outcomes in at-risk populations by examining the relationship between mindsets of health and the eating behaviors of African Americans, a group considered to be at-risk for less healthy eating habits. It is important to note that while we were able to show a stronger correlational relationship between growth mindsets of health and healthier eating intentions for African Americans, compared to White Americans, we were unable to experimentally replicate these findings. One possible explanation for this is that self-reported beliefs and intentions are often stronger than experimentally manipulated ones. Or, it could be that, contrary to our expectations, mindsets might not have significantly different health intentions outcomes for African Americans compared to White Americans. While, to our knowledge, no research in the health domain supports this possibility, the meta analyses by Sisk et al., (2018) offer insight into which groups are most likely to benefit from mindset interventions. They found that those facing more chronic challenges, such as economic disadvantage or previous course failure, rather than situational challenges, such as stereotype threat, are more likely to benefit from mindset interventions. These findings and others are starting to uncover the complicated boundary conditions of mindset interventions. As Chao et al. (2017) have shown, both self and situational factors can interactively influence the impact of growth mindset messages. Overall, more work is needed to further reconcile these discrepancies in findings.

Implications

Our research provides a nuanced understanding of the importance of mindsets in the health domain and has important implications for psychological theory. The extant research examining mindsets and health focus on attribute-specific mindsets (e.g., weight, fitness, smoking). The current work extends this literature to examine mindsets of the broader construct

of health. These more general mindsets about the nature of health have the potential to impact a variety of health-related goals and behaviors beyond the outcome of healthy eating intentions examined in this research. Additionally, our research directly tested the psychological processes linking mindsets to healthy intentions. Our work shows that believing that one can change one's health can promote healthy eating intentions by encouraging beliefs that one will be successful at eating healthy and that healthy eating is useful and intrinsically valuable. This work contributes to a growing literature linking mindsets to important self-regulatory outcomes through expectancy-value theory (Eccles & Wigfield, 2002; Orvidas et al., 2018).

In terms of practical implications, the current research shows that growth mindsets of health and expectancy-value beliefs regarding healthy eating inform individuals' healthy eating intentions, which can have important implications for their actual behaviors. Since unhealthy eating habits contribute to obesity outcomes (Wright & Aronne, 2012), our findings expose a potential area for intervention work aimed at helping individuals change or adopt healthier eating habits. Because mindsets can be manipulated, this provides leverage for intervening.

Limitations and Future Directions

Despite the finding that mindsets matter and, together with expectancy-value beliefs, inform individuals' eating intentions, especially for some at-risk populations, there are a few important limitations in the current study that are worth noting. First, in this study we addressed behavioral intentions rather than actual behavior. While research has shown that intentions can be predictive of future behavior (Armitage & Conner, 2001), actual behavioral data is more reliable than self- reported intentions (Webb & Sheeran, 2006). As such, future research should examine these research questions using behavioral data, for example by using food diaries to assess what participants are actually eating. Second, in Study 2 we had inconsistent findings

regarding the utility of growth mindsets for at-risk populations with the moderation results from Study 1 not replicating. More research is needed to investigate this discrepancy. Third, since we only manipulated mindsets of health in Study 2, we only have causal evidence for the link between mindsets and expectancy value and mindsets and eating intention and thus cannot speak to causality between expectancy value and eating intentions. More research is needed to examine causality in this link. Fourth, while we were specifically interested in, and recruited, African American participants for this study, there are other groups that can be considered to be at-risk that we did not assess in the current work as this was the beyond the scope of this initial extension to the domain of health more generally. Further research is therefore needed to extend this work to include other at-risk groups (e.g., individuals with higher BMI, lower SES, etc.). Finally, in this research we only included one mediator and, while significant, these types of mediation analyses are biased to find significant indirect effects and do not tell us what other mediating variables inform the relationship between mindsets of health and eating intentions.

Conclusion

Obesity related illnesses, like diabetes and heart disease, contribute to a large share of the annual mortality rate and economic burden of disease (Fabricatore & Walden, 2006). Addressing individuals' eating behaviors presents one avenue through which we can combat the rising obesity rates. The current research merges the two theoretical frameworks of mindsets of health and achievement motivation theory (e.g., expectancy-value) to examine ways to improve eating intentions. Our findings indicate that stronger growth mindsets of health relate to healthy eating intentions via expectancy-value beliefs. Future research should further explore these findings, and their applicability to at-risk populations, in an effort to create interventions aimed at enhancing healthy eating.

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Table 1

Means, standard deviations, alphas and correlations between scales (N= 158)

Variable	M	SD	α	1	2	3	4	5
1. ITH	6.00	1.04	0.79	-	-	-	-	-
2. EVB	5.89	0.85	0.91	.48**	-	-	-	-
3. HEI	5.66	1.28	0.92	.29**	.48**	-	-	-
4. Race	-	-	-	.07	-.03	.12	-	-
5. PHE	4.24	1.15	0.86	-.01	.32**	-.06	-.22**	-

Note: ITH= Implicit theories of health, EVB= Expectancy- value beliefs, HEI= Healthy eating intentions, Race: 0= African American, 1= White Americans, PHE= Past healthy eating *p < .05. **p < .01

Table 2

Means, standard deviations, alphas and correlations between scales (N= 158)

Variable	M	SD	α	1	2	3	4	5	6
1. Condition	-	-	-	-	-	-	-	-	-
2. ITH	5.64	1.22	.79	.37**	-	-	-	-	-
3. EVB	5.80	0.89	.92	.15*	.51**	-	-	-	-
4. HEI	4.40	1.01	.88	.20**	.52**	.70**	-	-	-
5. Race	-	-	-	-.02	-.19**	-.24**	-.29**	-	-
6. PHE	5.80	0.96	.83	-.10	.14*	.46*	.21**	0.08	-

Note: Condition: 0= Fixed condition, 1= Growth condition, ITH= Implicit theories of health,

EVB= Expectancy- value beliefs, HEI= Healthy eating intentions, Race: 0= African

American, 1= White Americans, PHE= Past healthy eating *p < .05. **p < .01

Figure 1

Hypothesized mediation model

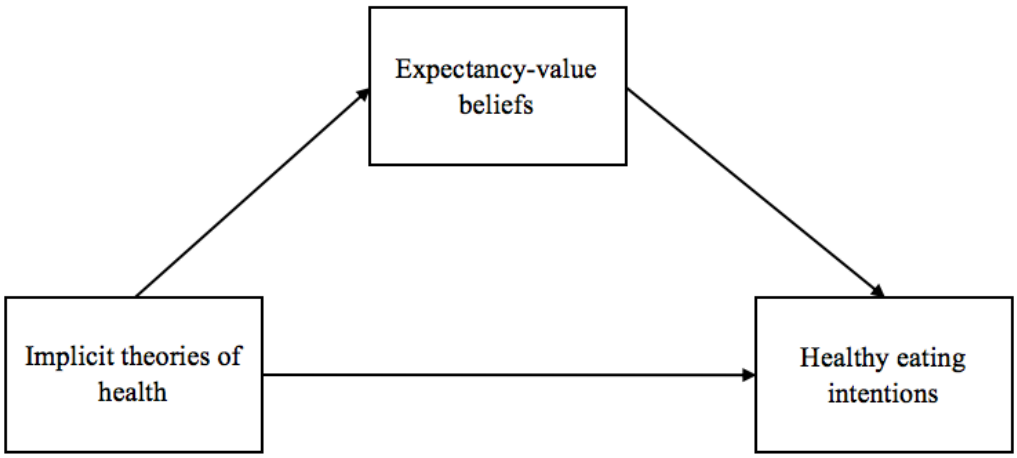
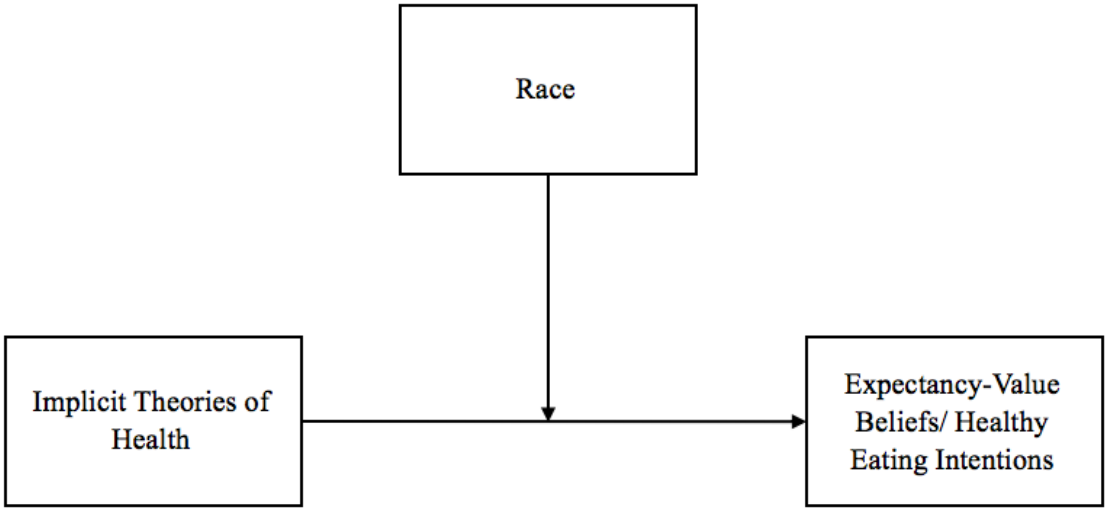


Figure 2

Hypothesized moderation model



CHAPTER 3

Introduction

We are constantly bombarded with information regarding weight-loss through social media and other outlets. It is important to recognize the influence of these health-related messages for physical and mental health as well as for our attitudes toward overweight individuals. The media is rife with conflicting messages about what, how much, and when to eat and drink in order to lose weight or maintain a healthy weight. For example, popular among weight-loss messages stressing the potential to change are those that suggest eating a variety of foods across the color spectrum, keeping a food and weight diary, eliminating liquid calories, measuring serving sizes, controlling portions, and eating mindfully—to name a few. These messages that feature personal responsibility and the potential to change one's weight are set in stark contrast to the increasingly prevalent message that diets do not work. This message is derived from research illustrating that dieting for weight-loss is not a strategy likely to lead to success—close to two thirds of people who lose weight by dieting regain it, often plus more, within a few years (Mann et al., 2007). The diets do not work messages highlight the complexities of trying to lose weight by describing the impediments and reiterating that for all but a small percentage of people diets are destined to fail.

Although both ideas share a common goal—to help people live healthier and happier lives—other aims and outcomes are quite different. Stressing regulating food seeks to help people reach their weight-loss goals through a change in diet but may also imply that people are to blame if they fail. In contrast, messages highlighting that diets do not work by stressing the evolutionary, biological, and metabolic barriers to weight-loss are designed to reduce blame and help people feel good about their body regardless of weight. These divergent messages distinctly impact people's beliefs about whether weight can be changed or not—termed mindsets. And,

these mindsets have important implications for health and stigma. In the current research, we empirically investigate how public health messages and weight-related mindsets influence health cognitions and behaviors related to thin ideals, psychological distress, and weight stigma.

Mindsets

Mindsets, referred to in earlier work as implicit theories, are people's lay beliefs about personal attributes, ranging from intelligence to sports ability (Dweck, 2000). The mindset approach differentiates between a fixed mindset (a belief in the static nature of human attributes) and a growth mindset (a belief in the malleable nature of human attributes) (Dweck & Leggett, 1988; Molden & Dweck, 2006). It is important to note that mindsets are domain specific, meaning that individuals can have a growth mindset in a certain domain (e.g., athletic ability) but a fixed mindset in another (e.g., math ability). These belief systems impact motivation, self-regulation, and goal achievement (e.g., Burnette, 2010; Burnette et al., 2013; Hoyt et al., 2014). Mindsets also serve as a framework that guide attributions about the self and others, with important implications for person perception (Erdley & Dweck, 1993; Hoyt & Burnette, 2013; Levy et al., 1998; Poon & Koehler, 2008).

Recent work extended the mindset approach to understand health behaviors including exercise intentions (Orvidas et al., 2018), dieting goal persistence (e.g., Burnette, 2010), addiction treatment intentions (Burnette et al., 2019), coping strategies for psychological distress (Park et al., 2017), and smoking cessation (Kauffman et al., 2017). For example, inducing a growth mindset about weight served as a buffer against weight-gain following severe dieting setbacks (Burnette & Finkel, 2012) and predicted healthier food choices (Ehrlinger et al., 2017). Additionally, growth mindsets regarding athletic ability predicted motivation and enjoyment of

physical education classes (Biddle et al., 2003). And, growth mindsets of health predicted healthier eating intentions (Thomas et al., 2019).

However, despite the benefits of a growth mindset for health behavior, some researchers question the implications of messages that weight is changeable for stigma, especially within the context of weight. Drawing on attribution theory, one of the most well-established predictors of stigma and prejudice against those with overweight or obesity is attributions of controllability; if weight is regarded as changeable, then people are deemed responsible for their weight (Crandall & Resser, 2005; Weiner et al., 1988). Indeed, the diets do not work movement emerged in part to offset the idea that weight can change through self-control because such beliefs can exacerbate weight-related stigma. People who are perceived to carry excess weight, and to be responsible for their condition, are the target of prejudice and discrimination in domains ranging from employment, to health care, to education (; Major et al., 2014; Puhl & Heuer, 2009; Tomiyama, 2014). Weight-related stigma and preferences for thinness develop at a young age and appear to be intractable (Cramer & Steinwert, 1998; Latner & Stunkard, 2003). This weight stigma can have a particularly pernicious effect on health and well-being when the stigma is internalized and individuals experience body shame and a sense of moral failure to meet societal standards and expectations (Durso & Latner, 2008; Noll & Fredrickson, 1998). Thus, understanding implications of mindsets for not only health behaviors but also psychological well-being and stigma, including the internalization of thinness ideals, is critical. In the current work, we empirically examine the complicated implications of growth mindset messages and beliefs for health cognitions and behaviors related to thin ideals, for psychological distress, and for weight stigma.

