

# **A Meta-Analysis of Weight Stigma and Health Behaviors**

Xun Zhu, Ph.D.

Department of Communication  
College of Arts & Sciences  
University of North Dakota

Rachel A. Smith, Ph.D.

Department of Communication Arts & Sciences  
College of the Liberal Arts  
Pennsylvania State University

Emily Buteau, M.A.

Department of Communication  
College of Arts & Sciences  
University of North Dakota

## **Author Note:**

We thank anonymous reviewers for their thoughtful feedback on an earlier draft of the paper and authors for providing additional data to calculate zero-order effect sizes.

Corresponding author: Xun Zhu, 501 N Columbia Rd Stop 7169, University of North Dakota, Grand Forks, ND, 58203. Email: [xun.zhu@und.edu](mailto:xun.zhu@und.edu). Tel: 701-777-3168

In press in *Stigma and Health*

## **Abstract**

Public health campaigns that explicitly or implicitly stigmatize higher-weight individuals are proliferating. Underlying this trend is an assumption that weight stigma can promote healthier behavioral change. Substantial research comprising empirical studies, narrative reviews, and meta-analyses has linked weight stigma to poorer psychological and physical health. While many studies have investigated how weight stigma affected health behaviors such as dieting and exercise, additional work is needed to understand the direction and size of the relationship. Through a meta-analysis of 54 studies including over 40,000 participants from 11 countries, we sought to present a precise estimate of the relationship between weight stigma and health behaviors and test potential moderators of the relationship. The results showed that weight stigma was positively related to unhealthy behaviors and negatively related to healthy behaviors. These relationships were consistent across stigma type (self-stigma vs. stigmatization), the focus of health behaviors (dietary behaviors vs. physical activities), and sample characteristics. The implications for the role of stigma in health promotion are discussed.

Keywords: stigma, weight, obesity, health promotion, meta-analysis

### **A Meta-Analysis of Weight Stigma and Health Behaviors**

Weight stigma is prevalent in the United States (Puhl & Suh, 2015). For example, a nationally representative survey showed that 42% of Americans reported experiencing weight stigma (Lee et al., 2021). Higher-weight individuals are stigmatized across life domains, such as healthcare, employment, education, and interpersonal relationships (Puhl et al., 2020). Stigmatizing portrayal of body weight is pervasive in traditional (Ata & Thompson, 2010) and emerging media (Lydecker et al., 2016). Implicit biases against higher-weight individuals remain largely unchanged, despite decreasing biases against other social groups based on, for example, race and sexual orientations (Charlesworth & Banaji, 2019). Substantial evidence has shown that weight stigma erodes psychological and physical health (Emmer et al., 2020; Hunger et al., 2015; Major et al., 2018; Puhl et al., 2020) and affects people exposed to it throughout their lifetime (Puhl & Lessard, 2020).

Despite its devastating consequences, some scholars and policymakers have argued that stigma could be a potent tool to promote weight loss. For example, Callahan (2013) advocated for a “stigmatization lite” strategy to “awaken [heavier people] to the reality of their condition” (p. 39) and instill the belief that “excessive weight and outright obesity are not socially acceptable any longer” (p. 37). Critics argued that stigmatizing weight for health promotion is morally and ethically unjustifiable (Vartanian & Smyth, 2013) and relies on unfounded assumptions about the influence of weight stigma (Hunger et al., 2020). Many empirical studies have shown that weight stigma is not effective in producing desired health behaviors and can result in unintended consequences (Hunger et al., 2015).

However, the preponderance of evidence has yet to dispel the myth that weight stigma can be useful for health promotion. In practice, public health campaigns continue to embrace

stigmatization as a tool of behavioral change. For example, a recent analysis of 25 “obesity” prevention campaigns in the U.S. found that almost half of them included stigmatizing content (Turner et al., 2020). Further, the argument for (re-)adopting weight stigma for health promotion appears to be regaining momentum with the COVID-19 pandemic, due to concerns of increasing death and hospitalization reported for higher-weight individuals and growing concerns of weight gain due to overeating and sedentary behavior during home confinement (Pearl & Schulte, 2021).

Prior work comprising narrative reviews (Hunger et al., 2015; Major et al., 2018; Puhl et al., 2020; Tomiyama, 2014; Vartanian & Smyth, 2013) and systematic, qualitative syntheses (Pearl & Puhl, 2018; Vartanian & Porter, 2016) have summarized many aspects of this growing body of research, such as internalized weight stigma and physical activity (Pearl & Puhl, 2018) and experiences of weight stigma and eating behaviors (Vartanian & Porter, 2016). In this study, we contribute to the literature by reporting a meta-analysis to a) present a precise estimate of the strength of the relationship between weight stigma and health behaviors and b) test potential moderators of the relationship.

## **Weight Stigma**

Weight stigma refers to the pervasive social devaluation and discrimination of people perceived to have higher body weight (Puhl et al., 2020). Extant research has investigated many facets of weight stigma, such as stigmatization and self-stigma. *Stigmatization* refers to the enactment of devaluation and experiences of unfair treatment (Smith et al., 2016). Weight stigmatization is enacted in interpersonal interactions, taking the forms such as teasing, bullying, hostility, rejection, and harassment (Spahlholz et al., 2016). It is also enacted at the institutional level through discriminatory policies and regulations, such as higher insurance premiums and

restricted coverage (Pearl, 2018), and biased framing of “obesity” in scientific discourses (i.e., scientific weightism; Calogero et al., 2016). In addition to stigmatization, people may experience *self-stigma*: an internalization of negative societal beliefs about oneself and the fear of being stigmatized due to one’s identification with a group (Corrigan & Watson, 2002; Lillis et al., 2020). Research shows that self-stigma is a key mechanism by which weight stigmatization leads to negative outcomes, such as disordered eating (O’Brien et al., 2016).

In Western society, body weight is widely believed to be a matter of self-control (Crandall, 1994). This belief presumes that successful weight loss can be achieved through individual effort, and constructs body weight as a representation of one’s character and social value. These assumptions create a problematic logic that holds people responsible for their stigmatizing condition and that assumes people must not be motivated enough to take the actions they could take to fit a socially constructed notion of ideal body weight. As Phelan et al. (2008) note, stigma enforces social norms by imparting a stiff cost against those who fail to comply. If “norm violators” respond by complying with prevailing societal expectations, they may be re-accepted as “valued” members (Phelan et al., 2008). Vartanian and Smyth (2013) noted that the faulty assumptions about body weight, along with the norm-enforcement function of stigma, underlie the arguments for embracing weight stigma to promote weight loss.

Accumulating evidence has shown that the assumptions about weight loss lack validity. Higher body weight does not necessarily mean poorer health, as the association may be confounded by many factors such as health behaviors (Hunger et al., 2020), metabolic dysfunction (Pennings et al., 2018), and stress experiences (Tomiyama, 2019). Indeed, higher body weight can be a protective factor for specific population segments (Flegal et al., 2013). Further, substantial evidence shows that body weight is not entirely within a person’s control; it

is affected by a complex set of genetic, physiological, and neural processes (Appelhans et al., 2011), and social determinants (Sheets et al., 2020). Losing weight and sustaining the weight loss are exceptionally challenging (Vartanian & Smyth, 2013). Even under optimal conditions, calorie-restricting diets rarely result in weight loss (Mann et al., 2007). Also, most people who manage to lose weight regain the lost weight within a few years (Franz et al., 2007).

Furthermore, counter-evidence has shown that instead of supporting health, weight stigma is associated with behaviors that impair mental and physical health (Hunger et al., 2015; Major et al., 2018). We review these pathways next.

### **Weight Stigma Leads to Poorer Health**

The weight-based social identity threat model posits that weight stigma inhibits behavioral change and damages mental and physical health because it threatens the social identity of higher-weight individuals (Hunger et al., 2015). Weight-based identity threat refers to a psychological state where people feel at risk of being devalued, rejected, or discriminated against because of their body weight. This threat arises from individuals' awareness that they may be categorized as having higher weight and concerns about the devaluation and discrimination as a result of that categorization. People may feel threatened when weight stigma is experienced (e.g., reading a news article on the burden of "obesity" on society), suspected (e.g., wondering whether being turned down for a job is due to their weight), or anticipated (e.g., worrying that they will be judged by health providers).

Experiencing weight-based identity threat is physiologically and psychologically stressful (Hunger et al., 2015). Research showed that exposure to a potential weight stigmatizing situation led higher-weight individuals to experience stronger cardiovascular reactivity (e.g., blood pressure) and greater stress-related emotions (e.g., anxiety) than their lower-weight counterparts

(Major et al., 2014). Concerns about social rejection mediated the increases in stress responses (Blodorn et al., 2016). Weight-based identity threat can induce stress even among lower-weight individuals (Schvey et al., 2014), as observing weight stigmatization reminds them of the possibility of being stigmatized themselves if they were perceived to gain weight (Hunger et al., 2015). Repeated experience of weight-based identity threat can result in allostatic overload (Hunger et al., 2015)—the cumulative burden on the body due to chronic over-activation of physiological systems in response to stressors (McEwen, 1998). Allostatic overload is thought to be a key biological mechanism linking stress and health issues associated with obesity, such as cardiovascular diseases and impaired immunity (McEwen, 1998). Stressful responses also activate the hypothalamic-pituitary-adrenal (HPA) axis that increases the secretion of the endocrine stress hormone cortisol (Tomiyaama, 2014). Elevated levels of cortisol sensitize the food reward system and incentivize the consumption of palatable food (Tomiyaama, 2014).