Mindsets, Attributions, and Essentialist Thinking

To theoretically tease out the nuanced implications of mindsets of weight, we draw on attribution theory and the essentialist thinking literature. Mindsets inform not only the attributions people make for acquiring a condition, such as excess weight, but they also influence beliefs about one's own potential efficacy for changing the condition (Brickman et al., 1982; Weiner et al., 1988). That is, mindsets influence both onset blame attributions (the extent to which people deem themselves and others as responsible for their current weight), as well as offset efficacy attributions (the extent to which they see themselves as having the capacity to change their weight in the future). Additionally, these mindsets of weight have implications for beliefs about the fixed nature of social categories—called social essentialism (Ryazanov & Christenfeld, 2018). Social essentialism is the belief that categories of people that differ on socially relevant attributes, such as race, gender, or weight, are fundamentally distinct kinds of people with an underlying and inherent essence (Rothbart & Taylor, 1992). To the extent that the social group is associated with traits that are devalued and stigmatized in society, such as people with obesity, social essentialism predicts stigma.

In the current work, differentiating mindsets, onset blame attributions, offset efficacy, and social essentialism, we offer an overall theoretical model that describes the implications of mindsets for how overweight is acquired as well as how, and if, weight can be managed in the future. Specifically, in this work, we test what has been called the stigma asymmetry model (Burnette et al., 2017; Hoyt et al., 2017), extending it beyond stigma to health-related outcomes. The asymmetry model proposes that growth mindsets of weight can have detrimental effects through attributions of blame but can have beneficial effects through attributions of offset efficacy and reduced social essentialism. We extend existing work on the stigma asymmetry

model to examine not only stigma, but also unhealthy cognitions related to being thin, unhealthy weight control behaviors, as well as psychological distress—what we term more generally the double-edged sword effect of growth mindsets (see Figure 1). We outline each of the paths in Figure 1.

First, we suggest that growth mindset messages and beliefs increase attributions of responsibility and blame toward those deemed to have excess weight (Weiner, 1985; Weiner et al., 1988) and via this mechanism have detrimental effects on outcomes (i.e., unhealthy eating-related cognitions and behaviors). When people believe that weight is changeable, this can result in self-blame for their weight and in turn, internalized stigma such as increased body shame (Burnette et al., 2017). Although growth mindsets can serve as a buffer during adversity (for a review of the moderating role of growth mindset in times of ego-threats see Burnette et al., 2013), such beliefs also lead individuals to look for causes of their failure in order to improve in the future. And, across domains, growth mindsets often go hand in hand with attributions related to personal effort, rather than personal ability. Thus, this blame or personal responsibility often helps motivate individuals to work harder and find new ways to improve. However, in the context of weight-loss, this is also tied to blaming oneself and others for not having the self-control, willpower, or perseverance to lose weight. And, such attributions lead to unfavorable judgments and potentially have psychological costs as well.

The adverse effects of blame undergird movements that focus on the fixed nature of weight; the thinking is that such messages should reduce blame which should, in turn, reduce the internalization of stigma (e.g., a drive to be thin, body shame). Indeed, “an attribution of internal controllability points the finger of blame directly at stigmatized individuals: Since they are responsible for their fate, they have earned its consequence” (Crandall, 2000, p. 129). A

prominent and detrimental consequence of considering individuals to be responsible for their weight is prejudice and discrimination toward those with overweight or obesity (Hoyt et al., 2017, 2019). Moreover, a reduction in blame should also help to curb unhealthy weight control behaviors associated with extreme dieting and reduce psychological distress. For example, Standen et al. (2018) showed that believing weight is controllable predicted disordered eating cognitions and behaviors, perceived stress, and depression. However, by measuring controllability of weight in terms of eating too much or the wrong foods, not exercising enough, snacking too much, and not controlling themselves, Standen et al. (2018) are confounding their measure of controllability with mindsets. They did not measure beliefs about whether weight is something that can be changed; they measured attributions about why people become fat—what we call onset blame. It is critical to distinguish between the broader belief system about the changeable vs. fixed nature of weight and the more specific attribution of blame for the onset of the condition. In theoretically teasing apart these different cognitions, we predict the following:

Hypothesis 1: Growth mindset of weight will predict greater onset blame (Path A).

Hypothesis 2: Increased onset blame will predict more negative outcomes, including greater risk for eating disorders, unhealthy weight control behaviors, psychological distress, body shame, and prejudice (Path B).

Hypothesis 3: These effects result in a positive indirect effect of growth mindsets on outcomes (Path A × Path B).

Second, in the double-edged sword model, growth mindsets and messages stressing the potential to change can also reduce unhealthy cognitions and behaviors and stigma via an increase in offset efficacy. Offset efficacy encapsulates hope and optimism that one has both the agency and competency to reach a future goal. A plethora of work highlights the importance of

growth mindsets in predicting the capacity to cope when challenges arise and to continue to expect to succeed in the future (Burnette et al., 2013). Of relevance to the current work, growth mindsets of weight predict offset efficacy, which in turn reduces body shame and stigma (Burnette et al., 2017). Believing that one has the capacity to make a change turns the perceived excess weight into a solvable problem rather than an everlasting deficiency. Hope (Snyder et al., 2002), optimism (Scheier &Carver, 1985), and self-efficacy (Bandura, 1977, 1986) are all related constructs that are cornerstones of well-being. These beliefs imply that one has the ability to plan and strategize ways to progress toward a goal (Snyder et al., 1991, 2002) and this sense of control is a fundamental human need with implications for well-being. For example, hope is positively related to health in patients coping with physical health problems (Moon & Snyder, 2000). Furthermore, optimism or expecting positive results in the future is associated with greater success in attaining goals (Shepperd et al., 1996), and predicts well-being across the lifespan (Peterson, 2000). Overall, growth mindsets help individuals believe in their capacity for future development, which is critical for well-being.

Hypothesis 4: Growth mindsets will predict greater offset efficacy (Path C).

Hypothesis 5: Offset efficacy will predict fewer negative outcomes (i.e., risk for eating disorders, unhealthy weight control behaviors, psychological distress, and body shame; Path D).

Hypothesis 6: These combined effects will result in a negative indirect effect of growth mindsets on outcomes (Path C × Path D).

Third, and related to offset efficacy, we expect growth mindsets to reduce essentialist thinking which will in turn weaken negative attitudes toward others. Offset efficacy is linked to the self and is driven by evaluations of one's own personal future potential. However, when considering attitudes toward others, research has shown that holding social essentialist beliefs—

believing in an inherent "differentness" that is deemed both serious and persistent—leads to prejudice against members of groups that are devalued (Hoyt et al., 2017, 2019). Importantly, individuals who endorse a growth mindset are less likely to endorse social essentialist thinking. Thus, in considering evaluations of others, we offer the following predictions:

Hypothesis 7: Growth mindsets will predict reduced essentialist thinking (Path E).

Hypothesis 8: Essentialist thinking will predict increased prejudice (Path F).

Hypothesis 9: These combined effects will result in a negative indirect effect of growth mindsets on prejudice (Path E × Path F).

Summary

The literature linking growth mindsets of weight to health-related outcomes, psychological distress, and stigma is complicated and at times confounded. For example, when controllability and responsibility attributions are mistakenly referred to as mindsets, there is a negative relationship between these controllability attributions and well-being, including unhealthy eating behaviors and cognitions (Standen et al., 2018). On the other hand, a plethora of work outlines the self-regulatory benefits of growth mindsets of weight (e.g., Burnette, 2010; Ehrlinger et al., 2017). And, other work delineates both the costs and benefits of growth mindsets of weight for body shame and stigma (Burnette et al., 2017; Hoyt et al., 2017). We contend that when considering domains such as weight—where being in a certain social category is stigmatized—to understand the effects of growth mindsets on outcomes, we must clearly assess and delineate onset and offset attributions as well as social essentialism—cognitions predicted by mindsets and various public health messages that stress the changeable vs. fixed nature of weight.

In the current work, we extend research on the stigma-asymmetry model to examine the nuanced effects of growth mindsets on physical and mental health as well as prejudice in a model we call the double-edged sword effect (see Figure 1). In Study 1, we employ a correlational methodological approach to test the predictions that growth, relative to fixed, mindsets will indirectly predict an increase in unhealthy risk for eating disorders, unhealthy weight control behaviors, and psychological distress through stronger onset blame attributions and will indirectly predict a decrease in these outcomes through enhanced offset efficacy attributions (Hypotheses 1–6). In Study 2, we use messages commonly seen in the media, employ an experimental design to show causal relations—at least with mediators—and include assessments of social essentialist thinking as well as prejudice. In Study 2, we develop a growth mindset message of weight designed to eliminate blame and thus do not expect any relations with blame or outcomes. Rather, in Study 2, we seek to test the predictions that the growth mindset message (without blame), relative to a fixed mindset message, will indirectly predict a decrease in eating disorder risk, unhealthy weight control behaviors, and body shame through increased offset efficacy (Hypotheses 4–6) and indirectly predict a decrease in prejudice through decreased social essentialism (Hypotheses 7–9).

Study 1

Methods and Materials

We recruited 340 participants from Amazon's Mechanical Turk (MTurk) to participate in the study in November 2018. We paid the participants $0.50 to complete a 15-min online Qualtrics survey, which contained measures of mindsets of weight, weight controllability beliefs (WCB), blame, efficacy, body dissatisfaction, drive for thinness, unhealthy weight control behaviors, stress, depression, and perceived weight. The institutional review board (IRB)

approved all the procedures. We excluded some participants, *n* = 11, for completing the study in an unreasonably long or short amount of time, we also excluded participants, *n* = 29 who provided inconsistent answers to questions, for example, reporting never having engaged in an unhealthy weight control behavior within the past year, but also reporting having engaged in those same behavior in the past month. This left a final sample of *N* = 311 participants, 76.5% white, 60.5% female, aged 19–80 years (*M* = 38.30, *SD* = 13.25). We electronically obtained informed consent from all participants.

Measures

Mindsets of Weight

We used the established 6-item measure (Burnette, 2010) to assess individuals' mindsets regarding the fixed or changeable nature of body weight, (e.g., "You have a certain body weight, and you can't really do much to change it"). We coded the items such that higher scores on this measure indicate a stronger growth mindset of weight [1 = *strongly disagree* to 7 = *strongly agree*, α= .86].

Onset Blame

To assess blame we used a single item measure (Burnette et al., 2017) to examine participants' ideas of how responsible someone is for their own weight (1= "Not at all responsible" to 7 = "Very responsible") as well as four items from the Beliefs About Obese Persons (BAOP) Scale. The BAOP is an established 8-item measure (Allison et al., 1991), assessing how much individuals blame obese people for being obese (e.g., "Most obese people cause their problem by not getting enough exercise"; . 1 = *strongly disagree* to 7 = *strongly agree*, α= .84). For this measure, higher scores indicate higher blame and assessment of individual responsibility.

Offset Efficacy

We used four items adapted from the Efficacy Beliefs Scale (Blackwell et al., 2007) and used in past stigma-asymmetry work (Burnette et al., 2017) to assess individuals' beliefs about the role of their own effort in weight management. We worded the items to reflect effort at managing weight, rather than schoolwork (e.g., "The harder I work at managing my weight, the better I will be at it"). For this measure, higher scores indicate higher efficacy [1 = *strongly disagree* to 7 = *strongly agree*, α= .64].

Eating Disorder Risk: Body Dissatisfaction and Drive for Thinness

We used two subscales of the Eating Disorder Inventory (Garner et al., 1983) to assess individuals' own body dissatisfaction and their drive for thinness. The body dissatisfaction subscale has nine items that assess individuals' thoughts and feelings about their bodies, (e.g., "I think my hips are too big"; α = 0.89). The drive for thinness subscale has seven items (e.g., "I am terrified of gaining weight"; α = 0.87). We combined the subscales into one measure of eating disorder risk (α = 0.90).

Unhealthy Weight Control Behaviors

We adapted the Unhealthy Weight Control Behaviors (UWC) scale (Neumark-Sztainer et al., 2012) to ask participants their frequency of engaging in nine unhealthy weight control behaviors, such as smoking more or using laxatives, within the past month as opposed to the past year. Participants responded yes/no and responses were summed.

Psychological Distress

To assess psychological distress, participants responded to well-validated measures of perceived stress (Perceived Stress Scale, Cohen et al., 1983) and depression (The Center for Epidemiologic Studies Depression [CES-D] Scale, Radloff, 1977). The measures used different

scales, thus to compute the overall distress measure responses on the stress ($\alpha = 0.88$) and depression ($\alpha = 0.95$) scales were normalized and averaged.