Coping with stress induced by weight-based identity threat is costly. Facing potential stigmatization, people become increasingly vigilant for cues to identity threat (Major et al., 2014). They may have to exert greater efforts to suppress negative stereotypes and emotions and engage in more behavioral compensation to create a positive impression (Hunger et al., 2015). The enhanced vigilance, suppression, and compensation may constrain cognitive resources to engage in healthy behaviors and instead increase maladaptive responses. For example, Major et al. (2014) found that exposure to weight stigmatizing (vs. non-stigmatizing) messages led participants who perceived themselves as overweight to consume more calories—an increase equivalent to about 4% of the total daily calorie intake recommended for an average adult.

Weight-based identity threat also motivates people to avoid situations where they may be stigmatized, and some of these domains are vital for physical and psychological health (Hunger

et al., 2015). For example, research has linked stronger weight stigma with less interest in dietary and physical activity behaviors (Pearl et al., 2015; Vartanian et al., 2018) and lower intention to utilize age-appropriate preventive care (Amy et al., 2006). Further, weight-based identity threat may lead higher-weight individuals to avoid forming social bonds, which shrinks the size and quality of their support networks (Strauss & Pollack, 2003). Restricted networks have been associated with lower income, which can mean less money for healthy, nutrient-dense food, less time to prepare home-cooked meals, and worse access to fitness facilities (Brewis, 2014).

Together, weight stigma leads to social identity threat, which induces physiological and psychological stress, constrains cognitive resources, and increases motivations to avoid stigmatizing situations and settings (Hunger et al., 2015). The effects of weight stigma, especially when experienced repeatedly, lead to “adverse health behaviors that impair weight-related health, often independent of one’s actual body weight or BMI” (Puhl et al., 2020, p. 277).

### **Previous Meta-Analyses**

To date, three meta-analyses have attempted to summarize the growing research on the effects of weight stigma. Alimoradi et al. (2020) analyzed 30 studies and found moderate, positive correlations between weight stigma and psychological distress (i.e., depression and anxiety). Emmer et al. (2020) examined a larger group of studies ( $N = 105$ ) and found a medium to large negative association between weight stigma and mental health (e.g., self-esteem, quality of life). The relationship was stable, regardless of age, gender, coping strategies, and social support. Ma and colleagues (2021) analyzed 18 studies on the relationship between weight stigma and weight status in children aged between 6 and 18. Weight stigma was found to predict about two times the increased risk of having higher body weight, especially among younger children and boys.

The current meta-analysis extends this body of work in several ways. First, the previous meta-analyses focused exclusively on mental health and weight status. In this study, we sought to quantify the extent to which weight stigma affected health behaviors and their psychological underpinnings (e.g., attitudes, efficacy beliefs, and motivations). According to the weight-based social identity threat model, health behavior is a mediator through which weight-based identity threat affects mental and physical health (Hunger et al., 2015). Hence, the evidence from the current study can advance theory development. Second, we include health behaviors and psychological antecedents for dietary and physical activity behaviors because the two outcomes drew much attention in the literature and were frequently targeted by obesity prevention campaigns. Last, we assess the influence of weight stigma on behaviors with different health implications by including both evidence-based lifestyle modification (e.g., regular physical activity, CDC, 2021) and unhealthy behaviors (e.g., using laxatives; Haynos et al., 2018).

## **Method**

### **Literature Search and Selection**

We identified studies for this meta-analysis by searching several computerized databases, including CINAHL, Communication & Mass Media Complete, Embase, PsychINFO, PubMed, SCOPUS, and Web of Science. The final search was carried out on February 16, 2021. We performed title and keyword searches using all possible cross-set combinations of the following search queries: a) *stigma*, b) *weight*, *overweight*, *obesity*, or *Body Mass Index*, and c) *weight control*, *weight loss/gain*, *exercise*, *physical activity*, or *diet*. Alternative search terms (e.g., stigmatization, stigmas, and activities) were allowed. The full set of search queries were available in the supplemental materials. Our search yielded an initial sample of 2,255 studies, including published (e.g., peer-reviewed articles) and unpublished (e.g., dissertations) studies.

The eligibility of studies was screened in two steps. First, we randomly selected 250 studies (~10% of the sample). The first author and another independent coder read each study's title and abstract to determine its applicability to the current meta-analysis. Studies were excluded if they were (a) duplicates of the studies we had collected, (b) irrelevant to the topic of interest, (c) written in languages other than English, or (d) qualitative. Because we achieved a perfect agreement rate, one coder independently screened the remaining studies. This process eliminated 1,388 studies, leaving 363 studies. In addition, we identified another 33 studies from references included in past reviews of weight stigma (e.g., Pearl & Puhl, 2018; Puhl et al., 2020; Puhl & Heuer, 2010; Vartanian & Porter, 2016), collecting a total of 396 potential studies.

Second, the two coders reviewed the 396 potential studies in full for eligibility. Four inclusion criteria were applied. First, the study had to focus on weight stigma (anticipated, experienced, or internalized devaluation and discrimination). We excluded studies on weight bias—the negative, prejudicial beliefs that higher-weight individuals are lazy, unmotivated, incompetent, and lacking willpower (Puhl et al., 2020). Although stigma is related to stereotyping and prejudice, it is conceptually broader. Stigma involves pervasive, normalized beliefs about the devalued status of a social group in a power situation that enforces and perpetuates the profound discrimination against the group (Link & Phelan, 2001). It is this nexus of labeling, separation, devaluation, and discrimination that makes stigma particularly pernicious for health and well-being (Link & Phelan, 2001). Second, the study had to include measures of stigma and health behavior outcomes. The outcomes included health behaviors (e.g., frequency and quantity of dietary intake) and their psychological antecedents (e.g., self-efficacy and attitudes). We excluded studies of physical health outcomes, such as body mass index, weight loss, and cardiometabolic risk. Studies where stigma was experimentally manipulated but not

measured were also excluded. The two coders achieved reasonable reliability for screening based on measured variables ( $\kappa = .88$ ). Third, the study had to provide the necessary statistical information to calculate a zero-order effect size. Because partial effect sizes are affected by the specific sets of variables that are controlled or partialled in different studies, meta-analyses using partial effect sizes may lead to different conclusions than those based on the original effects (Aloe, 2014). In cases in which only partial effect sizes of stigma on health behaviors were reported, we contacted the corresponding authors for more information. This process resulted in seven additional studies. Fourth, each study needed to provide unique data. We excluded one study (Boswell & White, 2015), which used the same dataset reported in Schvey et al. (2013). Percent agreement was 94% for screening based on effect sizes. When discrepancies were found, the coders reviewed the primary studies together and reached a consensus through discussion. Figure 1 shows a flowchart of the selection process.

These procedures yielded a sample of 54 studies performed between 2005 and 2021, covering 58 independent samples. Fifty-one of these studies appeared in peer-reviewed journals, and three were dissertations. Effect size estimates are available at the Open Science Framework data repository (<https://osf.io/b86qy/>). When applicable, the reporting was guided by the standards of the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA; Page et al., 2021).

### **Study Attributes**

We developed a codebook to describe each study. The codebook included sample characteristics, such as age, gender, race/ethnicity, country of origin, and body mass index. The type of weight stigma was coded as (a) self-stigma (e.g., internalized or ashamed) or (b) stigmatization (e.g., experiences of devaluation) based on how the variable was operationalized

in a study. In our sample, most studies assessed weight self-stigma with the Weight Bias Internalization Scale (Durso & Latner, 2008), its modified version (Pearl & Puhl, 2014), or the Weight Self-Stigma Questionnaire (Lillis et al., 2010). The most common measures of weight stigmatization were the Stigmatizing Situations Inventory (Myers & Rosen, 1999) and its brief version (Vartanian, 2015). Two studies (Duarte et al., 2017; Major et al., 2014) assessed broad weight stigma concerns—defined as concerns of others’ negative judgment based on one’s weight. For example, one item of the weight concerns scale asked participants how much they were concerned that others’ opinions would be based on their weight (Major et al., 2014). This item was not specifically related to the internalization of a stigmatized view, nor the experience of weight discrimination. Hence, these two studies were included in estimating the overall effects of weight stigma, but were excluded from the subgroup analysis by stigma type.

Behavioral outcomes were classified as (a) healthy or (b) unhealthy based on the guidelines from the Centers for Disease Control and Prevention (CDC, 2021). Healthy behaviors emphasize long-term, lifestyle changes toward healthy eating, regular physical activity, and balanced calorie management (CDC, 2021). By contrast, behaviors, such as vomiting, using laxatives, and smoking for appetite reduction, have been linked to negative consequences (Haynos et al., 2018) and were coded as unhealthy. One study examined the effects of stigmatization on children’s liking for sedentary activities with their friends (Hayden-Wade et al., 2005). While liking for sedentary activities indicates physical inactiveness, more interaction with friends suggests less withdrawal and isolation due to experiencing weight stigma. Because of its ambiguous valence, we excluded the liking for sedentary, social activities from sub-group analyses by behavioral valence. We also coded whether outcomes were behavioral (e.g., frequency of physical activity within a typical week) or psychological (e.g., motivations, self-

efficacy, or attitudes concerning physical activity), and whether the outcomes were related to diet or physical activity.

The coders reviewed the conceptual and operational definitions of stigma and practiced identifying sample characteristics and distinguishing different types of stigma with studies not relevant to the current meta-analysis. After the training, each coder rated all the eligible studies independently. Most sample characteristics extracted from the studies had a perfect agreement. The intercoder reliabilities for potential moderators were reasonable ( $\kappa = .88$  to  $1.00$ ). Discrepancies were resolved through discussion.

### **Meta-Analytical Approach**

In this meta-analysis, the Pearson product-moment correlation coefficient ( $r$ ) was used as the effect size indicator. When available,  $r$  coefficients were directly extracted from the study. When they were not reported, other statistics (e.g.,  $t$  statistics) were converted into correlations (Lipsey & Wilson, 2001). We corrected for measurement error when the studies reported reliability estimates for measures of stigma and health behaviors (Hunter & Schmidt, 2014). Reliabilities for stigma measures ranged from .62 to .96, and reliabilities for health behaviors ranged between .56 and .97. Effect sizes that have been corrected for measurement error were weighted by their inverse variance and were combined using random-effects models (Lipsey & Wilson, 2001). We calculated the  $I^2$  statistic to explore whether heterogeneity existed among the effect sizes. An  $I^2$  statistic of 75% or higher suggests considerable heterogeneity among effect sizes and the presence of potential moderators (Higgins & Thompson, 2002).

Publication bias was assessed using funnel plots and Egger's test. A funnel plot is a scatter plot of effect size estimates against individual studies' size or precision (Sterne & Egger, 2001). If there were no publication bias, the distribution of observed effect sizes would

approximate the shape of an inverted funnel, where effect sizes from smaller studies showed more variability than those from larger studies. Because the interpretation of funnel plots may be open to subjectivity, we further used Egger's test to examine whether the asymmetry could be attributed to chance alone; a statistically significant coefficient would suggest publication bias.

Many studies in the sample yielded multiple relevant effect sizes because they included multiple measures of stigma and health behaviors. Instead of averaging multiple measures into a composite score for each study, we calculated separate effect sizes between different measures of stigma and health behaviors within studies. Separating effects avoids the problem of mixing theoretically distinct constructs into one relationship, which can invalidate meta-analytical findings. A total of 273 effect sizes were obtained from the 58 independent samples.

Including multiple effect sizes from the same sample, however, violated the assumption of independence in the meta-analysis. Traditionally, interdependent effect sizes have been modeled with a multilevel meta-analysis (Konstantopoulos, 2011). Multilevel meta-analysis assumes independent sampling errors within clusters. This is a reasonable assumption when a meta-analysis involves non-overlapping samples nested under a higher-level unit (e.g., different samples collected by a collection of studies in multiple countries). However, the assumption of independent sampling errors within clusters is unlikely when the same group of participants provides data on multiple effect sizes (Hedges et al., 2010), which is the case for the current study. Hence, we used robust variance estimates (RVE; Hedges et al., 2010; Tannenbaum et al., 2015) to handle the interdependence among effect sizes. RVE accounts for interdependence arising from both hierarchical effects (e.g., effect sizes nested under a study) and correlated effects (e.g., effect sizes from the same group of participants), providing a useful method to analyze statistically dependent effect sizes.

We further conducted sensitivity analyses to evaluate the robustness of meta-analytical findings. The findings are considered robust if they do not change substantially across methods based on different assumptions and optimal conditions. Carter et al. (2019) recommended a two-step procedure: Researchers first determine the bias-correcting methods that may perform reasonably well given the meta-analytical conditions at hand and then estimate the effects with multiple methods and compare them to evaluate the robustness of the conclusions. We re-estimated the effects of weight stigma on healthy and unhealthy behaviors using the three-parameter selection model (3PSM; McShane et al., 2016) because the simulation results showed that 3PSM substantially reduced Type I error rates when there were moderate to strong publication bias, high heterogeneity among effect sizes, and a relatively large sample of studies (Carter et al., 2019)—the meta-analytical conditions of the current study. We also used the trim-and-fill method (TF; Duval & Tweedie, 2000) because it was frequently used in practice and easily interpreted (Carter et al., 2019). The analyses were conducted using *metafor* (Viechtbauer, 2010) and *robumeta* packages (Fisher & Tipton, 2015) in *R* (version 3.6).

## Results

### Sample Characteristics and Publication Bias

Table 1 presents the sample and study characteristics of studies included in the meta-analysis. The 58 independent samples included 42,105 participants from 11 countries (Australia, Canada, Chile, China, Germany, Italy, Portugal, Sweden, Turkey, the United Kingdom, and the United States). By continent, participants were from Asia ( $N = 549$ , 1.3%), Australia ( $N = 4,025$ , 9.6%), Europe ( $N = 4,426$ , 10.5%), North America ( $N = 32,722$ , 77.7%), and South America ( $N = 383$ , 0.9%). Most participants were between 35 and 50 years old; ten samples included children or adolescents. Females accounted for over half of the participants in all but three samples ( $M =$

72%,  $SD = 19\%$ ). The average BMI of the participants was  $31.3 \text{ kg/m}^2$  ( $SD = 5.60$ ). Of the 58 samples, 30 (52%) consisted of only higher-weight individuals.

As shown in Figure 2, the distribution of observed effect sizes of stigma on healthy behaviors was symmetrical ( $z = 0.36$ ,  $p = .72$ ) and approximated the shape of an inverted funnel, suggesting that the results were unlikely to be biased due to publication bias. By contrast, as shown in Figure 3, the effect sizes of stigma on unhealthy behaviors appeared skewed ( $z = -2.97$ ,  $p = .003$ ). There were few studies of smaller sample sizes reporting strong, positive associations between stigma and unhealthy behaviors, suggesting that the results may underestimate the effect of stigma on unhealthy behaviors.

### Overall Effect Sizes and Subgroup Analysis

**Healthy behaviors.** Of the 58 independent samples, 28 examined the relationship between stigma and healthy behaviors, yielding a total of 114 effect sizes. The weighted mean effect size of stigma on healthy behaviors ( $\bar{r}_w$ ) was  $-.06$  (95% CI  $[-.12, -.01]$ ). The effect size was negative and significantly differed from zero, suggesting that stronger stigma was linked to decreased engagement in healthy behaviors. The effect size was relatively small (Cohen, 1988). It was also heterogenous ( $I^2 = 89.59\%$ ), so we conducted subgroup analyses. Table 2 shows the effect size estimates for the overall and the subgroup analyses.

First, we considered the type of stigma. The confidence intervals for effects on healthy behaviors based on self-stigma ( $r = -.10$ , 95% CI  $[-.16, -.05]$ ) overlapped with the effects based on stigmatization ( $r = -.04$ , 95% CI  $[-.09, .02]$ ). Hence, the effects of stigma on healthy behaviors were not moderated by the type of stigma.

Next, we considered the focus (dietary or physical activity) and type (psychological or behavioral) of healthy behavioral outcomes. The overlapping confidence intervals suggested that

the (negative) stigma-healthy behavior relationship did not depend on whether the behaviors were related to diet ( $r = -.06$ , 95% CI  $[-.18, .05]$ ) or physical activity ( $r = -.08$ , 95% CI  $[-.14, -.02]$ ). In addition, the overlapping confidence intervals showed that stigma had a similar (negative) effect on behavioral ( $r = -.06$ , 95% CI  $[-.11, -.01]$ ) and psychological outcomes ( $r = -.11$ , 95% CI  $[-.22, .01]$ ).

Third, we considered the sample demographics. The effects of stigma were not moderated by whether the sample consisted of only higher weight participants (higher weight participants only:  $r = -.10$ , 95% CI  $[-.16, -.04]$ , or higher and lower weight participants:  $r = -.05$ , 95% CI  $[-.12, .03]$ ). Last, the effects of stigma were not moderated by whether the sample consisted of children and adolescents ( $r = -.09$ , 95% CI  $[-.40, .22]$ ) or adults ( $r = -.06$ , 95% CI  $[-.12, -.01]$ ).

In summary, the findings revealed that stronger weight stigma was related to *less* engagement in healthy dietary and physical activity behaviors. Although heterogeneous, the relationship did not depend on the type of stigma, the focus and type of healthy behaviors, and the sample demographics. Notably, the effect of stigma on healthy dietary and physical activity behaviors was homogenous among higher-weight participants ( $I^2 = 69.1\%$ ) and those who experienced self-stigma ( $I^2 = 73.9\%$ ).