Body Mass Index and Perceived Weight

For use as covariates, we calculated Body Mass Index (BMI) using the standard formula (weight in kilograms divided by height in centimeters squared) based on participants' self-reported height and weight. The mean BMI was 27.85 (*SD* = 7.77). The perceived weight measure (Standen et al., 2018) assesses individuals' perceptions of their weight with a single item asking participants how they would classify their weight, ranging from: 1 = *very underweight* to 5 = *very overweight*.

We also assessed the weight controllability measure from Standen et al. (2018; $\alpha = 0.78$). Although not part of primary analyses, we report results regarding this assessment in the section "Discussion."

Results

We analyzed data using the SPSS statistical program. See Table 1 for means, standard deviation, and bivariate correlations. The UWC (unhealthy weight control behavior) and BMI measures were positively skewed. A square root transformation was successful in decreasing the skewness in the weight control behavior variable and a log transformation was successful in normalizing the BMI variable. For ease of interpretation, descriptive data are presented with the untransformed data. We first present simple bivariate relations. To test our primary hypotheses (see Figure 1), we conducted indirect effect analyses for each of the three outcomes using Hayes (2013) PROCESS macro model 4, entering both onset blame and offset efficacy attributions into the regression equation simultaneously as parallel or concurrent mediators and mindsets of weight as the predictor.

Correlations

Mindsets are positively correlated with onset blame and offset efficacy, and both blame and efficacy are positively correlated with each other. Growth mindsets are negatively correlated with unhealthy weight control behaviors and psychological distress, but not with eating disorder risk. In addition, onset blame is not correlated with any of the outcomes, but efficacy is negatively correlated with all three primary outcome variables (see Table 1).

Hypothesis Testing

Hypotheses 1–3 (Paths A, B, and A × B)

In support of Hypothesis 1, Path A, an endorsement of stronger growth mindsets predicted stronger onset blame beliefs {B = 0.34, $t(309) = 7.39$, $p < 0.001$, 95% CI [0.25, 0.43]}. In contrast to Hypothesis 2, Path B, onset blame did not predict any of the outcomes (eating disorder risk, $p = 0.137$; unhealthy weight control behaviors, $p = 0.081$; psychological distress, $p = 0.105$), although all are trending in the expected direction. Thus, also in contrast to Hypothesis 3, Path A × B, there were no significant positive indirect effects of growth mindsets through onset blame.

Hypotheses 4–6 (Paths C, D, and C × D)

In support of Hypothesis 4, Path C, stronger growth mindsets predicted stronger offset efficacy beliefs, {B = 0.42, $t(309) = 8.90$, $p < 0.001$, 95% CI [0.33, 0.51]}. And, in line with Hypothesis 5, Path D, stronger offset efficacy predicted less eating disorder risk {B = −0.52, $t(307) = -7.98$, $p < 0.001$, 95% CI [−0.65, −0.39]}, fewer unhealthy weight control behaviors {B = −0.21, $t(307) = -4.22$, $p < 0.001$, 95% CI [−0.31, −0.11]} and less psychological distress {B = −0.34, $t(307) = -6.78$, $p < 0.001$, 95% CI [−0.44, −0.24]}. And in support of Hypothesis 6, Path

C × D, analyses revealed a significant negative indirect effect of growth mindsets (with 95% confidence interval) through offset efficacy on eating disorder risk (indirect effect = −0.22, 95% CI [−0.31, −0.15]), unhealthy weight control behaviors, (indirect effect = −0.09, 95% CI [−0.13, −0.05]) and psychological distress (indirect effect = −0.14, 95% CI [−0.20, −0.09]).

Total and Direct Effects

Considering the contrasting effects outlined in the model, we did not anticipate any total effects and had no specific hypotheses regarding direct effects. For total effects, as outlined in the brief presentation of correlations, there was no total effect of growth mindsets on eating disorder risk (total effect = 0.00, $p = 0.982$, 95% CI [−0.11, 0.12]), but there were significant total effects on both unhealthy weight control behaviors (total effect = −0.15, $p < 0.001$, 95% CI [−0.24, −0.07]) and psychological distress (total effect = −0.26, $p < 0.001$, 95% CI [−0.35, −0.17])1 such that stronger growth mindsets predicted fewer unhealthy weight control behaviors and less psychological distress. As for direct effects, the negative direct effect of endorsement of a growth, relative to a fixed, mindset on unhealthy behaviors did not reach significance (direct effect = −0.10, $p = 0.057$, CI [−0.20, 0.00]). There was a significant negative direct effect of growth mindsets on distress (direct effect = −0.15, $p = 0.003$, CI [−0.25, −0.05]). In addition, there was a positive direct effect of endorsement of a growth, relative to a fixed, mindset on risk (direct effect = 0.18, $p = 0.005$, CI [0.06, 0.31]). Thus, although growth mindsets indirectly and negatively predict risk for eating disorder through increased offset efficacy, when the attributions are in the equation, some facet of growth mindsets of weight positively predicts eating disorder risk.

Covariates

We re-ran the above analyses using BMI and perceived weight as covariates and all of the findings still hold with minor changes for eating disorder risk: the positive direct effect is no longer significant ($p = 0.16$) and the indirect effect through blame is significant (indirect effect = 0.05, 95% CI [0.01, 0.09]) such that endorsement of a stronger growth mindsets predicted stronger onset blame beliefs which in turn predicted greater eating disorder risk {B = 0.14, t(303) = 2.40, $p = 0.017$, 95% CI [0.03, 0.26]}.

Summary

Study 1 revealed that when considering the parallel mediators, growth, relative to fixed, mindsets indirectly and negatively predicted unhealthy weight related risks and behaviors and psychological distress. We did not find the detrimental effects of onset blame on these health and well-being outcomes. However, we did find an adverse direct effect of growth mindsets on eating disorder risk when we partialled out the variance from both blame and offset efficacy. Thus, Study 1 reveals that growth theories of weight are generally associated with more favorable health and well-being outcomes, and this is driven largely by the offset efficacy attribution associated with these mindsets. These findings suggest that when considering the impact of mindsets about weight on health and psychological well-being outcomes, future-oriented beliefs matter more than considerations of blame and responsibility. This is consistent with a robust finding across literatures—from hope, to optimism, to self-efficacy—that a future-oriented sense of control over reaching a goal is foundational to well-being (Bandura, 1977, 1986; Scheier & Carver, 1985; Snyder et al., 2002).

The primary limitation of Study 1 is examining mediational effects, and the related inferences in causation, in cross-sectional data (Fairchild & McDaniel, 2017; Maxwell &Cole,

2007). Although these concerns are lessened by the strong theoretical rationale underlying the predictions, we sought to investigate our predictions using an experimental approach in Study 2. We also tested a growth mindset message used in past work that is designed to reduce effects on blame, but maintain offset efficacy, called compensatory messaging (Burnette et al., 2017). This type of growth mindset message is designed to keep the benefits without the costs. Similar to Study 1, we examine the outcomes of risk for eating disorders and unhealthy weight control behaviors; however, rather than measuring psychological distress, we explore the role of weight mindsets on body shame in Study 2. In addition, we test our remaining hypotheses (H7–H9; paths E, F, and E × F) related to essentialist thinking and prejudice.

Study 2

In this study, we focus on harnessing the beneficial effects of the offset efficacy attributions associated with growth mindsets, replicating findings regarding compensatory growth mindset messaging, which manipulates mindsets about the malleability of weight without manipulating attributions of blame (Burnette et al., 2017). We also garnered ecological validity with this experimental approach by using public health weight-related messages that are often seen in the media to manipulate mindsets. This is the first study, to our knowledge, that examines the popular message that diets do not work, compared to messages stressing the changeable nature of weight. Within the scientific literature, an argument has been made that, although diets can be successful, this success is often short lived, and weight regain is likely (Tomiyama et al., 2013). Further, researchers have even gone so far as to advise against recommending diets for individuals with obesity (Mann et al., 2007). When this research is taken to more mainstream media outlets (such as Mann and Tomiyama's [2017] *The Conversation* article used to create the manipulation article in the present work), the main point is that dieting efforts are futile. We

explored the implications of such a message for health and stigma. Namely, we examine if a compensatory (no blame) growth message, relative to a diets do not work fixed message indirectly decreases eating disorder risk, unhealthy weight control behaviors, and body shame through increased offset efficacy (Hypotheses 4–6) and decreases prejudice through decreased social essentialism (Hypotheses 7–9).

We predict no differences across conditions in blame as the compensatory growth message has been shown to wipe out the potential detrimental effects of growth messages for blame (Burnette et al., 2017).

Methods and Materials

We recruited $N = 551$ participants from Amazon's Mechanical Turk (MTurk) to participate in a 15-min online Qualtrics survey study. We obtained IRB approval and electronic informed consent from all participants. Participants were paid $0.50 to complete the study in December 2018. We excluded $n = 159$ participants: $n = 75$, for completing the study in an unreasonably long or short amount of time, $n = 34$ for failing attention checks, $n = 33$ for not completing any of the scales, and $n = 17$ who provided inconsistent answers to questions. This left a final sample of $N = 392$ participants, 84.7% white, 68.4% female, aged 20–81 years ($M = 41.29$, $SD = 12.98$).

Procedures

We randomly assigned participants to one of two conditions to manipulate mindsets of weight. In the growth compensatory condition ($n = 204$), participants read a Psychology Today type article, entitled "Weight can be managed with a lot of effort and the right strategies," used in past work to eliminate the indirect effects via blame and therefore included information about the changeable nature of weight but also stressed the importance of not blaming or shaming

people for being overweight (e.g., “A key to success is not blaming or shaming yourself or others”). This message has been shown in previous work to promote growth mindsets without the concomitant blame attributions (Burnette et al., 2017). In the fixed condition (*n* = 188), participants read an article about diets not working (e.g., “Dieting is a difficult and all-consuming battle, and it fails in the long term for the majority of individuals”), entitled “Lasting weight loss is impossible: Researchers say ‘diets don’t work.’” Although crafted by the authors of the present study, the research and quotes presented in this article were taken from an article entitled “What thin people do not understand about dieting,” from an online media source – *The Conversation* – that aims to bring academic science to the public (Mann & Tomiyama, 2017). The article presented to participants closely mirrors the information they might be receiving in a real-world setting from experts in the field. After reading the article, participants responded to reading comprehension questions and then completed the measures and demographic questions.

Measures

Mindsets of Weight

As a manipulation check, we used the same established 6-item measure (Burnette, 2010) of weight mindsets used in Study 1 ($\alpha = 0.89$).

Onset Blame and Offset Efficacy

We included the same measures to assess blame and efficacy in this study. Both measures revealed adequate reliability ($\alpha = 0.83$, $\alpha = 0.76$, respectively).

Social Essentialist Thinking

Participants responded to the single item on a 7-point scale of agreement: “Once you are obese, you are destined to be overweight forever.”

Unhealthy Eating Disorder Risk: Drive for Thinness

We used only the drive for thinness subscale of the Eating Disorder Inventory (Garner et al., 1983) to assess participants eating disorder risk ($\alpha = 0.89$).

Unhealthy Weight Control Behaviors

We modified the measure used in Study 1 for future events. Participants were asked to indicate how likely they would be to engage in the behaviors in order to lose weight or keep from gaining weight in the next month.

Psychological Body Shame

Participants completed the 6-item shame subscale of the Weight and Body-Related Shame and Guilt Scale (Conradt et al., 2007). Participants rated items on a 0 (never) to 4 (always) scale. An example item is, "The appearance of my body is embarrassing for me in front of others." Higher numbers represent greater shame ($\alpha = 0.92$).

Anti-fat Prejudice

Participants responded to the 11-item anti-fat prejudice measure used in the stigma asymmetry work (Hoyt et al., 2017) that was modified from the Antifat Attitudes Questionnaire (Crandall, 1994) and the Universal Measure of Fat Bias (Latner et al., 2008). Participants responded on a 6-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). An example item is "Fat people make me somewhat uncomfortable." Higher numbers represent stronger negative attitudes ($\alpha = 0.95$).

Body Mass Index and Perceived Weight

BMI and perceived weight were assessed as they were in Study 1.

We also assessed Major et al.'s (2014) self-efficacy for dietary control measure and two essentialism items looking at immutability, as opposed to social essentialism (or fundamentality;

Hegarty & Pratto, 2001) as exploratory measures and do not report findings regarding these items.

Results

We analyzed data using SPSS. See Table 2 for means, standard deviation, and bivariate correlations. The anti-fat prejudice, unhealthy weight control behavior, and BMI measures were positively skewed. A square root transformation was successful in decreasing the skewness in the anti-fat prejudice and weight control behavior variables and a log transformation was successful in normalizing the BMI variable. For ease of interpretation, descriptive data are presented with the untransformed data. After conducting manipulation checks, we conducted a series of indirect effects analyses using Hayes (2013) PROCESS macro model 4 to test the predictions. First, to test Hypotheses 4–6, we conducted three separate indirect effect analyses entering offset efficacy attributions and onset blame as the mediators and condition as the predictor with each of the three outcomes: eating disorder risk, unhealthy weight control behaviors, and body shame. For Hypotheses 7–9, we conducted one indirect effect analysis entering social essentialism and onset blame as the mediators and condition as the predictor of prejudice.