***Unhealthy behaviors.*** Of the 58 independent samples, 49 examined the relationship between stigma and unhealthy dietary and physical activity behaviors, yielding a total of 157 effect sizes. The weighted mean effect size of stigma on unhealthy behaviors ( $\bar{r}_w$ ) was .37 (95% CI  $[-.31, .43]$ ). The effect size was positive and differed from zero, suggesting that stronger stigma was associated with more engagement in unhealthy behaviors. The effect size was medium (Cohen, 1988). It was also heterogeneous ( $I^2 = 97.74\%$ ), so we conducted subgroup

analyses.

The subgroup analyses showed that the effects of stigma on unhealthy dietary and physical activity behaviors were invariant across different types of stigma, outcomes, and sample demographics. The overlapping confidence intervals showed that the (positive) effect of weight stigma on unhealthy behaviors did not differ based on the type of stigma (self-stigma:  $r = .43$ , 95% CI [.36, .51] vs. stigmatization:  $r = .29$ , 95% CI [.21, .37]), the focus of behaviors (diet:  $r = .37$ , 95% CI [.30, .43] vs. physical activity:  $r = .37$ , 95% CI [.18, .56]), or the type of outcomes (behavioral:  $r = .34$ , 95% CI [.24, .44] vs. psychological:  $r = .39$ , 95% CI [.32, .45]). In addition, the effects did not significantly differ depending on the sample characteristics (higher weight participants:  $r = .35$ , 95% CI [.26, .43] vs. higher and lower weight participants:  $r = .38$ , 95% CI [.28, .47]), or age (children and adolescents:  $r = .38$ , 95% CI [.23, .54] vs. adults:  $r = .36$ , 95% CI [.29, .43]).

In summary, the findings revealed that stronger weight stigma was related to greater engagement in unhealthy dietary and physical activity behaviors. The relationship was heterogeneous, but it did not differ by the type of stigma, the focus and type of unhealthy behaviors, and the sample demographics. Subgroup effects remained heterogeneous ( $I^2$  greater than 90%).

**Sensitivity analyses.** Because no significant moderators were detected, we focused sensitivity analyses on the overall effects of weight stigma on healthy and unhealthy dietary and physical activity behaviors. The effect of weight stigma on healthy behaviors was  $-.09$ , 95% CI [-.13, -.06] with the 3PSM and  $-.08$ , 95% CI [-.11, -.06] with the TF method. These results were consistent with the estimate from the RVE method used in the main model ( $-.06$ , 95% CI [-.12, -.01]), suggesting that the finding was robust. Further, the effect of weight stigma on unhealthy

behavior was .32, 95% CI [.26, .38] with the 3PSM and .34, 95% CI [.30, .39] with the TF method, which converged with the effect reported in the main model (.37, 95% CI [.31, .43]).

Hence, the relationship between weight stigma and unhealthy behaviors was also robust.

### **Discussion**

Public health campaigns that explicitly or implicitly stigmatize higher-weight individuals for health promotion are proliferating (Turner et al., 2020). Indeed, the COVID-19 pandemic may have created a resurgence in attempts to justify weight stigmatization as a tool to promote weight loss (Pearl & Schulte, 2021), even though many studies have shown that weight stigma impairs mental and physical health (Hunger et al., 2015; Puhl et al., 2020). Stigma is not recommended as a tool for behavioral change related to weight management, but given flawed assumptions about body weight, this fallacy persists in practice and policy deliberation (Hunger et al., 2020)<sup>1</sup>. The current meta-analysis adds to this growing body of research by quantifying the strength of the relationship between weight stigma and a range of dietary and physical activity behaviors, and by testing potential moderators. The meta-analysis included 54 studies that collectively involved over 40,000 participants from 11 countries. The results showed that weight stigma was positively related to unhealthy dietary and physical activity behaviors and negatively related to healthy behaviors. These relationships were consistent across stigma type, the focus of health behaviors, and sample characteristics.

### **Weight Stigma and Health Behaviors**

The current meta-analysis recorded a correlation of .37 between weight stigma and unhealthy dietary and physical activity behaviors. To understand the magnitude of this relationship, it is worth considering the finding in juxtaposition with other meta-analytical

---

<sup>1</sup> We thank an anonymous reviewer for providing this observation.

evidence on weight stigma. For example, previous meta-analyses showed that weight stigma was positively associated with depression ( $r = .41$ ; Alimoradi et al., 2020) and body weight ( $r = .38$ ; Ma et al., 2021). The current study, thus, demonstrated that the effects of weight stigma on unhealthy behaviors were on par with those on mental outcomes and weight status. Further, we found that the magnitude of weight stigma's effects on unhealthy dietary and physical activity behaviors was comparable between higher- and lower-weight individuals. This finding was consistent with the weight-based social identity threat model (Hunger et al., 2015), which posits that perceived, rather than physical, weight determines people's responses to weight stigma. Even if people do not consider body weight as a central part of their self-concept, they are vulnerable to weight stigma when they perceive themselves, or believe others view themselves, as having higher weight (Hunger et al., 2015).

Weight stigma contributes to a wide array of outcomes that have negative health implications. Among the studies included in the current meta-analysis, for example, people who experienced weight stigma reported more frequent binge eating (Palmeira et al., 2016), emotional overeating (Remmert et al., 2019), and vomiting for weight control (Mañano et al., 2018), a greater consumption of fast and fried food (Gómez-Pérez et al., 2020), and a stronger preference for isolative, sedentary activities (Hayden-Wade et al., 2005). These behaviors may negatively affect health, regardless of one's body weight. Tomiyama (2014) notes that the negative effects of weight stigma are especially difficult to break for people experiencing weight stigmatization because many psychological coping mechanisms, such as identification with similar others, may be unavailable or ineffective in this context.

Implicit in the health campaigns that embrace stigma is the fundamental assumption that weight stigma can induce healthier behavior change. The current results undermined the validity

of this assumption. We found a correlation of  $-.06$  between weight stigma and behaviors that may contribute to good health, regardless of one's actual body weight. Weight stigma may inhibit healthy behaviors by directly limiting material and social aspects of people's lives that are vital to their health (Major et al., 2018). For example, higher-weight individuals, especially women, were found to experience a wage penalty that persisted over the first two decades of their careers (Baum & Ford, 2004), limiting their ability to access and afford a healthier lifestyle. Experiencing weight stigma can significantly constrain the support networks available to higher-weight individuals, leading to social isolation and loneliness. For example, higher-weight adolescents received fewer friend nominations from peers and were more peripheral to social networks than their lower-weight counterparts (Strauss & Pollack, 2003). Being isolated in social networks deprives higher-weight individuals of informational and emotional support conducive to adaptive behaviors.

Weight stigma can also indirectly affect health behaviors by inducing social identity threat, leading to a cascade of physiological and psychological responses with negative health implications (Hunger et al., 2015). Experiencing weight-based identity threat can induce negative emotions such as shame. Accompanied by "a sense of shrinking" or "being small," feelings of shame motivate people to repair self-esteem (Tangney et al., 1996, p. 1257). Research shows that binge eating serves an ego-protective function in relation to shame (Chao et al., 2012). Indeed, shame was found to be particularly effective in orchestrating physiological responses such as the HPA axis activation and cortisol secretion (Dickerson et al., 2004), which stimulate a drive toward high fat and high sugar foods that contribute to weight gain (Tomiyaama, 2014). As discussed earlier, weight-based identity threat also motivates people to avoid situations where stigmatization may occur (Hunger et al., 2015). The motivation to escape stigma leads higher-

weight individuals to underutilize facilities and services, such as fitness and health care (Hunger et al., 2015). Last, weight-based identity threat may decrease people's perceived capacity to engage in adaptive behaviors (Major et al., 2014; Myre et al., 2020) or overcome barriers to engagement (Lambert et al., 2019). Importantly, existing theories emphasized a bidirectional process, whereby weight stigma impairs health through maladaptive eating and other biobehavioral mechanisms, which in turn increases stigmatization (Hunger et al., 2015; Major et al., 2018; Tomiyama, 2014).

Self-stigma is especially pernicious. People who internalize weight bias may view discriminatory treatment as justified and fair, and therefore are more vulnerable to weight-based identity threat than those who refute the internalization (Major et al., 2018). We found that the confidence intervals for the effects of stigmatization on healthy behaviors included zero, but the intervals for self-stigma did not. Previous research suggested that self-stigma moderated the relationship between weight stigmatization and unhealthy behaviors. For example, Durso et al. (2012) found that participants were more likely to report binge eating in response to weight stigmatization when they internalized weight bias. The current finding suggests that the moderating role of self-stigma may extend to healthy dietary and physical activity behaviors.

### **Implications for Public Health Campaigns**

We echo the call by other researchers that “public health campaigns should eliminate the use of weight stigma, whether implicitly or explicitly” (Hunger et al., 2020, p. 90). As many have argued, using stigma as a tool to promote health behavior is unethical: It obfuscates the complex mechanisms underpinning body weight (Appelhans et al., 2011) and exculpates the broader social contexts in which negative outcomes are produced and reproduced (Blacksher, 2018). With the current body of evidence, it is clear that weight stigma inhibits healthy dietary

and physical activity behaviors. Further complicating this is the fact that stigma is difficult to eradicate once it is created. Meta-analytical evidence suggests that the effects of interventions to reduce stigma are small (Lee et al., 2014) and may not persist over time (Corrigan et al., 2012). What is needed, instead, is a comprehensive strategy that adopts a weight-inclusive (as opposed to weight-centric) approach to health promotion, combats weight stigma at multiple levels, and includes large-scale, coordinated policy innovations that create a socio-economic environment conducive for a healthy lifestyle (Hunger et al., 2020; Tomiyama et al., 2018; Tylka et al., 2014).

### **Limitations and Future Directions**

The current study has several important limitations. First, the quality of primary studies affects the validity of meta-analytical findings (Lipsey & Wilson, 2001). Although our meta-analysis included studies that together involved over 40,000 participants, the majority were from North America and developed countries. This leaves us uncertain regarding how well the current findings can be generalized to other countries. As weight stigma has spread globally (Brewis et al., 2018), future research is needed to examine the effects of weight stigma on health behaviors in developing countries around the globe. Second, most studies in this meta-analysis used cross-sectional data, limiting our ability to make causal inferences between stigma and behavior outcomes. Future research using well-designed longitudinal studies is needed to provide insights into the mechanisms through which weight stigma affects health behaviors and the evolution of these mechanisms over time. Third, most studies included in the meta-analysis focused on overall weight stigma, ignoring the different contexts (e.g., healthcare, family, and education) by which stigma unfolds. Such evidence would be useful, as interventions to challenge stigma may target different behaviors depending on the specific contexts of interest. This would further inform future meta-analysis by moving beyond dieting and physical activities and including

other important outcomes such as quality of conversation with healthcare providers and efforts to challenge weight stigma when it occurs.

### **Conclusion**

Despite substantial evidence that indicates otherwise, the assumption that weight stigma is effective for health promotion persists in practice and policy discussion. The COVID-19 pandemic may have created a resurgence in attempts to justify weight stigmatization as a tool to promote weight loss. Using stigma for health promotion is unethical and ineffective. This meta-analysis demonstrates that weight stigma *inhibits* healthy dietary and physical activity behaviors and *exacerbates* unhealthy behaviors. Public health campaigns should be grounded in empirical evidence rather than flawed assumptions, and empower rather than trample human dignity.

## References

*\*References marked with an asterisk were studies included in the meta-analysis.*

Alimoradi, Z., Golboni, F., Griffiths, M. D., Broström, A., Lin, C. Y., & Pakpour, A. H. (2020).

Weight-related stigma and psychological distress: A systematic review and meta-analysis. *Clinical Nutrition*, 39(7), 2001-2013. <https://doi.org/10.1016/j.clnu.2019.10.016>

\*Almenara, C. A., Aimé, A., Maïano, C., Ejova, A., Guèvremont, G., Bournival, C., & Ricard,

M.-M. (2017). Weight stigmatization and disordered eating in obese women: The mediating effects of self-esteem and fear of negative appearance evaluation. *European Review of Applied Psychology*, 67(3), 155–162.

<https://doi.org/10.1016/j.erap.2017.02.004>

Aloe, A. M. (2014). An empirical investigation of partial effect sizes in meta-analysis of

correlational data. *The Journal of General Psychology*, 141(1), 47–64.

<https://doi.org/10.1080/00221309.2013.853021>

Amy, N. K., Aalborg, A., Lyons, P., & Keranen, L. (2006). Barriers to routine gynecological

cancer screening for White and African-American obese women. *International Journal of Obesity*, 30(1), 147-155. <https://doi.org/10.1038/sj.ijo.0803105>

Appelhans, B. M., Whited, M. C., Schneider, K. L., & Pagoto, S. L. (2011). Time to abandon the

notion of personal choice in dietary counseling for obesity? *Journal of the American Dietetic Association*, 111(8), 1130–1136. <https://doi.org/10.1016/j.jada.2011.05.014>

Ata, R. N., & Thompson, J. K. (2010). Weight bias in the media: A review of recent research.

*Obesity Facts*, 3(1), 41-46. <https://doi.org/10.1159/000276547>

Baum, C. L., & Ford, W. F. (2004). The wage effects of obesity: a longitudinal study. *Health*

*Economics*, 13(9), 885-899. <https://doi.org/10.1002/hec.881>

- Blacksher, E. (2018). Public health and social justice: An argument against stigma as a tool of health promotion and disease prevention. In B. Major, J. F. Dovidio, B. G., Link (Eds.), *The Oxford handbook of stigma, discrimination, and health*. (pp. 439-453). Oxford University Press.
- Blodorn, A., Major, B., Hunger, J., & Miller, C. (2016). Unpacking the psychological weight of weight stigma: A rejection-expectation pathway. *Journal of Experimental Social Psychology*, 63, 69-76. <https://doi.org/10.1016/j.jesp.2015.12.003>
- Boswell, R. G., & White, M. A. (2015). Gender differences in weight bias internalisation and eating pathology in overweight individuals. *Advances in Eating Disorders*, 3(3), 259–268. <https://doi.org/10.1080/21662630.2015.1047881>
- Brewis, A. A. (2014). Stigma and the perpetuation of obesity. *Social Science & Medicine*, 118, 152–158. <https://doi.org/10.1016/j.socscimed.2014.08.003>
- Brewis, A., SturtzSreetharan, C., & Wutich, A. (2018). Obesity stigma as a globalizing health challenge. *Globalization and Health*, 14(1), 1-6. <https://doi.org/10.1186/s12992-018-0337-x>
- \*Burmeister, J. M., & Carels, R. A. (2014). Television use and binge eating in adults seeking weight loss treatment. *Eating Behaviors*, 15(1), 83–86. <https://doi.org/10.1016/j.eatbeh.2013.10.001>
- \*Burmeister, J. M., Hinman, N., Koball, A., Hoffmann, D. A., & Carels, R. A. (2013). Food addiction in adults seeking weight loss treatment. Implications for psychosocial health and weight loss. *Appetite*, 60, 103-110. <https://doi.org/10.1016/j.appet.2012.09.013>
- Callahan, D. (2013). Obesity: Chasing an elusive epidemic. *Hastings Center Report*, 43(1), 34–40. <https://doi.org/10.1002/hast.114>

- Calogero, R. M., Tylka, T. L., & Mensinger, J. L. (2016). Scientific weightism: A view of mainstream weight stigma research through a feminist lens. In T. A. Roberts, N. Curtin, L. Cortina & L. E. Duncan (Eds.), *Best practices on building a psychological science of gender* (pp. 9–28). Springer.
- \*Carels, R. A., Wott, C. B., Young, K. M., Gumble, A., Koball, A., & Oehlhof, M. W. (2010). Implicit, explicit, and internalized weight bias and psychosocial maladjustment among treatment-seeking adults. *Eating Behaviors, 11*(3), 180–185.  
<https://doi.org/10.1016/j.eatbeh.2010.03.002>
- Carter, E. C., Schönbrodt, F. D., Gervais, W. M., & Hilgard, J. (2019). Correcting for bias in psychology: A comparison of meta-analytic methods. *Advances in Methods and Practices in Psychological Science, 2*(2), 115–144.  
<https://doi.org/10.1177/2515245919847196>
- Centers for Disease Control and Preventions (2021). *Healthy weight, nutrition, and physical Activity*. <https://www.cdc.gov/healthyweight/index.html>
- Chao, Y. H., Yang, C. C., & Chiou, W. B. (2012). Food as ego-protective remedy for people experiencing shame. Experimental evidence for a new perspective on weight-related shame. *Appetite, 59*(2), 570–575. <https://doi.org/10.1016/j.appet.2012.07.007>
- Charlesworth, T. E., & Banaji, M. R. (2019). Patterns of implicit and explicit attitudes: I. Long-term change and stability from 2007 to 2016. *Psychological Science, 30*(2), 174–192.  
<https://doi.org/10.1177/0956797618813087>
- \*Cheng, O. Y., Yam, C. L. Y., Cheung, N. S., Lee, P. L. P., Ngai, M. C., & Lin, C. Y. (2019). Extended theory of planned behavior on eating and physical activity. *American Journal of Health Behavior, 43*(3), 569–581. <https://doi.org/10.5993/AJHB.43.3.11>

- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2<sup>nd</sup> ed.). Erlbaum.
- Corrigan, P. W., Morris, S. B., Michaels, P. J., Rafacz, J. D., & Rüsch, N. (2012). Challenging the public stigma of mental illness: a meta-analysis of outcome studies. *Psychiatric Services*, 63(10), 963-973. <https://doi.org/10.1176/appi.ps.201100529>
- Corrigan, P. W., & Watson, A. C. (2002). The paradox of self-stigma and mental illness. *Clinical Psychology: Science and Practice*, 9(1), 35-53. <https://doi.org/10.1093/clipsy.9.1.35>
- Crandall, C. S. (1994). Prejudice against fat people: ideology and self-interest. *Journal of Personality and Social Psychology*, 66(5), 882-894. <https://doi.org/10.1037/0022-3514.66.5.882>
- Dickerson, S. S., Kemeny, M. E., Aziz, N., Kim, K. H., & Fahey, J. L. (2004). Immunological effects of induced shame and guilt. *Psychosomatic Medicine*, 66(1), 124-131. <http://doi.org/10.1097/01.PSY.0000097338.75454.29>
- \*Douglas, V., & Varnado-Sullivan, P. (2016). Weight stigmatization, internalization, and eating disorder symptoms: The role of emotion dysregulation. *Stigma and Health*, 1(3), 166–175. <https://doi.org/10.1037/sah0000029>
- \*Duarte, C., Matos, M., Stubbs, R. J., Gale, C., Morris, L., Gouveia, J. P., & Gilbert, P. (2017). The impact of shame, self-criticism and social rank on eating behaviours in overweight and obese women participating in a weight management programme. *PLOS ONE*, 12(1), e0167571. <https://doi.org/10.1371/journal.pone.0167571>
- Durso, L. E., & Latner, J. D. (2008). Understanding self-directed stigma: development of the weight bias internalization scale. *Obesity*, 16(S2), S80-S86. <https://doi.org/10.1038/oby.2008.448>
- \*Durso, L. E., Latner, J. D., & Hayashi, K. (2012). Perceived discrimination is associated with

- binge eating in a community sample of non-overweight, overweight, and obese adults. *Obesity Facts*, 5(6), 869–880. <https://doi.org/10.1159/000345931>
- \*Durso, L. E., Latner, J. D., White, M. A., Masheb, R. M., Blomquist, K. K., Morgan, P. T., & Grilo, C. M. (2012). Internalized weight bias in obese patients with binge eating disorder: Associations with eating disturbances and psychological functioning. *International Journal of Eating Disorders*, 45(3), 423–427. <https://doi.org/10.1002/eat.20933>
- Duval, S., & Tweedie, R. (2000). Trim and fill: A simple funnel-plot–based method of testing and adjusting for publication bias in meta-analysis. *Biometrics*, 56(2), 455-463. <https://doi.org/10.1111/j.0006-341X.2000.00455.x>
- Emmer, C., Bosnjak, M., & Mata, J. (2020). The association between weight stigma and mental health: A meta-analysis. *Obesity Reviews*, 21(1), e12935. <https://doi.org/10.1111/obr.12935>
- \*Essayli, J. H., Murakami, J. M., Wilson, R. E., & Latner, J. D. (2017). The impact of weight labels on body image, internalized weight stigma, affect, perceived health, and intended weight loss behaviors in normal-weight and overweight college women. *American Journal of Health Promotion*, 31(6), 484-490. <https://doi.org/10.1177/0890117116661982>
- Fisher, Z., & Tipton, E. (2015, March 7). *Robumeta: An R-package for robust variance estimation in meta-analysis*. Retrieved from <http://arxiv.org/abs/1503.02220>
- Flegal, K. M., Kit, B. K., Orpana, H., & Graubard, B. I. (2013). Association of all-cause mortality with overweight and obesity using standard body mass index categories: a systematic review and meta-analysis. *JAMA*, 309(1), 71-82. <https://doi.org/10.1001/jama.2012.113905>

- Franz, M. J., VanWormer, J. J., Crain, A. L., Boucher, J. L., Histon, T., Caplan, W., ... & Pronk, N. P. (2007). Weight-loss outcomes: A systematic review and meta-analysis of weight-loss clinical trials with a minimum 1-year follow-up. *Journal of the American Dietetic Association*, 107(10), 1755-1767. <https://doi.org/10.1016/j.jada.2007.07.017>
- \*Fung, X. C. C., Pakpour, A. H., Wu, Y.-K., Fan, C.-W., Lin, C.-Y., & Tsang, H. W. H. (2019). Psychosocial variables related to weight-related self-stigma in physical activity among young adults across weight status. *International Journal of Environmental Research and Public Health*, 17(1), 64. <https://doi.org/10.3390/ijerph17010064>
- \*Gómez-Pérez, D., Cancino, M., Moreno, P. I., & Ortiz, M. S. (2020). Weight stigma, chronic stress, unhealthy diet, and obesity in Chilean adults. *International Journal of Behavioral Medicine*. <https://doi.org/10.1007/s12529-020-09917-1>
- \*Greenleaf, C., Petrie, T. A., & Martin, S. B. (2014). Relationship of weight-based teasing and adolescents' psychological well-being and physical health. *Journal of School health*, 84(1), 49-55. <https://doi.org/10.1111/josh.12118>
- \*Hayden-Wade, H. A., Stein, R. I., Ghaderi, A., Saelens, B. E., Zabinski, M. F., & Wilfley, D. E. (2005). Prevalence, characteristics, and correlates of teasing experiences among overweight children vs. non-overweight peers. *Obesity Research*, 13(8), 1381–1392. <https://doi.org/10.1038/oby.2005.167>
- Haynos, A. F., Wall, M. M., Chen, C., Wang, S. B., Loth, K., & Neumark-Sztainer, D. (2018). Patterns of weight control behavior persisting beyond young adulthood: Results from a 15-year longitudinal study. *International Journal of Eating Disorders*, 51(9), 1090–1097. <https://doi.org/10.1002/eat.22963>
- Hedges, L. V., Tipton, E., & Johnson, M. C. (2010). Robust variance estimation in meta-

- regression with dependent effect size estimates. *Research Synthesis Methods*, 1(1), 39–65. <https://doi.org/10.1002/jrsm.5>
- Higgins, J. P. T., & Thompson, S. G. (2002). Quantifying heterogeneity in a meta-analysis. *Statistics in Medicine*, 21(11), 1539–1558. <https://doi.org/10.1002/sim.1186>
- \*Himmelstein, M. S., Puhl, R. M., & Quinn, D. M. (2018). Weight stigma and health: The mediating role of coping responses. *Health Psychology*, 37(2), 139–147. <https://doi.org/10.1037/hea0000575>
- \*Horenstein, A., Kaplan, S. C., Butler, R. M., & Heimberg, R. G. (2021). Social anxiety moderates the relationship between body mass index and motivation to avoid exercise. *Body Image*, 36, 185–192. <https://doi.org/10.1016/j.bodyim.2020.11.010>
- Hunger, J. M., Major, B., Blodorn, A., & Miller, C. T. (2015). Weighed down by stigma: How weight-based social identity threat contributes to weight gain and poor health. *Social and Personality Psychology Compass*, 9(6), 255–268. <http://doi.org/10.1111/spc3.12172>
- Hunger, J. M., Smith, J. P., & Tomiyama, A. J. (2020). An evidence-based rationale for adopting weight-inclusive health policy. *Social Issues and Policy Review*, 14(1), 73–107. <http://doi.org/10.1111/sipr.12062>
- Hunter, J. E., & Schmidt, F. L. (2014). *Methods of meta-analysis: Correcting error and bias in research findings* (3<sup>rd</sup> ed.). Sage Publications.
- \*Innamorati, M., Imperatori, C., Lamis, D. A., Contardi, A., Castelnovo, G., Tamburello, S., Manzoni, G. M., & Fabbriatore, M. (2017). Weight bias internalization scale discriminates obese and overweight patients with different severity levels of depression: The Italian version of the WBIS. *Current Psychology*, 36(2), 242–251. <https://doi.org/10.1007/s12144-016-9406-6>

- \*Koball, A. M., Mueller, P. S., Craner, J., Clark, M. M., Nanda, S., Kebede, E. B., & Grothe, K. B. (2018). Crucial conversations about weight management with healthcare providers: Patients' perspectives and experiences. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 23(1), 87–94. <https://doi.org/10.1007/s40519-016-0304-6>
- Konstantopoulos, S. (2011). Fixed effects and variance components estimation in three-level meta-analysis. *Research Synthesis Methods*, 2(1), 61-76. <https://doi.org/10.1002/jrsm.35>
- \*Lambert, E. R., Koutoukidis, D. A., & Jackson, S. E. (2019). Effects of weight stigma in news media on physical activity, dietary and weight loss intentions and behaviour. *Obesity Research & Clinical Practice*, 13(6), 571–578. <https://doi.org/10.1016/j.orcp.2019.09.001>
- Lee, K. M., Ata, R. N., & Brannick, M. T. (2014). Malleability of weight-biased attitudes and beliefs: A meta-analysis of weight bias reduction interventions. *Body Image*, 11(3), 251-259. <https://doi.org/10.1016/j.bodyim.2014.03.003>
- Lee, K. M., Hunger, J. M., & Tomiyama, A. J. (2021). Weight stigma and health behaviors: evidence from the Eating in America Study. *International Journal of Obesity*, 45(7), 1499-1509. <https://doi.org/10.1038/s41366-021-00814-5>
- \*Lessard, L. M., Puhl, R. M., & Watson, R. J. (2020). Gay–straight alliances: A mechanism of health risk reduction among lesbian, gay, bisexual, transgender, and questioning adolescents. *American Journal of Preventive Medicine*, 59(2), 196–203. <https://doi.org/10.1016/j.amepre.2020.02.020>
- \*Lillis, J., Luoma, J. B., Levin, M. E., & Hayes, S. C. (2010). Measuring weight self-stigma: The Weight Self-Stigma Questionnaire. *Obesity*, 18(5), 971–976. <https://doi.org/10.1038/oby.2009.353>