Manipulation Checks

First, we investigated if participants in the growth condition reported a stronger endorsement of a growth mindset about weight than participants in the fixed condition (growth condition = 1 and fixed condition = 0). A UNIANOVA confirmed this, $F(1, 390) = 16.24$, $p < 0.001$, partial $\eta 2 = 0.04$. Participants in the growth condition reported stronger endorsement of a growth mindset ($M = 5.52$, SD = 1.06) than participants in the fixed condition ($M = 5.07$, SD = 1.15). Second, we tested the prediction that the growth, relative to fixed, condition would increase offset efficacy (Path C) and decrease social essentialism (Path E) but that there would

be no difference in blame (Path A). As expected, results of a multivariate ANOVA, revealed a significant multivariate effect, $F(3,338) = 10.09$, $p < 0.001$; Wilks' lambda = 0.928, partial $\eta 2 = 0.07$. Tests of between subjects effects revealed that participants who read the compensatory growth article reported greater levels of offset efficacy (Path C; $M = 4.90$; $SD = 1.09$) and lower levels of social essentialism (Path E; $M = 2.20$; $SD = 1.24$) than those who read the diets do not work article (efficacy: $M = 4.63$; $SD = 1.24$; $F(1,390) = 5.50$, $p = 0.020$, partial $\eta 2 = 0.01$; essentialism: $M = 2.93$; $SD = 1.46$; $F(1,390) = 28.47$, $p < 0.001$; partial $\eta 2 = 0.07$). Participants' reported blame did not differ across conditions (Path A; compensatory growth: $M = 4.97$; $SD = 1.04$; diets do not work: $M = 4.98$; $SD = 1.09$; $p = 0.939$).

Compensatory Messaging Hypotheses

As expected, the compensatory message wiped out the effects of mindsets on blame (Path A, $p = 0.939$) and thus also wiped out the negative indirect effects of growth mindsets messaging on any of the outcome variables: eating disorder risk (95% CI [−0.04, 0.04]), unhealthy weight control behaviors (95% CI [−0.01, 0.00]), body shame (95% CI [−0.03, 0.02]), and prejudice (95% CI [−0.02, 0.02]).

Hypotheses 4–6 (Paths C, D, and C × D)

We next tested our predictions that the growth condition would indirectly predict a lower risk for an eating disorder, fewer unhealthy weight control behaviors in the upcoming month, and less body shame through increased offset efficacy (Hypotheses 4–6). First, in support of Hypothesis 4, Path C, those in the growth condition reported greater offset efficacy beliefs, {$B = 0.28$, $t(1, 390) = 2.35$, $p = 0.020$, 95% CI [0.04, 0.51]}. Second, in line with Hypothesis 5, Path D, stronger efficacy attributions predicted less eating disorder risk {$B = -0.42$, $t(3, 388) = -6.90$, $p < 0.001$, 95% CI [−0.55, −0.30]}, fewer unhealthy weight control behaviors {$B = -0.04$, t(3,

388) = −3.20, p = 0.002, 95% CI [−0.07, −0.02]}, and less body shame {B = −0.47, t(3,388) = −10.50, p < 0.001, 95% CI [−0.56, −0.38]}. Third, in support of Hypothesis 6, Path C × D, analyses revealed significant negative indirect effects of the growth condition through offset efficacy on eating disorder risk (indirect effect = −0.12, 95% CI [−0.24, −0.02]), unhealthy weight control behaviors, (indirect effect = −0.01, 95% CI [−0.03, −0.00]); and body shame (indirect effect = −0.13, 95% CI [−0.24, −0.02]).

Hypotheses 7–9: Prejudice (Paths E, F, and E × F)

Next, we tested our predictions that the growth condition would indirectly predict lower anti-fat prejudice through decreased social essentialism. First, in line with Hypothesis 7, Path E, participants in the growth condition reported weaker social essentialism beliefs {B = −0.73, t(1,390) = −5.34, p < 0.001, 95% CI [−1.00, −0.46]}. Second, in line with Hypothesis 8, Path F, weaker essentialism beliefs predicted less prejudice {B = 0.04, t(3,388) = 3.63, p < 0.001, 95% CI [0.02, 0.07]}. Third, in line with Hypothesis 9, Path E × F, there was a significant negative indirect effect of growth mindset condition on prejudice through decreased essentialism (indirect effect = −0.03, 95% CI [−0.05, −0.02]) and, once again, there was no indirect effect of blame as condition did not predict blame.

Total and Direct Effects

There were no total effects of weight message condition on any of the outcome variables: eating disorder risk (p = 0.764), unhealthy weight control behaviors (p = 0.349), body shame (p = 0.391), or prejudice (p = 0.436). In addition, there were no direct effects of condition on eating disorder risk (p = 0.239), unhealthy weight control behaviors (p = 0.588), or prejudice (p = 0.846). There was a significant direct effect of condition on body shame such that those in the growth condition reported more shame (direct effect = 0.23, p = 0.024, 95% CI [0.03, 0.42]).

Covariates

We re-ran all of the above analyses using BMI and perceived weight as covariates. All of the findings hold with one minor change: the direct effect of condition on shame became non-significant ($p = 0.085$).

Summary

We showed that experimentally promoting growth relative to fixed mindsets (i.e., diets do not work) about the nature of weight, promotes the belief that individuals have the ability to manage their weight and decreases the beliefs in an inherent devalued social group of those with overweight. These beliefs, in turn, have beneficial effects for risk for an eating disorder, unhealthy weight control behaviors, and body shame, and lowers their prejudice against those perceived to carry excess weight.

General Discussion

This research contributes to a growing literature showing that how people think about the nature of weight can have a profound impact on stigma, health, and well-being. We tested predictions stemming from the asymmetry model (Burnette et al., 2017; Hoyt et al., 2017) that growth mindsets of weight have detrimental effects through attributions of blame but beneficial effects through attributions of offset efficacy and reduced social essentialism (see Figure 1). In Study 1, assessing naturally occurring mindsets of weight, we found that growth, relative to fixed, mindsets indirectly decreased the risk for eating disorders, unhealthy weight control behaviors, and psychological distress through stronger offset efficacy attributions. Although growth mindsets strongly predicted onset blame, we did not find the detrimental effects of blame on these health and well-being outcomes. In Study 2, we experimentally demonstrated that a compensatory (no blame) growth message, relative to a diets do not work message, did not

increase blame. However, this message indirectly decreased eating disorder risk, unhealthy weight control behaviors, and body shame through increased offset efficacy and indirectly decreased prejudice via a reduction in social essentialist thinking.

Theoretically speaking, this work makes important contributions to our understanding of the psychological implications of beliefs and public health messages regarding the fixedness or changeability of weight. First, this work contributes to an attribution theory perspective by showing that mindsets about the malleability of traits influence both attributions of blame (onset responsibility) and attributions regarding the capacity to change in the future (offset efficacy; Brickman et al., 1982; Weiner et al., 1988). In both studies, mindsets were strongly and positively correlated with both. Importantly, in working to extend the asymmetry model to health outcomes, we found that offset efficacy robustly predicted these outcomes. We found mixed support for the role of blame. In Study 1, blame did not significantly predict the outcomes, although they all trended in the expected direction. In Study 2, although blame did not differ across conditions, blame did predict greater eating disorder risk and body shame but failed to predict unhealthy weight control behaviors. In addition, blame predicted prejudice, consistent with significant work in attribution theory (Crandall, 2000). Overall, the more powerful role of efficacy over blame points to the power of future oriented beliefs when considering the impact of mindsets and messages about weight on health and psychological well-being outcomes. These findings are consistent with those from the literature on hope (Snyder et al., 2002), optimism (Scheier & Carver, 1985), and self-efficacy (Bandura, 1977; 1986) showing that a future-oriented sense of control overreaching a goal is a fundamental contributor to well-being.

Importantly, our findings are in direct contrast with Standen et al.'s (2018) findings that "believing that weight is controllable was associated with disordered eating cognitions and

behaviors, perceived stress, and depression." Yet, we largely suggest this is because their controllability measure is more in line with blame than mindsets. For exploratory purposes in Study 1, we also assessed the weight controllability measure from Standen et al. (2018). Although they did not actually assess implicit theories of weight, but rather beliefs about controllability and attributions, using their measure we were unable to replicate their findings. Specifically, we found that greater beliefs of controllability were associated with lower levels of unhealthy weight control behaviors and lower levels of psychological distress. Therefore, there is a critical need for researchers to be clear about their constructs, for example, to disambiguate changeability from controllability and to further tease out controllability in terms of onset vs. offset attributions.

In Study 2, we successfully replicated the effectiveness of a compensatory growth mindset message that manipulated beliefs about the malleability of weight without manipulating attributions of blame (Burnette et al., 2017). In addition, we also replicated the stigma-related effects of growth mindsets of weight that has been shown in the stigma asymmetry model (Hoyt et al., 2017). The growth message served to decrease the beliefs in an inherent devalued social group of those with overweight and in turn decrease anti-fat prejudice.

This work has important implications for understanding how public health messages can, intentionally or not, influence health and well-being. Although this work did not robustly find deleterious effects of blame, there are legitimate concerns that sending a message about the changeability of weight might fuel blame with subsequent negative cognitive and behavioral health implications. However, these concerns should be evaluated while also considering the beneficial effects that growth mindsets of weight can have via expectations regarding the potential for change in the future.

An important caveat is that we focused on the consequences of beliefs and messages about the nature of weight, not on the actual scientific evidence regarding the nature of weight. Indeed, the literature in this area is complex. For example, there is significant work showing that dieting does not work (Mann et al., 2007; Powell et al., 2007) and that once people gain a significant amount of weight it is difficult for them to become thin (Fildes et al., 2015). However, there is also evidence that whereas dieting might not work in the long run, weight is changeable in the short term (Perri & Fuller, 1995). Moreover, whereas dieting might not work in the long run, dieting plus physical activity might lead to successful weight-loss (Ostendorf et al., 2019). The goal of the current work was not to contribute to these debates about the actual malleability of weight but rather to empirically test the implications of these messages for health and stigma.

When considering public health messaging, it is important to consider both what we know about the actual nature of weight, as well as what we know about how beliefs about the nature of weight affect individuals. Whereas scholars generally separate beliefs about changeability from actual changeability, there is a wealth of research showing how beliefs can bring about responses consistent with expectations (Crum et al., 2013; Dweck, 2008). For example, striking new research shows that experimentally induced expectations about one's genetic risk for obesity, unrelated to actual risk, changed gene-relevant outcomes (Turnwald et al., 2019). The manipulated beliefs brought about behavioral, physiological, and subjective changes that served to actually change risk in a belief-consistent direction. Thus, those developing public health messages around weight should consider the nature of weight, the powerful influence of beliefs, as well as the self-fulfilling role of beliefs. In addition, future research should examine if mindsets of weight can bring about actual changes in weight. We

hope the work presented here serves as a springboard for such inquiries by providing an overall theoretical model for testing double-edged sword effects of different beliefs and messages about the nature of weight.

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Table 1

Study 1 Scale means, Standard deviations, and Correlations

1. MW	5.3	1.13	--						
2. ONB	5.31	1.00	.39***	--					
3. OFE	4.74	1.05	.45***	.17**	--				
4. EDR	4.20	1.18	0	0.08	-.37***	--			
5. UWC	1.83	2.18	-.25***	0.01	-.28***	.23***	--		
6. DIS	0	0.940	-.32***	-0.04	-.45***	.44***	.36***	--	
7. BMI	27.85	7.77	0.1	-0.07	-0.1	.42***	-.13*	0.02	--
8. PW	3.58	0.77	0.06	-0.02	-.15**	.49***	-0.04	0.1	.72***

Note. MW = Mindsets of Weight, ONB = Onset Blame, OFE = Offset Efficacy, EDR = Eating Disorder Risk, UWC = Unhealthy Weight Control Behaviors, DIS = Psychological Distress, BMI = Body Mass Index, PW = Perceived Weight.

Table 2

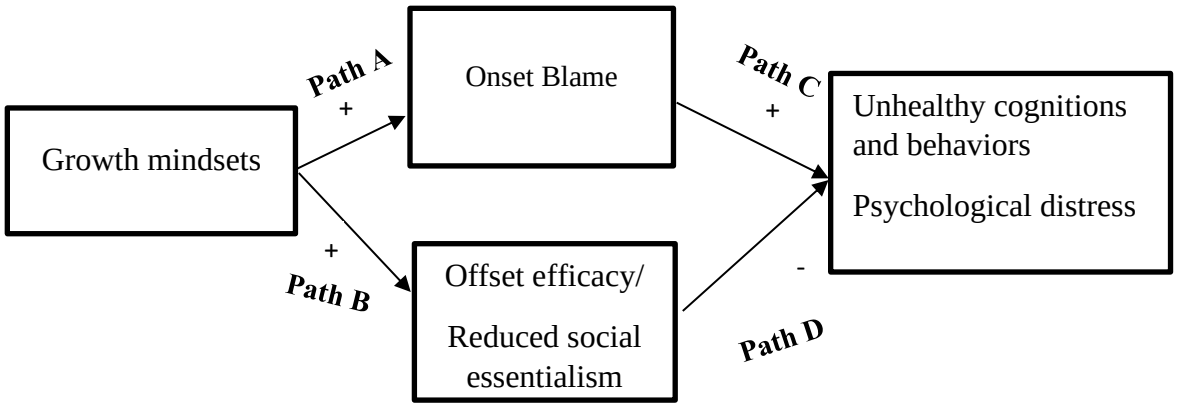
Study 2 Scale Means, Standard Deviations, and Correlations

	M	SD	1	2	3	4	5	6	7	8	9
1. MW	5.30	1.13	--								
2. ONB	4.98	1.06	.42***	--							
3. OFE	4.77	1.17	.47***	.31***	--						
4. ESS	2.55	1.4	.57***	.21***	.41***	--					
5. EDR	3.92	1.42	0.01	0.02	.31***	0.07	--				
6. UWC	2.05	0.91	-0.07	-0.01	.17***	.17***	.40***	--			
7. SHM	1.64	1.10	-.14**	-0.04	.45***	.17***	.59***	.39***	--		
8. PRJ	1.96	0.97	-0.02	.32***	0.01	.10*	0.06	.13**	0.03	--	
9. BMI	29.35	7.82	0.02	-0.06	.25***	0.03	0.1	0.06	.36***	-.15**	--
10. PW	3.61	0.71	0.03	-0.08	.28***	0.03	0.27	0.06	.45***	.22***	.67***

Note. MW = Mindsets of Weight, ONB = Onset Blame, OFE = Offset Efficacy, ESS = Essentialist Thinking, EDR = Eating Disorder Risk, UWC = Unhealthy Weight Control Behaviors, SHM = Body Shame, PRJ = Antifat Prejudice, BMI = Body Mass Index, PW = Perceived Weight. *= $p \leq .05$ **=$p \leq .01$ ***= $p \leq .001$

Figure 1

Theoretical representation of the double-edged sword effect



Note. Indirectly, growth mindsets of weight serve to both diminish and intensify unhealthy cognitions and behaviors related to weight as well as prejudice. Paths E and F are only tested in Study 2 and relate only to the outcome prejudice.