- \*Lillis, J., Thomas, J. G., Levin, M. E., & Wing, R. R. (2020). Self-stigma and weight loss: The impact of fear of being stigmatized. *Journal of Health Psychology, 25*(7), 922–930.  
<https://doi.org/10.1177/1359105317739101>
- Link, B. G., & Phelan, J. C. (2001). Conceptualizing stigma. *Annual Review of Sociology, 27*(1), 363-385. <https://doi.org/10.1146/annurev.soc.27.1.363>
- Lipsey, M. W., & Wilson, D. B. (2001). *Practical meta-analysis*. Sage.
- Lydecker, J. A., Cotter, E. W., Palmberg, A. A., Simpson, C., Kwitowski, M., White, K., & Mazzeo, S. E. (2016). Does this Tweet make me look fat? A content analysis of weight stigma on Twitter. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity, 21*(2), 229-235. <https://doi.org/10.1007/s40519-016-0272-x>
- Ma, L., Chu, M., Li, Y., Wu, Y., Yan, A. F., Johnson, B., & Wang, Y. (2021). Bidirectional relationships between weight stigma and pediatric obesity: A systematic review and meta-analysis. *Obesity Reviews*. Advance online publication.  
<https://doi.org/10.1111/obr.13178>
- \*Maïano, C., Aimé, A., Lepage, G., & Morin, A. J. (2019). Psychometric properties of the Weight Self-Stigma Questionnaire (WSSQ) among a sample of overweight/obese French-speaking adolescents. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity, 24*(3), 575-583. <https://doi.org/10.1007/s40519-017-0382-0>
- \*Maïano, C., Lepage, G., Aimé, A., Morin, A. J. S., Bayard, C., Dansereau-Trahan, É., Granger, L., & Vallerian, A. (2018). Perceived weight-related victimization and physical activity outcomes among adolescents with overweight and obesity: Indirect role of perceived physical abilities and fear of enacted stigma. *Psychology of Sport and Exercise, 34*, 70–78. <https://doi.org/10.1016/j.psychsport.2017.08.007>

- \*Major, B., Hunger, J. M., Bunyan, D. P., & Miller, C. T. (2014). The ironic effects of weight stigma. *Journal of Experimental Social Psychology, 51*, 74–80.  
<https://doi.org/10.1016/j.jesp.2013.11.009>
- Major, B., Tomiyama, A. J., & Hunger, J. M. (2018). The negative and bidirectional effects of weight stigma on health. In B. Major, J. F., Dovidio, & B. G. Link (Eds). *The Oxford Handbook of Stigma, Discrimination, and Health* (pp. 499–519). Oxford University Press
- Mann, T., Tomiyama, A. J., Westling, E., Lew, A., Samuels, B., & Chatman, J. (2007). Medicare’s search for effective obesity treatments: Diets are not the answer. *The American Psychologist 62*(3), 220–233. <http://doi.org/10.1037/0003-066X.62.3.220>
- McEwen, B. S. (1998). Protective and damaging effects of stress mediators. *New England Journal of Medicine, 338*(3), 171–179. <http://doi.org/10.1056/NEJM199801153380307>
- McShane, B. B., Böckenholt, U., & Hansen, K. T. (2016). Adjusting for publication bias in meta-analysis: An evaluation of selection methods and some cautionary notes. *Perspectives on Psychological Science, 11*(5), 730-749. <https://doi.org/10.1177/1745691616662243>
- Myers, A., & Rosen, J. (1999). Obesity stigmatization and coping: Relation to mental health symptoms, body image, and self-esteem. *International Journal of Obesity, 23*(3), 221–230. <https://doi.org/10.1038/sj.ijo.0800765>
- \*Myre, M., Berry, T. R., Ball, G. D. C., & Hussey, B. (2020). Motivated, fit, and strong—Using counter-stereotypical images to reduce weight stigma internalisation in women with obesity. *Applied Psychology: Health and Well-Being, 12*(2), 335–356.  
<https://doi.org/10.1111/aphw.12187>
- \*O’Brien, K. S., Latner, J. D., Puhl, R. M., Vartanian, L. R., Giles, C., Griva, K., & Carter, A. (2016). The relationship between weight stigma and eating behavior is explained by

weight bias internalization and psychological distress. *Appetite*, 102, 70–76.

<https://doi.org/10.1016/j.appet.2016.02.032>

\*Olson, K. L. (2017). *Eating, exercise, and quality of life: The role of body image among adult women attempting weight loss* [Doctoral dissertation, The Ohio State University]. ProQuest Dissertations Publishing.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372. <https://doi.org/10.1136/bmj.n71>

\*Palmeira, L., Pinto-Gouveia, J., & Cunha, M. (2016). The role of weight self-stigma on the quality of life of women with overweight and obesity: A multi-group comparison between binge eaters and non-binge eaters. *Appetite*, 105, 782–789. <https://doi.org/10.1016/j.appet.2016.07.015>

\*Palmeira, L., Pinto-Gouveia, J., Cunha, M., & Carvalho, S. (2017). Finding the link between internalized weight-stigma and binge eating behaviors in Portuguese adult women with overweight and obesity: The mediator role of self-criticism and self-reassurance. *Eating Behaviors*, 26, 50–54. <https://doi.org/10.1016/j.eatbeh.2017.01.006>

\*Panza, E. (2018). *Minority stress and eating behavior among overweight and obese sexual minority women: An ecological momentary assessment study*. [Doctoral dissertation, Rutgers, The State University of New Jersey]. ProQuest Dissertations Publishing.

Pearl, R. L. (2018). Weight bias and stigma: public health implications and structural solutions. *Social Issues and Policy Review*, 12(1), 146-182. <https://doi.org/10.1111/sipr.12043>

\*Pearl, R. L., & Puhl, R. M. (2014). Measuring internalized weight attitudes across body weight

- categories: Validation of the Modified Weight Bias Internalization Scale. *Body Image*, 11(1), 89–92. <https://doi.org/10.1016/j.bodyim.2013.09.005>
- Pearl, R. L., & Puhl, R. M. (2018). Weight bias internalization and health: A systematic review. *Obesity Reviews*, 19(8), 1141–1163. <https://doi.org/10.1111/obr.12701>
- \*Pearl, R. L., Puhl, R. M., & Dovidio, J. F. (2015). Differential effects of weight bias experiences and internalization on exercise among women with overweight and obesity. *Journal of Health Psychology*, 20(12), 1626–1632. <https://doi.org/10.1177/1359105313520338>
- Pearl, R. L., & Schulte, E. M. (2021). Weight bias during the COVID-19 pandemic. *Current Obesity Reports*, 10, 181–190. <https://doi.org/10.1007/s13679-021-00432-2>
- Pennings, N., Jaber, J., & Ahiawodzi, P. (2018). Ten-year weight gain is associated with elevated fasting insulin levels and precedes glucose elevation. *Diabetes/Metabolism Research and Reviews*, 34(4), e2986. <https://doi.org/10.1002/dmrr.2986>
- Phelan, J. C., Link, B. G., & Dovidio, J. F. (2008). Stigma and prejudice: One animal or two? *Social Science & Medicine*, 67(3), 358–367. <https://doi.org/10.1016/j.socscimed.2008.03.022>
- \*Potter, L. N. (2018). *An ecological momentary investigation of weight stigma: Exploring associations between weight vigilance and poor health in everyday life*. [Doctoral dissertation, The Pennsylvania State University]. ProQuest Dissertations Publishing.
- Puhl, R. M., & Heuer, C. A. (2010). Obesity stigma: Important considerations for public health. *American Journal of Public Health*, 100(6), 1019–1028. <https://doi.org/10.2105/AJPH.2009.159491>
- \*Puhl, R. M., & Himmelstein, M. S. (2018). Weight bias internalization among adolescents

seeking weight loss: Implications for eating behaviors and parental communication.

*Frontiers in Psychology*, 9, 2271. <https://doi.org/10.3389/fpsyg.2018.02271>

Puhl, R. M., Himmelstein, M. S., & Pearl, R. L. (2020). Weight stigma as a psychosocial contributor to obesity. *American Psychologist*, 75(2), 274–289.

<https://doi.org/10.1037/amp0000538>

\*Puhl, R. M., Himmelstein, M. S., Pearl, R. L., Wojtanowski, A. C., & Foster, G. D. (2019).

Weight stigma among sexual minority adults: Findings from a matched sample of adults engaged in weight management. *Obesity*, 27(11), 1906-1915.

<https://doi.org/10.1002/oby.22633>

Puhl, R. M., & Lessard, L. M. (2020). Weight stigma in youth: prevalence, consequences, and considerations for clinical practice. *Current Obesity Reports*, 9, 402-411.