CHAPTER 4

Introduction

The United States adult obesity rate is 39.8%, with about 93.3 million adults meeting the criteria to be classified as having obesity (CDC, 2018). When compared to the reported adult obesity of 30.5% in 1999-2000, it is clear that obesity rates have significantly and steadily risen over the past 20 years (Trust for America's Health, 2019). Having obesity negatively impacts physical and mental health, contributes to lower quality of life and higher mortality rates, and it is economically costly both at the individual and societal level (Biener et al., 2017; Dixon, 2009; Fabricatore & Walden, 2006; Stein & Colditz, 2014; Taylor et. al.,2013).

Considering the personal and societal toll of obesity, researchers often examine ways to prevent, reduce and treat it. Although the etiology of obesity is complex and multifactorial, a considerable amount of obesity prevention and reduction research focuses on individual's eating and exercise behaviors as these behaviors are heavily implicated as causes of obesity. Within this area of research, there is increasing focus on how mindsets (Bunda & Busseri, 2017; Burnette & Finkel, 2012; Ehrlinger et al., 2017; Lyons et al., 2015; Orvidas et al., 2018; Thomas et al.,2019) and attributions regarding the causes of obesity (Dar-Nimrod et al., 2014; McFarren & Mukhoppadhyay, 2013; Wang & Coups, 2010) impact obesity-related health attitudes, behaviors and outcomes.

Mindsets and Attributions

Mindsets, also known as implicit theories, are beliefs regarding the malleable or fixed nature of human traits or attributes (Dweck, 1999; Levy, Chiu & Hong, 2006). Mindsets exist along a continuum, anchored at one end by the beliefs that traits or attributes are static and unchangeable (fixed mindsets), and on the other end by beliefs that attributes or traits are malleable or changeable (growth mindsets) (Dweck & Leggett, 1988; Molden & Dweck, 2006).

It is important to note that mindsets are domain specific, meaning an individual can hold a growth mindset in one domain (e.g., weight) and a fixed mindset in another (e.g., intelligence). Additionally, within the domain of health, mindset beliefs typically range from weaker to stronger growth mindsets, instead of fixed to growth mindsets, with means on mindset measures routinely falling above the scale midpoints (Burnette & Finkel, 2012; Hopper et al., 2018; Hoyt et al., 2019; John-Henderson et al., 2020; Orvidas et al., 2018; Thomas et al., 2019: See Table 1 for examples). This might indicate that people generally believe that health attributes are changeable but differ with regard to the degree of this perceived changeability. The type of mindset an individual holds matters because mindsets predict motivation, self-regulation, engagement in goal related behavior, and goal achievement (Burnette et al., 2013; Hoyt et al., 2014).

Additionally, mindsets inform the meaning assigned to events—they are directly yoked to the attributions that people make (Hoyt et al, 2019; Yeager et al., 2013). Attribution theory argues that people try to explain why things happen and these explanations, or attributions, guide their behaviors (Weiner, 1972). Such attributions can be about the self and others, or about the cause of an event, behavior, or condition (Hoyt et al, 2019; Yeager et al., 2013). Beliefs about the malleable or changeable nature of traits and attributes inform attributions by providing a lens through which individuals interpret events or conditions. For example, students who hold a growth mindset of intelligence are more likely to attribute academic performance to effort whereas those who hold a fixed mindset of intelligence are more likely to attribute it to ability (Hong et al., 1999). When students attribute failure on an academic task to a lack of ability, compared to lack of effort, they are less likely to choose to take remedial lessons or practice

more in order to improve on the task. This is likely due to viewing ability as something that cannot merely be changed by increasing effort (Burnette et al., 2017; Hong et al., 1999).

In the context of obesity, mindsets inform attributions regarding the etiology of obesity and an individual's responsibility for having obesity (Burnette et al., 2017). These are often called onset attributions, as they are explanations for how people become overweight. Mindsets also predict attributions and expectations about the potential value of exerting effort to lose weight in the future. These beliefs about the ability to change their weight in the future are often called offset efficacy attributions (Burnette et al., 2017; Hoyt et al., 2017; Pearl & Lebowitz, 2014). Onset and offset attributions often have opposing effects on stigma, well-being and health—called the double-edged sword model (Hoyt et al., 2020). Generally, attributions about the etiology of obesity, or onset of the condition, can be classified as behavioral attributions, (obesity is caused by poor eating habits and/or lack of adequate exercise), or genetic attributions, (obesity is hereditary or caused by specific genes), (Dar-Nimrod et al., 2014; McFarren & Mukhoppadhyay, 2013; Wang & Coups, 2010).

In the current work, we argue that, rather than operating independently, obesity-related mindsets and attributions for obesity exist as a set of allied beliefs, and that understanding how this allied belief system operates would provide important insights relevant to understanding and addressing obesity. Further, we propose that these allied beliefs are not uniformly held, but rather individuals hold them in varying degrees and combinations. To that end, our first research goal is to use a latent class analysis (LCA) approach to examine whether there exist groups of individuals who share unique patterns of obesity-related mindsets and obesity etiology attributions. For mindsets, we used measures assessing beliefs about the fixed or changeable nature of overall health, weight, and fitness. We focused on these three primary mindsets as

indicators because they inform important obesity-related beliefs, attitudes, and behaviors, including expectancy-value beliefs, healthy eating, and physical activity (Burnette & Finkel, 2012; Orvidas, et al., 2018; Thomas et al., 2019). We add to this set of beliefs attributions for the onset of obesity, as these etiology beliefs are important predictors of health behaviors, namely healthy eating and exercise engagement, and BMI (McFarren & Mukhopadhyay, 2013; Wang & Coups, 2010).

H1. There will be 3-4 unique groups of individuals with shared combinations of health-related mindsets and attributions for the onset of obesity.

Based on findings from past work on health mindsets and attributions regarding the etiology of obesity, we tentatively propose that the groups will have the following unique characteristics:

Group A: There will be a group of individuals that hold *strong growth mindsets* across all three mindset indicators (health, weight, fitness) and *strongly attribute obesity to both poor eating habits and lack of exercise but not strongly to genetics*.

Group B: There will be a group consisting of individuals whose *growth mindsets are at the population mean* across all three mindset indicators, whose *obesity attributions are at the mean* across all three attribution indicators.

Group C: Another group will be made up of individuals with *weaker growth mindsets* across all three mindset indicators and *weakly attribute obesity to poor eating habits and lack of exercise* but *strongly attribute it to genetics.*

Group D: Based on the emerging literature on compensatory growth beliefs of obesity, i.e. the onset of obesity is largely outside the individual's control but people are still capable of changing their weight (e.g., Burnette et al., 2017; Hoyt et al., 2017; Hoyt et al., 2019), we

tentatively propose that there might exist a group of individuals with *strong growth mindsets* across all mindset indicators who also *weakly endorse* poor eating habits and lack of exercise, *but strongly endorse genetics* as the cause of obesity.

Motivation, Behavior, and Outcomes

Next, we propose that the resulting unique combinations might differently inform health attitudes like healthy eating and exercise expectancy-value beliefs, promote or hinder engagement in health behaviors like exercise and healthy eating, and distally impact individual's weight. Indeed, mindset beliefs and attributions for obesity inform health-related expectancy-value beliefs, health behaviors, and influence individual's body mass index (Burnette, 2010; John-Henberson et al., 2020; Knerr et al., 2015; Orvidas et al., 2018; Pearl & Lebowitz, 2014; Thomas et al., 2019).

First, expectancy refers to assessments of self-efficacy, or an individual's belief that they are capable of successfully completing a task or attaining a desired goal, while value is an evaluation of a task or behavior as being important, enjoyable, and/or useful (Bandura, 1996; Eccles & Wigfield, 2002). When compared to individuals with fixed mindsets, or weaker growth mindsets, those with stronger growth mindsets of health report higher expectancy-value beliefs of healthy eating (Thomas et al., 2019), those with stronger mindsets of fitness report greater self-efficacy and value of exercise beliefs (Orvidas et al., 2017), and individuals with growth mindsets of weight report greater nutrition self-efficacy (Ehrlinger et al., 2017).

Additionally, individuals who attribute obesity onset to genetic or biological causes, compared to other causes, are more likely to report lower healthy eating and exercise self-efficacy (Dar-Nimrod et al., 2014; Wang & Coups, 2010) whereas individuals who report dietary causal beliefs report greater self-efficacy for weight control (Knerr et al., 2015). Making genetic

attributions for obesity can also undermine the value placed on engaging in obesity-related health behaviors like healthy eating (Dar-Nimrod et al., 2014).

Second**,** initial findings from research investigating mindsets in the health domain suggest that mindsets inform engagement, or lack thereof, in health behaviors and body weight. For example, growth mindsets predict greater engagement, or intention to engage in healthier eating behaviors (Ehrlinger et al., 2017; Thomas et al., 2019), greater physical activity (Lyons et al., 2015; Orvidas et al., 2018), as well as intentions to engage in both healthy eating and more exercising (Bunda & Busseri, 2017). Additionally, growth mindsets of health are associated with a lower body mass index (John-Henberson et al., 2020).

Similarly, attributions of obesity inform health behavior engagement and body weight. For example, across six studies, researchers examined people's beliefs regarding whether obesity is caused by eating too much or lack of exercise. They found that individuals who believe that obesity is caused by lack of exercise consumed more food than those who believe it to be caused by poor eating habits (McFarren & Mukhoppadhyay, 2013). Presumably these participants did not tie food consumption to obesity, despite research that implicates over-consumption and unhealthy diets as contributors to obesity (O'Donnell et al., 2010; Wright & Aronne, 2010). Importantly, in this study individuals who believed that obesity was primarily caused by lack of exercise were more likely to have higher BMI than those who believed it to be caused by poor eating habits.

Further, genetic onset attributions for obesity contribute to beliefs that having obesity is beyond the individual's control (Hibert et al., 2009; Sanderson et al., 2009). Individuals who attribute obesity to genetic or biological causes, compared to other causes, are more likely to report lower engagement in healthy eating and physical activity (Dar-Nimrod et al., 2014; Wang

& Coups, 2010). For example, of the individuals that participated in the 2007 Health Information National Trends Survey (HINTS), those who reported a genetic attribution for obesity, compared to lifestyle behaviors attributions, had lower rates of physical activity and lower fruit and vegetable intake (Wang & Coups, 2010).

Overall, mindset beliefs and attributions separately inform health-related attitudes, engagement in health behaviors, and are related to body mass index (BMI). We argue that should people hold unique combinations of health-related mindset beliefs and attributions for obesity, then these unique combinations will have differing impacts on health attitudes, patterns of behavioral engagement, and BMI. Thus, our second goal is to examine whether group membership is related to health–related attitudes, namely, expectancy-value beliefs regarding healthy eating and exercise, engagement in healthy eating and exercise behaviors, and BMI.

H2. These profiles will be associated motivation, behavior, and BMI.

Based on the makeup of the groups proposed in the first hypothesis, and the pattern of relationships between mindsets, attributions, and outcomes of interest, we tentatively expect that the relationship between group membership and outcomes will be as follows:

Group A will report the strongest levels of expectancy-value beliefs, high levels of past healthy eating and exercise, and have lower BMI scores. Group B will report average expectancy-value beliefs, relatively healthy eating habits and moderate exercise habits, and average BMI scores. Group C will have low expectancy-value beliefs, report less healthy eating and exercise engagement in the past and have the highest BMI scores. Group D will have strong expectancy-value beliefs, report healthy eating and exercise habits, and have low BMI scores.

Exploratory Question: Are there demographic differences in group membership?

Finally, while demographic characteristics, like race, gender, age, and income are importantly related to obesity (Ogden et al., 2015; Ogden et al., 2017), limited research has explored the impact of these demographic characteristics on the relationship between attributions of obesity, obesity-related health mindsets, and health attitudes, behaviors, and outcomes. Some of this work indicates that racial and gender differences might exist. For example, African American individuals with growth mindsets of health reported stronger expectancy-value beliefs of healthy eating, and healthier eating intentions, compared to White participants (Thomas et al., 2019). And, when compared to Hispanic women, non-Hispanic White women reported greater beliefs that obesity is caused by genetics and/or lack of exercise (Knerr et al., 2016).

Given the importance of demographic characteristics for obesity outcomes, and the existing, though limited, findings that some characteristics might be differently related to mindset beliefs and attributions for obesity, we examined whether groups differed by demographic characteristics, including race, gender, age, and income.

Summary

Obesity-related health mindset beliefs and attributions of obesity inform obesity-related health attitudes, behavioral engagement, and health outcomes. In the current work, we argue that, rather than operating separately, these beliefs combine to form an allied belief system that predicts health attitudes and behaviors, and impact BMI. In the current study, we explore this by answering three questions: 1) Are there groups of individuals with shared unique combinations of allied beliefs? 2) Do the group characteristics predict motivation, behavior and outcomes in expected ways? and 3) Do demographic characteristics relate to group membership?

Methods and Materials

Participants

We recruited 455 participants using a Human Intelligence Task (HIT) posted on Amazon's Mechanical Turk (MTurk) research platform in January 2020. All MTurk workers over 18 years old and currently residing in the US were eligible to participate. To explore possible race differences in group membership, we used MTurk panels to recruit an equal number of African American and Non-Hispanic White participants. We paid the participants $0.50 to complete an online Qualtrics survey which contained measures of mindsets of health, weight, and fitness, attributions for obesity, healthy eating and exercise self-efficacy, and healthy eating and exercise value.

To ensure valid and reliable MTurk data, we included a variety of recommended response validity indicators in this study. At the beginning of the Qualtrics survey we included a CAPTCHA (Completely Automated Public Turing Test to tell Computers and Humans Apart) verification to ensure respondents were humans and not bots (Chmielewski & Kucker, 2019). Potential participants had to successfully complete the CAPTCHA, by checking a box indicating that they are not a robot, to access the survey. Additionally, we included an open-response item asking participants to tell us what they thought the purpose of the study was in order to check for atypical responding (Dennis et al., 2018). Finally, we checked response time per item (Wood et al., 2017), to identify individuals who completed the survey faster than one second per item (SPI). The Institutional Review Board approved all procedures. We electronically obtained consent from all participants.

We excluded data from 7 participants for atypically answering the open-ended question (e.g., answering "honest" as the cause of obesity), 2 participants for giving incongruent answers

on the demographic questions (e.g., reporting height as 5'8" and weight as 58 pounds), and 6 participants for completing less than 85% of the questionnaire. Of the remaining participants, 15 participants finished the study in a time that indicated that they completed some of the items in less than 1 second. However, once we cross-checked their responses on the open-response item their answers indicated that they had paid sufficient attention to the measures and thus we decided not to exclude their data. This left a final sample of 440 participants, 63% female, 50.5% White; 49.1% Black/African American, aged 19 to 74 years (*M*= 39.86, SD= 12.77).

Measures

Mindsets of Health

This 4-item measure (Thomas et al., 2019) assesses mindsets regarding health. Items on this scale examine the degree to which an individual believes their health is a changeable attribute (e.g., "Your ability to be healthy is something about you that you can't change very much"). Higher scores indicate stronger growth mindsets of health. [1 = *strongly disagree* to 7 = *strongly agree*, α= .81].

Mindsets of Weight

This 6-item measure (Burnette, 2010) assesses individuals' mindsets regarding the fixed or changeable nature of body weight, (e.g., "You have a certain body weight, and you can't really do much to change it"). Higher scores on this measure indicate a stronger growth mindset of weight [1= *strongly disagree* to 7= *strongly agree*; α= .89].

Mindsets of Fitness

This 6-item measure (Orvidas et al., 2018) assesses the degree to which an individual believes his or her fitness is a changeable attribute (e.g., "Your ability to be fit is something

about you that you can't change very much"). Higher scores indicate a stronger growth mindset regarding fitness [1 = *strongly disagree* to 7 = *strongly agree*; α=.86].

Attributions for Obesity

We used the 3-item Lay Theories of Obesity measure (McFarren & Mukhopadhyay, 2012) assesses an individuals' beliefs regarding the causes of obesity (e.g., "The primary cause of obesity is eating too much"; "lack of exercise"; "genetics"). Higher scores indicate a stronger belief regarding the particular cause [1 = *strongly disagree* to 7 = *strongly agree*].

Expectancy-Value Beliefs of Healthy Eating

To assess expectancy-value beliefs regarding healthy eating, participants responded to a validated measure of healthy eating efficacy beliefs (Schwarzer & Renner, 2000) and a validated measure of healthy eating value beliefs (Thomas et al., 2019). These measures use the same type of 1-7 Likert scale, with higher scores indicating greater efficacy or stronger value beliefs regarding healthy eating. We combined the efficacy (α=.92) and value (α=.94) scales to create an expectancy-value of healthy eating measure (α=.72)

Expectancy-Value Beliefs of Exercise

To assess expectancy-value beliefs regarding exercise, participants responded to a validated measure of exercise efficacy (Schwarzer & Renner, 2000) and an adapted version of the value of healthy eating measure (Thomas et al., 2019). Specifically, for the adapted value of exercise scale we replaced the phrases "healthy foods" and "healthy eating behaviors" with the phrases "exercise" or "physical activity" (e.g. "Engaging in more physical activity is worth it to me"). Both measures use a 1-7 Likert scale, with higher scores indicating greater efficacy or stronger value beliefs regarding exercise. We combined the efficacy (α=.90) and value (α=.92) scales to create an expectancy-value of exercise (α=.82)

Past Eating Habits

This 5-item measure (Thomas et al., 2019) examines individuals' past eating habits (e.g., "How often do you monitor the portions of food you're consuming?"). Higher scores indicate healthier past eating habits [1= *never* to 7= *always*; α=.86].

Past Exercising Frequency

This measure (Verplanken & Melkevik, 2008) assesses the amount of exercise the individual retrospectively reports to have engaged in over the past week, month, six months, and year. For this four-item scale, higher scores indicate more frequent exercise. This scale ranges from [1= *never* to 5= *almost every day*; α=.93].

Body Mass Index (BMI)

We asked participants to self-report their weight and height and used this information to calculate BMI (weight in kilograms divided by height in squared centimeters). The mean BMI was 28.04 (*SD*= 7.44).

Demographics

Participants self-reported their age, race, gender, and family income. To measure family income participants selected their income on a 9-point scale [1= *Less than $40,000* to 9= *More than $180,000*] with the rest of the scale points representing a $19,999 range (e.g. 3= $60,000-$79,999). Higher scores indicate higher income.

Plan of Analysis

First, we examined subgroup heterogeneity among participants by conducting a latent class analysis (LCA) using Mplus, Version 8.4 (Muthen & Muthen, 2019). The latent class approach is a multivariate method used to identify latent subgroups, meaning groups of individuals who share similar combinations of specific indicators in a population (Lanza et al.,

2010). There are several advantages to using LCA. First, it is a people-oriented approach, instead of a variable-oriented approach, meaning that instead of focusing on the relationship between variables and assuming that this relationship holds for all participants, latent class analysis allows us to examine individual patterns and use these to classify individuals with shared patterns into subgroups with similar individuals (Bergman & Magnusson, 1997; Magdison & Vermunt, 2002; Pastor et al., 2006). LCA is also more compatible with survey data as it can be used to analyze data that doesn't meet assumptions like multivariate normality and having equal variances within each class (Magdison & Vermunt, 2002). Finally, LCA is a preferable clustering approach as it allows one to estimate many cluster models and then use various statistics to choose the number of clusters that best fit the data (Magdison & Vermunt, 2002).

Latent class indicators included mindsets of health, mindsets of weight, mindsets of fitness, and attributions for obesity. The estimates are based on the mean scores for each of the participants on the indicators. To determine the number of groups best represented by the data, we considered the following criteria: 1) the Bayesian information criterion (BIC) with smaller values indicate better model fit, 2) the Lo-Mendell-Rubin Adjusted Likelihood Ratio Test (LMR-LRT) which compares a target class solution with the one with 1 fewer classes. When LMR-LRT is significant, this means that the higher class solution best fits the data. 3) Entropy greater than 80%; higher entropy indicates better fit, 4) no classes contain less than 5% of the total sample, and 5) we examined the estimated models for clarity and theoretical usefulness before deciding on a final class solution.

Next, we used the SPSS software package to conduct further analysis examining the relationship between class membership and the outcomes of interest (healthy eating, physical

activity, self-efficacy, and value beliefs) and demographic characteristics (race, gender, and BMI).

Results

See Table 2 for means, standard deviations, alphas, and bivariate correlations.

H1. Extracting latent classes

We conducted latent class analysis for 1-6 class solutions (see Table 3), and, based on the criteria listed above, determined that the best fitting solution was four classes. Specifically, compared to the three-class model solution, the four-class solution had a lower BIC value and a slightly higher entropy value making it a better fit. While the five-class solution had a lower BIC and higher entropy value compared to the four-class solution, the LMR- LRT was not significant, and one of the classes contained only 1.6% of the total sample of participants, making the four-class solution, whose smallest class contains 8.2% of the total sample of participants a better fit. Furthermore, in assessing the class solutions for interpretability, the four-class solution made better theoretical sense compared to the 5-class solution.

The four classes were characterized as follows (See Figure 1). Class 1 (46.8% of participants) had scores at the mean across all six indicator variables (see Table 4). This indicates that members of this class believe they can change their health, weight, and fitness ability, and think that obesity is caused by poor eating habits, lack of exercise, and genetics. We call this class the "*Mean Growth-Behavior Focus*" group

Class 2 (8.2% of participants) was characterized by scores around the mean for all mindset indicators, very low scores (more than one standard deviation below the mean) for poor eating and lack of exercise attributions, and slightly above the mean scores for genetic attributions (see Table 4). This indicates that members of this class generally believe that they

can change their health, weight and fitness ability. They also believe that obesity is determined by one's genetic makeup, but not their eating and exercise behaviors. We call this class the "*Mean Growth-Genetic Focus*" group.

Class 3 (28.6% of participants) had scores above the mean for all mindset indicators, scores above the mean on poor eating and lack of exercise attributions, and slightly below mean scores for genetics attributions for obesity (see Table 4). This indicates that members of this class strongly believe that they can change their health, weight, and fitness ability, and strongly attribute having obesity to poor eating and lack of exercise but not to genetics. We call this class the "*Strong Growth-Behavior Focus*" group.

Finally, Class 4 (16.4% of participants) members had scores greater than one standard deviation below the mean across all three mindset indicators, and scores below the mean on attributions to poor eating habits and lack of exercise but had scores above the mean for genetic attributions of obesity (see Table 4). This indicates that members of this class did not strongly believe that they were capable of changing their health, weight, or fitness ability. Further, they weakly attribute obesity to eating and exercise behaviors but strongly believe that it has a genetic cause. We call this class the "*Weak Growth-Genetic Focus*" group.

Once we determined the appropriate number of classes, we assigned participants to a class based on their predicted probability of group membership (See Table 5 for probabilities). These resulting groups were then used as predictor variables in further analysis.

H2. Group differences in health attitudes and behavioral outcomes

See Table 6 for group means for expectancy-value beliefs of healthy eating and exercise, past healthy eating and exercise, and BMI.

We ran a one-way ANOVA to test for differences between groups in attitudes and behavioral health outcomes. The Levene's test for equality of variances indicated that there was homogeneity of variances in expectancy-value beliefs of healthy eating (p=.419), expectancy-value beliefs of exercise (p=.474), past eating behaviors (p=.845), and past exercise behaviors (p=.180) between groups.

Motivation: Expectancy-Value Beliefs

Results of the one-way ANOVA indicated that there were no statistically significant group differences in expectancy-value beliefs of healthy eating, $F(3,436)= .69$, $p= .559$, or expectancy-value beliefs of exercise, $F(3,436)= .47$, $p= .707$.

Behavior[1]

Eating

There were statistically significant group differences in reported past eating behaviors $F(3,436)= 4.86$, $p= .002$, We conducted a Tukey's post hoc test as a follow up to examine the group differences in past eating. Results indicated that members of the Strong Growth-Behavior Focus group ($M= 4.76$, $SD= 1.06$) reported significantly higher scores, indicating healthier eating behaviors, compared to those in the Mean Growth-Behavior Focus group ($M= 4.41$, $SD= 1.02$), the Mean Growth-Genetic Focus group ($M= 4.17$, $SD= 1.14$), and the Weak Growth-Genetic Focus group ($M= 4.35$, $SD= 1.00$). There were no statistically significant differences in past eating behavior between other groups.

Exercise

There were statistically significant group differences in reported past exercise behaviors $F(3,436)=4.524$, $p= .004$. We followed up with a Tukey's post hoc test which indicated that

[1] We ran ANCOVA analysis with BMI as a covariate and results were similar to those without the covariate.

participants in the Weak Growth-Genetic Focus group reported significantly more engagement in exercise in the past (*M*=3.25, *SD*= 1.30) compared to those in the Mean Growth-Genetic Focus group (*M*=2.56, *SD*= 1.04). There were no statistically significant differences in past exercise behavior between other groups.

BMI[2]

Assessment of BMI by group indicated that members of the Mean Growth-Genetic Focus group had the highest mean BMI scores, (*M*=32.04, *SD*= 10.80), followed by those in the Strong Growth-Behavior Focus group (*M*=28.69, *SD*=7.37), then the Mean Growth-Behavior Focus group (*M*= 27.44, *SD*= 6.64), and the Weak Growth-Genetic Focus group had the lowest scores (*M*=26.63, *SD*= 7.00). These means indicate that, on average, members of the Mean Growth-Genetic Focus group met the criteria for obesity while those in all other groups met the criteria for overweight.

We used ANOVA to examine the association between group membership and BMI. While Levene's test for equality of variances was violated, ANOVA is robust with large sample sizes (Norman, 2010) and thus we decided to interpret the results of the analysis. There were statistically significant group differences in BMI, $F(3,281.62)= 5.24$, $p= .001$. A Tukey's post hoc analysis test indicated that the Mean Growth-Genetic Focus group (*M*= 32.04, *SD*= 10.80) had a significantly higher BMI compared to Mean Growth-Behavior Focus group (*M*= 27.44, *SD*= 6.64), and the Weak Growth-Genetic Focus group (*M*=26.63, *SD*= 7.00). The Strong Growth-Behavior Focus group fell intermediate to and did not significantly differ (*M* = 28.69, *SD* = 7.37).

[2] We log transformed BMI to correct for skewness and kurtosis. We ran the analysis with the untransformed and the transformed variable and the results are similar. For ease of interpretation we report the results using the untransformed variable.

H3. Group membership and demographic characteristics

Race

Assessment of racial makeup of the groups indicated that the Mean Growth-Behavior Focus group had fewer African American/Black participants compared to White participants (43.9% Black), the Mean Growth-Genetic Focus group had almost equal numbers of participants by race (48.6% Black), as did the Strong Growth-Behavior Focus group (50.8% Black), and finally the Weak Growth-Genetic Focus group had more African American/Black participants compared to White ones (62.5% Black). Although these percentages indicate some differences in membership by race, a chi square test revealed that the relationship between group membership and race did not reach statistical significance, χ^2 (3)=7.53, p= .057.

Gender

Assessment of the gender makeup of groups indicated that there were more female participants, compared to male, in all groups. A chi square test revealed no statistically significant differences in group membership based on gender, χ^2 (6)= 1.53, p= .958.

Age

A one-way ANOVA revealed that there were statistically significant differences in group membership based on age F(3,436)=7.27, p< .001. We followed up with a Tukey's post hoc test which indicated that participants in the Mean Growth-Behavior Focus group were significantly older (M=42.46, SD= 12.86) compared to those in the Strong Growth-Behavior Focus group (M=38.57, SD= 12.33) and the Weak Growth-Genetic Focus group (M=34.86, SD= 11.85). There were no statistically significant differences in age between other groups.

Income

Assessment of income by group indicated that the Mean Growth-Genetic Focus group had the highest income (M=2.94, SD=2.71), followed by the Strong Growth-Behavior Focus (M=2.85, SD=1.97), then the Weak Growth-Genetic Focus (M= 2.70, SD= 1.92), participants in Mean Growth-Behavior Focus group reported the lowest income (M= 2.33, SD=1.66). However, a one-way ANOVA revealed no statistically significant differences in group memberships based on income, $F(3,434)=2.56$, $p=.055$.

Discussion

In this research, we identified four distinct subgroups of individuals who share unique combinations of health-related mindsets and attributions for the etiology of obesity. These results provide support for our first hypothesis that there are 3-4 unique groups. Additionally, of the extracted groups, the Strong Growth-Behavior Focus group matched our hypothesized Group A, the Mean Growth-Behavior Focus group matched our hypothesized Group B and the Weak Growth-Genetic Focus group matched our hypothesized Group C, thus providing further support for our hypothesis.

Specifically, the Mean Growth-Behavior Focus group had average scores for all indicators, similar to our hypothesized Group B, the Strong Growth-Behavior Focus group had strong growth mindsets on all the mindset indicators, strong eating and exercise attributions, but weaker genetic attributions, similar to our hypothesized Group A, and the Weak Growth-Genetic Focus group had weaker growth mindsets across all mindset indicators, weak eating and exercise attributions, and strong genetic attributions for obesity, similar to our hypothesized Group C. However, there were differences between the Mean Growth-Genetic Focus group and the hypothesized Group D. We hypothesized that members of this group would have strong growth

mindsets, weak eating and exercise attributions, and strong genetic attributions for obesity, although members of the extracted Mean Growth-Genetic Focus group met most of these criteria, they were different in that they had what we consider to be average, rather than strong, growth mindsets across all mindset indicators.

Although these unique combinations of allied beliefs did not predict motivation, they had important implications for health behaviors and BMI. First, the group of individuals who reported strong growth mindsets, strong behavior attributions, and weak genetic attribution (Strong Growth-Behavior Focus) reported healthier eating and greater exercise engagement compared to all other groups. Second, the group of individuals who reported average growth mindsets, weak behavior attributions, and average genetic attributions (Mean Growth-Genetic Focus) reported the lowest rates of exercise engagement, less healthy eating, and had the highest BMI, meeting the criteria for obesity.

Additionally, there were some demographic differences. First, older individuals were more likely to hold growth mindsets and attribute obesity more to behavior rather than genetics. Second, although they did not meet the threshold for significance, we deemed the observed racial differences important enough to discuss. Although we recruited an equal number of African American/Black and White participants, we found that, compared to White participants, there were more African American/Black participants in the group with weak growth mindset beliefs, weak behavioral attributions, and strong genetics attributions (Weak Growth-Genetic Focus). Additionally, there were fewer African American/Black participants in the group that reported average growth mindsets, and average behavior and genetic attributions of obesity (Mean Growth-Behavior Focus). Finally, although the differences in income did not meet the threshold for significance, we think that they also warrant discussion. The group that had average scores

for all indicators (Mean Growth-Behavior Focus) group reported the lowest income whereas the group that reported strong growth mindsets, strong behavior attributions, and weak genetic attributions (Strong Growth-Behavior Focus) reported the highest income.

Overall, these findings point to the importance of the beliefs that individuals hold regarding the etiology of obesity. Importantly, when a person does not believe that they can change their weight, doubts that engagement in behaviors like eating and exercise are successful avenues of weight control, and also attributes obesity to genetics, they are unlikely to engage in such healthy behaviors. We found a group that reflects this allied system of strong fixed beliefs across the assessments (weak growth mindsets, weak behavioral attributions, and strong genetic attributions) and we found initial evidence of the costs of such beliefs. This group differed from others in consistent ways with an overall pattern that has practical implications. For example, the stronger fixed belief group reported less healthy eating, lower exercise engagement, and they also had the highest BMI. Additionally, this fixed group reported lower incomes and were more likely to be Black/ African American—indicating additional potential risks for unhealthy eating (Cockerham et al., 2017). Thus, although this group is relatively small in terms of percentage of the sample, they represent a potential group with the most room for improvement when implementing growth mindset of health interventions. This finding provides initial information that can be used to guide the tailoring of interventions to address the specific areas of concern for different subgroups of individuals.

This work replicates and extends existing mindset and attributions literature by showing that mindset beliefs and attributions about the cause of a condition impact behavioral engagement related to alleviating or controlling that condition (Hong et al.,1999; Knerr, 2016; Weiner et al., 1988). Further, we contribute to the literature on mindsets and attributions as allied

belief systems (Dweck & Yeager, 2019; Hong et al., 1999; Hoyt et al., 2019), and illustrate how these belief systems impact engagement in healthy eating and exercise behaviors. These findings suggest that it is important to have a clear understanding of how allied sets of beliefs related to a health condition like obesity inform health behaviors related to the condition.

Additional work is needed to examine the utility of this information in intervention work to explore whether tailoring makes a difference in health behavior engagement. Further research should also examine other combinations of factors that impact health behaviors related to obesity. While we examined an important group of allied beliefs, we acknowledge that these are just a few of the factors, at the individual level, that contribute to obesity. More research is needed to examine how multiple factors, including social, environmental, public policies, and others that go beyond an individual's control inform individuals' health beliefs and attributions and consequently their health behaviors.

Limitations and Strengths

A major strength of the current work is that we used a person-centered approach to determine subgroups of individuals who share unique mindset beliefs and attributions for obesity, that are not otherwise obvious, that importantly inform obesity-related health attitudes and behavioral engagement. Another strength is that we included a racially diverse sample of participants.

Despite these strengths, there are a few limitations that must be noted. First, we used a cross-sectional design and thus we cannot make causal inferences about the relationship between the allied beliefs and outcomes. Another limitation is that, although we set BMI as an outcome, it is hard to tease apart the place of BMI in such work. It is possible that rather than being an outcome, BMI comes earlier in the process and informs mindsets and attributions of obesity and

predicts health behavior engagement. While it is possible that having specific combinations of the allied set of beliefs contribute to obesity, it is also likely that individuals who already have high BMIs have developed mindset beliefs and make attributions that are aligned with their own experiences living with obesity. For example, suppose an individual with obesity has tried several times to reduce their weight through diet and exercise but has routinely been unable to do so. They might conclude that their weight is a product of genes rather than their behavior. Finally, in this study we used self-reported eating and physical activity engagement which are not always accurate assessments of behavioral engagement and might contain reporting bias. Future work should examine these questions using more objective behavioral measures.

In conclusion, the current work shows that individuals share unique patterns of health-related mindsets and attributions for obesity and that these patterns are related to health attitudes, behaviors, and BMI. These findings point to the need for more tailored obesity interventions that address the needs of different subgroups of people.

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Table 1

Study means for physical health related mindset measures

Health Domain	Measure	Scale Points	Participant Mean(s)	Authors/Year
Health	Mindsets of health	1-7	*M*= 6.00, *SD*= 1.04; *M*=5.64, *SD*=1.22	Thomas et al., (2019)
	Health mindsets	1-6	*M*= 10.30, *SD*= 4.57*	John-Henderson et al., (2020).
Weight	Mindsets of weight	1-6	*M* = 4.50; *SD* = 0.90; *M* = 4.77, *SD* = 0.91	Hopper et al., (2018).
	Mindsets of weight	1-6	*M*= 5.17, *SD*= .70; *M*= 4.84, *SD*=.91	Burnette, J. L., & Finkel, E. J. (2012).
	Mindsets of weight	1-7	*M*= 5.30, *SD*= 1.13; *M*= 5.30, *SD*= 1.13	Hoyt et al., (2019).
Fitness	Fitness Mindsets	1-6	*M*= 4.82, *SD*= 0.76; *M*=5.11, *SD*= 1.08	Orvidas et al., (2018).

Note. * Scores for all three health mindsets items were added and then averaged. Listings with multiple Means and SDs indicate that multiple studies were included in the article.

Table 2

Means, Standard deviations, alphas, and correlations between scales

	M	SD	α	1	2	3	4	5	6	7	8	9	10	11
ITH	5.77	1.01	0.81	-	-	-	-	-	-	-	-	-	-	-
ITW	5.65	1.01	0.89	.64**	-	-	-	-	-	-	-	-	-	-
ITF	5.76	0.94	0.86	.67**	.71**	-	-	-	-	-	-	-	-	-
OEat	5.1	1.42	-	.18**	.26**	.24**	-	-	-	-	-	-	-	-
OExe	4.93	1.41	-	.19**	.22**	.12**	.450**	-	-	-	-	-	-	-
OGen	3.95	1.39	-	-.18**	-.30**	-.30**	-.10*	-0.03	-	-	-	-	-	-
EVEat	5.63	1	0.72	-0.02	0	-0.03	-.10*	0	0.03	-	-	-	-	-
EVExe	5.21	1.08	0.82	-0.01	0.01	-0.03	-.10*	0.03	0.02	.71**	-	-	-	-
PHE	4.48	1.05	0.86	0.09	.14**	.096*	.18**	.10*	-.10*	-0.04	-0.03	-	-	-
PEB	3.03	1.09	0.93	0.05	0.05	0.04	.19**	0.07	-0.07	-0.06	0.01	.49**	-	-
BMI	28.04	7.44	-	0.05	0.06	0.06	-.10*	-0.06	0.05	0.01	0.04	-.34**	-.29**	-

Note. ITH= Implicit theories of health, ITW= Implicit theories of weight, ITF= Implicit theories of fitness, OEat= Obesity is caused by poor diet, OExe= Obesity is caused by lack of exercise, OGen= Obesity is caused by genetics, EVEat= Expectancy-value beliefs of healthy eating, EVExe= Expectancy-value beliefs of exercise, PHE= Past healthy eating, PEB= Past exercise behavior, BMI= Body Mass Index

*p < .05. **p < .01.

Table 3

Model-fit indices for latent class models

	Likelihood	BIC	Entropy	LMR_LRT	LMR_p
1 Class	-4175.308	8423.657	n/a	n/a	n/a
2 Class	-3894.868	7905.385	0.854	648.018	<.001
3 Class	-3794.312	7746.880	0.807	196.500	<.001
4 Class	-3750.28	7701.423	0.818	86.045	0.011
5 Class	-3722.576	7688.623	0.857	54.137	0.055
6 Class	-3688.984	7664.046	0.839	65.644	0.177

Note. BIC = Bayesian information criterion (smaller values indicate better model fit). Entropy at least.80 (higher values indicates well identified classes). LMR-LRT = Lo-Mendell- Rubin Adjusted Likelihood Ratio Test, test of fit between the model of interest (e.g., four-class model) and the model with one less class (e.g. the three-class model).

Table 4

Group mean scores on indicator variables

Group	ITF	ITH	ITW	OEat	OExe	OGen
Mean Growth-Behavior Focus	5.720	5.719	5.602	5.352	4.982	4.035
Mean Growth-Genetic Focus	5.860	5.887	5.694	2.441	2.968	4.242
Strong Growth- Behavior Focus	6.643	6.615	6.574	5.830	5.550	3.392
Weak Growth-Genetic Focus	4.271	4.369	4.123	4.495	4.702	4.564

Note. ITH= Implicit theories of health, ITW= Implicit Theories of Weight, ITF= Implicit Theories of Fitness, OEat= Obesity is caused by poor diet, OExe= Obesity is caused by lack of exercise, OGen= Obesity is caused by genetics.

Table 5

Average probability for latent class membership

	1	2	3	4
Class 1	0.870	0.024	0.082	0.024
Class 2	0.089	0.889	0.013	0.009
Class 3	0.070	0.004	0.909	0.000
Class 4	0.030	0.004	0.000	0.967

Table 6

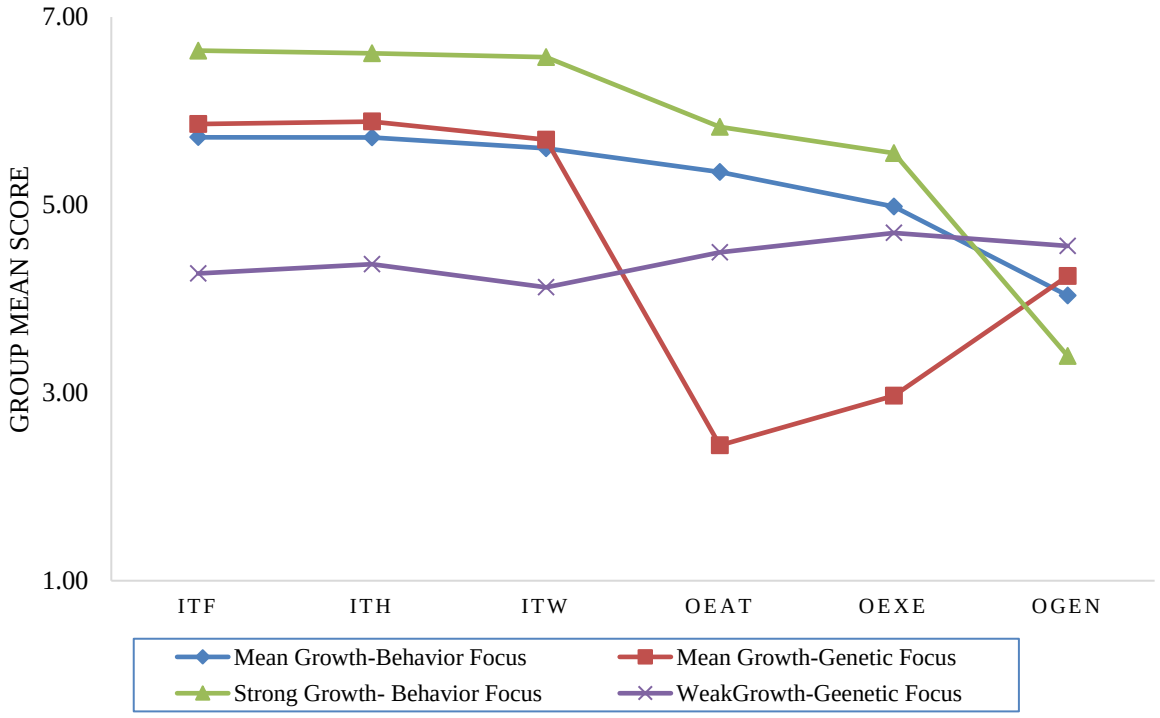
Means and standard deviations for outcomes by group

	N	EVEat	EVExercise	Past Eating	Past Exercise	BMI
Mean Growth-Behavior Focus	204	5.60 (.07)	5.25 (1.12)	4.38 (.07)	2.95 (1.07)	27.44 (6.64)
Mean Growth-Genetic Focus	36	5.84 (.17)	5.34 (.99)	4.37 (.16)	2.56 (1.04)	32.04 (10.80)
Strong Growth-Behavior Focus	125	5.61 (.09)	5.14 (1.09)	4.79 (.09)	3.24 (1.13)	28.69 (7.37)
Weak Growth-Genetic Focus	72	5.67 (.12)	5.18 (1.05)	4.28 (.12)	3.11 (.98)	26.63 (7.00)

Note. EVEat= Expectancy-value beliefs of health eating, EVExercise= Expectancy-value beliefs of exercise, BMI= Body Mass Index

Figure 1

Group profiles



Note. ITH= Implicit theories of health, ITW= Implicit Theories of Weight, ITF= Implicit Theories of Fitness, OEat= Obesity is caused by poor diet, OExe= Obesity is caused by lack of exercise, OGen= Obesity is caused by genetics

CHAPTER 5

Integrative Review

Obesity is rapidly increasing worldwide. Beyond negatively impacting physical and mental health, obesity also lowers quality of life, adds to the personal and societal financial burden, and contributes to higher mortality rates (Dixon, 2009; Fabricatore & Walden, 2006; Stein & Colditz, 2014). Given these adverse consequences, there is interest in finding empirically supported mechanisms for promoting health behaviors, like healthy eating and exercise, that prevent or reduce obesity. Research and interventions aimed at increasing positive behavioral engagement and combatting the obesity epidemic are ongoing at multiple levels, including work that focuses on public and institutional policies, community involvement and individual behavior change.

The studies included in this dissertation contribute to the ongoing research regarding ways to prevent and reduce obesity by examining how mindsets inform health behaviors and exploring the mechanisms underlying this relationship. In the following sections, I summarize the findings of each study and discuss their implications for future research and for interventions aimed at promoting engagement in healthy eating and exercise behaviors.

Summary of Findings

In the first publication (Thomas et al., 2019), I examined the relation between mindsets of health, expectancy-value beliefs of healthy eating, and future healthy eating intentions. In Study 1, individuals with growth mindsets of health reported healthier eating intentions and higher expectancy-value beliefs. Further, race moderated the relationship between mindsets and beliefs such that the effects of growth mindsets on the outcomes were stronger for African American compared to White participants. In Study 2, an experimental study, we randomly assigned participants to a growth or fixed mindset condition, and manipulated mindsets of health using a

Psychology Today news style article which framed health as either a changeable (growth condition) or static (fixed condition) trait. Like Study 1, growth mindsets predicted healthier eating intentions and expectancy-value beliefs mediated this relationship. However, in contrast to findings in Study 1, race did not moderate the links between growth mindsets and outcomes. Overall, we showed a relationship between growth mindsets and eating intentions and also provided initial correlational evidence of the mediating effect of expectancy-value beliefs. Additionally, we showed that mindsets might matter more for groups at-risk for less healthy eating behaviors.

In the second publication (Hoyt et al., 2019), we examined the effects of weight-related beliefs and public health messages regarding the nature of weight on individuals' physical and mental health as well as on prejudice. In a correlational study, we examined mindsets of weight, onset blame, offset efficacy, eating disorder risk, unhealthy weight control behaviors, and psychological distress. The results of this study revealed that growth mindsets of weight indirectly decreased the risk for eating disorders, unhealthy weight control behaviors, and psychological distress via the mediating effect of stronger offset efficacy attributions. We did not find any effects of blame. In the second study, we experimentally manipulated participants' mindsets using a *Psychology Today* type article presenting either a growth compensatory message or a fixed message of weight. In addition to the variables in Study 1, we also assessed social essentialist thinking and prejudice. Results from this study show that a growth compensatory message, designed to remove blame and shame while stressing the importance of hard work and the right weight-loss strategies, relative to a diets don't work message, eliminated blame and indirectly decreased eating disorder risk, unhealthy weight control behaviors, and prejudice through increased offset efficacy and decreased social essentialism. Overall, findings

from this paper indicate that weight related beliefs and public health messages regarding the nature of weight predict, at least indirectly, individuals' physical and mental health. Further, we found that a growth compensatory message decreased social essentialism and, in turn, anti-fat prejudice.

In the final manuscript, I examined whether there exist subgroups of individuals who share unique patterns of obesity-related mindsets and attributions for obesity, and whether these combinations are related to motivation, healthy habits, and Body Mass Index. Results indicated that participants could be classified into four distinct groups with shared combinations of health-related mindsets and attributions for obesity. Further, these unique combinations were related to health behaviors and BMI. Additionally, there were limited initial findings pointing to the importance of demographic characteristics like race and income. These findings highlight a potential avenue for tailoring health behavior interventions to meet the specific needs of different groups of individuals.

In summary, findings across the three manuscripts demonstrate that there are significant relationships between health mindsets, healthy behaviors, and health-related outcomes. Further, they show how this relationship is informed by various mechanisms, including expectancy-value beliefs, offset efficacy, and social essentialism.

Implications

The implications of the current work are multifaceted. First, this body of work contributes to the growing field of mindset research within the health domain by showing that various types of mindsets, namely mindsets of health, weight, and fitness, are related to individual's health attitudes, and promote greater engagement in health behaviors like healthy eating and exercise. Specifically, we show that individuals who have growth mindsets of health, weight, and fitness, are more likely to engage in healthy eating and exercise. Second, this

research contributes to the theoretical foundation of mindset research by outlining underlying mechanisms that inform these relationships. Drawing on achievement motivation theory, this work shows that expectancy and value beliefs mediate the relationship between mindsets and behavioral engagement, with mindsets predicting expectancy-value, which in turn predicts healthier eating and exercise behaviors. Additionally, drawing on attribution theory, this work shows that mindsets and attributions for a condition like obesity form an allied belief system that informs behavioral engagement and health outcomes (i.e., BMI).

Third, in terms of practical implications, the work included here highlights the potential utility of using a mindset approach in interventions aimed at promoting engagement in healthy eating and exercise behaviors. For example, in this work we show that mindsets can be easily manipulated using short online articles and that these articles can be used to cultivate growth mindsets, which in turn promote greater engagement in health behaviors, lower risk for eating disorders, and reduce engagement in unhealthy weight control behaviors. Additionally, our findings show that using growth compensatory messaging reduces blame and essentialism while promoting efficacy beliefs. This information can contribute to the crafting of public health messages that promote engagement in health behaviors. In this work we also show that individuals can be separated into unique subgroups, based on their shared patterns of mindset beliefs and attributions, and that these combinations uniquely influence health-related habits and BMI. Additionally, across the first and third manuscripts we show that there are important differences in mindsets and health behavior engagement based on race and income. These findings demonstrate that the mindset approach can be used in interventions to promote health behaviors, and also demonstrate a need for tailoring interventions to address the needs of different individuals and populations.

Future Directions

Although the current work provides initial insights into the relationship between mindsets and health attitudes and behaviors, more work is needed to further explore the nature of these relationships. For example, because the current work focused on health behavior intentions and self-reported health behaviors, future research should obtain objective measures of actual behaviors. Additionally, given the findings that people can be classified into unique subgroups of individuals with shared patterns of beliefs that uniquely inform their behaviors, future work should explore whether interventions tailored to the needs of these unique subgroups are more effective than one-size-fits-all mindset interventions targeting obesity-related health behaviors. Further, the finding that mindsets and public health messages regarding weight can impact behavioral engagement and stigma points to potential avenues for crafting public health messages that promote health without contributing to the negative outcomes.

Some of the initial findings in this work also point to a need for more research that examines how mindsets inform health behaviors in different populations. For example, in the first study of the first publication included here, we found that growth mindsets of health predicted healthier eating for African Americans, a population at greater risk of engaging in unhealthy eating behavior. And, in the study in the final manuscript, we found that African Americans and individuals with lower incomes were more likely to belong to the group who reported weaker mindsets of health and stronger genetic attributions for obesity, which also had the highest BMI and met the criteria for being classified as having obesity. While the results from the first publication were not experimentally replicated, and the findings in the latter were only marginally significant, these findings should be further explored to gain a better understanding of whether there exist race and income based differences in health-related mindsets as this would inform better interventions for different populations. Finally, future

research should examine how factors beyond an individual's control—for example environmental factors, food access, or public policies—inform individual's mindset beliefs, and how such external factors might impede their engagement in health behaviors despite holding growth mindsets.

Conclusions

As obesity rates continue to rise rapidly across the world, there is an increasing need to not only develop a clear understanding of why individuals fail to engage in health behaviors—like healthy eating and exercise—that have been shown to help prevent and reduce obesity, but also leverage this information in creating interventions that promote such behaviors. The three manuscripts included in this dissertation investigate the relationships between health mindsets, health attitudes, and health behaviors. Results indicate that growth mindsets of health predict healthier eating behaviors, growth mindsets of weight decrease unhealthy weight control behaviors, reduce the risk for eating disorders and reduce prejudice against individuals with obesity, and mindsets of health, weight, and fitness and attributions for obesity form an allied belief system that impacts engagement in healthy eating and exercise behaviors. Additionally, the current work shows that various factors, including expectancy and value beliefs, attributions, offset efficacy, and social essentialism beliefs, play an important role in the relationship between mindsets and behavioral health outcomes. Finally, the work included in this manuscript provides initial evidence of the importance of examining demographic characteristics, especially race and income, for a more nuanced understanding of the relationship between mindsets and outcomes.

Overall, the work included in this dissertation contributes new knowledge to the fields of health mindsets and health behavior, highlights potential avenues for leveraging mindsets in

creating, and tailoring, interventions to promote health, and suggests new avenues for further research.

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