<https://doi.org/10.1007/s13679-020-00408-8>

\*Puhl, R. M., Moss-Racusin, C. A., & Schwartz, M. B. (2007). Internalization of weight bias: implications for binge eating and emotional well-being. *Obesity*, 15(1), 19-23.

<https://doi.org/10.1038/oby.2007.521>

\*Puhl, R. M., Quinn, D. M., Weisz, B. M., & Suh, Y. J. (2017). The role of stigma in weight loss maintenance Among U.S. adults. *Annals of Behavioral Medicine*, 51(5), 754–763.

<https://doi.org/10.1007/s12160-017-9898-9>

Puhl, R., & Suh, Y. (2015). Health consequences of weight stigma: Implications for obesity prevention and treatment. *Current Obesity Reports*, 4(2), 182–190.

<https://doi.org/10.1007/s13679-015-0153-z>

\*Raves, D. M., Brewis, A., Trainer, S., Han, S.-Y., & Wutich, A. (2016). Bariatric surgery

patients' perceptions of weight-related stigma in healthcare settings impair post-surgery

- dietary adherence. *Frontiers in Psychology*, 7. <https://doi.org/10.3389/fpsyg.2016.01497>
- \*Remmert, J. E., Convertino, A. D., Roberts, S. R., Godfrey, K. M., & Butryn, M. L. (2019). Stigmatizing weight experiences in health care: Associations with BMI and eating behaviours. *Obesity Science & Practice*, 5(6), 555–563. <https://doi.org/10.1002/osp4.379>
- \*Roberto, C. A., Sysko, R., Bush, J., Pearl, R., Puhl, R. M., Schvey, N. A., & Dovidio, J. F. (2012). Clinical correlates of the weight bias internalization scale in a sample of obese adolescents seeking bariatric surgery. *Obesity*, 20(3), 533–539. <https://doi.org/10.1038/oby.2011.123>
- \*Sattler, K. M., Deane, F. P., Tapsell, L., & Kelly, P. J. (2018). Gender differences in the relationship of weight-based stigmatisation with motivation to exercise and physical activity in overweight individuals. *Health Psychology Open*, 5(1), 2055102918759691. <https://doi.org/10.1177/2055102918759691>
- Sheets, L. R., Kelley, L. E. H., Scheitler-Ring, K., Petroski, G. F., Barnett, Y., Barnett, C., ... & Parker, J. C. (2020). An index of geospatial disadvantage predicts both obesity and unmeasured body weight. *Preventive Medicine Reports*, 18, 101067. <https://doi.org/10.1016/j.pmedr.2020.101067>
- Schvey, N. A., Puhl, R. M., & Brownell, K. D. (2014). The stress of stigma: Exploring the effect of weight stigma on cortisol reactivity. *Psychosomatic Medicine*, 76(2), 156–62. doi:10.1097/PSY.0000000000000031
- \*Schvey, N. A., Roberto, C. A., & White, M. A. (2013). Clinical correlates of the Weight Bias Internalization Scale in overweight adults with binge and purge behaviours. *Advances in Eating Disorders*, 1(3), 213–223. <https://doi.org/10.1080/21662630.2013.794523>
- \*Schvey, N. A., Sbrocco, T., Bakalar, J. L., Ress, R., Barmine, M., Gorlick, J., Pine, A.,

- Stephens, M., & Tanofsky-Kraff, M. (2017). The experience of weight stigma among gym members with overweight and obesity. *Stigma and Health*, 2(4), 292–306.  
<https://doi.org/10.1037/sah0000062>
- \*Schvey, N. A., & White, M. A. (2015). The internalization of weight bias is associated with severe eating pathology among lean individuals. *Eating Behaviors*, 17, 1–5.  
<https://doi.org/10.1016/j.eatbeh.2014.11.001>
- \*Sevincer, G. M., Kaya, A., Bozkurt, S., Akin, E., & Kose, S. (2017). Reliability, validity, and factorial structure of the Turkish version of the Weight Self-Stigma Questionnaire (Turkish WSSQ). *Psychiatry and Clinical Psychopharmacology*, 27(4), 386–392.  
<https://doi.org/10.1080/24750573.2017.1379717>
- \*Sienko, R. M., Saules, K. K., & Carr, M. M. (2016). Internalized weight bias mediates the relationship between depressive symptoms and disordered eating behavior among women who think they are overweight. *Eating Behaviors*, 22, 141–144.  
<https://doi.org/10.1016/j.eatbeh.2016.06.002>
- Smith, R. A., Zhu, X., & Quesnell, M. N. (2016). Stigma and health/risk communication. In J. F. Nussbaum (Ed.), *Oxford research encyclopedia of communication: Health and risk message design and processing* (pp. 1–33). Oxford University Press.
- Spahlholz, J., Baer, N., König, H.-H., Riedel-Heller, S. G., & Luck-Sikorski, C. (2016). Obesity and discrimination—A systematic review and meta-analysis of observational studies. *Obesity Reviews*, 17(1), 43–55. <https://doi.org/10.1111/obr.12343>
- Sterne, J. A. C., & Egger, M. (2001). Funnel plots for detecting bias in meta-analysis: Guidelines on choice of axis. *Journal of Clinical Epidemiology*, 54(10), 1046–1055.  
[https://doi.org/10.1016/S0895-4356\(01\)00377-8](https://doi.org/10.1016/S0895-4356(01)00377-8)

Strauss, R. S., & Pollack, H. A. (2003). Social marginalization of overweight children. *Archives of Pediatrics & Adolescent Medicine*, 157(8), 746-752.

<https://doi.org/10.1001/archpedi.157.8.746>

\*Sutin, A., Robinson, E., Daly, M., & Terracciano, A. (2016). Weight discrimination and unhealthy eating-related behaviors. *Appetite*, 102, 83–89.

<https://doi.org/10.1016/j.appet.2016.02.016>

\*Sutin, A. R., Stephan, Y., Robinson, E., Daly, M., & Terracciano, A. (2020). Body-related discrimination and dieting and substance use behaviors in adolescence. *Appetite*, 151, 104689. <https://doi.org/10.1016/j.appet.2020.104689>

Tangney, J. P., Miller, R. S., Flicker, L., & Barlow, D. H. (1996). Are shame, guilt, and embarrassment distinct emotions?. *Journal of Personality and Social Psychology*, 70(6), 1256-1269. <https://doi.org/10.1037/0022-3514.70.6.1256>

Tannenbaum, M. B., Hepler, J., Zimmerman, R. S., Saul, L., Jacobs, S., Wilson, K., & Albarracín, D. (2015). Appealing to fear: A meta-analysis of fear appeal effectiveness and theories. *Psychological Bulletin*, 141(6), 1178–1204.

<https://doi.org/10.1037/a0039729>

\*Täuber, S., Gausel, N., & Flint, S. W. (2018). Weight bias internalization: the maladaptive effects of moral condemnation on intrinsic motivation. *Frontiers in Psychology*, 9, 1836.

<https://doi.org/10.3389/fpsyg.2018.01836>

Tomiyama, A. J. (2014). Weight stigma is stressful. A review of evidence for the Cyclic Obesity/Weight-Based Stigma model. *Appetite*, 82, 8–15.

<https://doi.org/10.1016/j.appet.2014.06.108>

Tomiyama, A. J. (2019). Stress and obesity. *Annual Review of Psychology*, 70, 703–718.

<https://doi.org/10.1146/annurev-psych-010418-102936>

Tomiyama, A. J., Carr, D., Granberg, E. M., Major, B., Robinson, E., Sutin, A. R., & Brewis, A.

(2018). How and why weight stigma drives the obesity ‘epidemic’ and harms health.

*BMC Medicine*, 16(1), 1-6. <https://doi.org/10.1186/s12916-018-1116-5>

Turner, M. M., Ford, L., Somerville, V., Javellana, D., Day, K. R., & Lapinski, M. K. (2020).

The use of stigmatizing messaging in anti-obesity communications campaigns:

Quantification of obesity stigmatization. *Communication Reports*, 33(3), 107–120.

<https://doi.org/10.1080/08934215.2020.1793375>

Tylka, T. L., Annunziato, R. A., Burgard, D., Daníelsdóttir, S., Shuman, E., Davis, C., &

Calogero, R. M. (2014). The weight-inclusive versus weight-normative approach to

health: Evaluating the evidence for prioritizing well-being overweight loss. *Journal of*

*Obesity*, 983495. <https://doi.org/10.1155/2014/983495>

Vartanian, L. R. (2015). Development and validation of a brief version of the Stigmatizing

Situations Inventory. *Obesity Science & Practice*, 1(2), 119–125.

<https://doi.org/10.1002/osp4.11>

\*Vartanian, L. R., & Novak, S. A. (2011). Internalized societal attitudes moderate the impact of weight stigma on avoidance of exercise. *Obesity*, 19(4), 757–762.

<https://doi.org/10.1038/oby.2010.234>

Vartanian, L. R., Pinkus, R. T., & Smyth, J. M. (2018). Experiences of weight stigma in

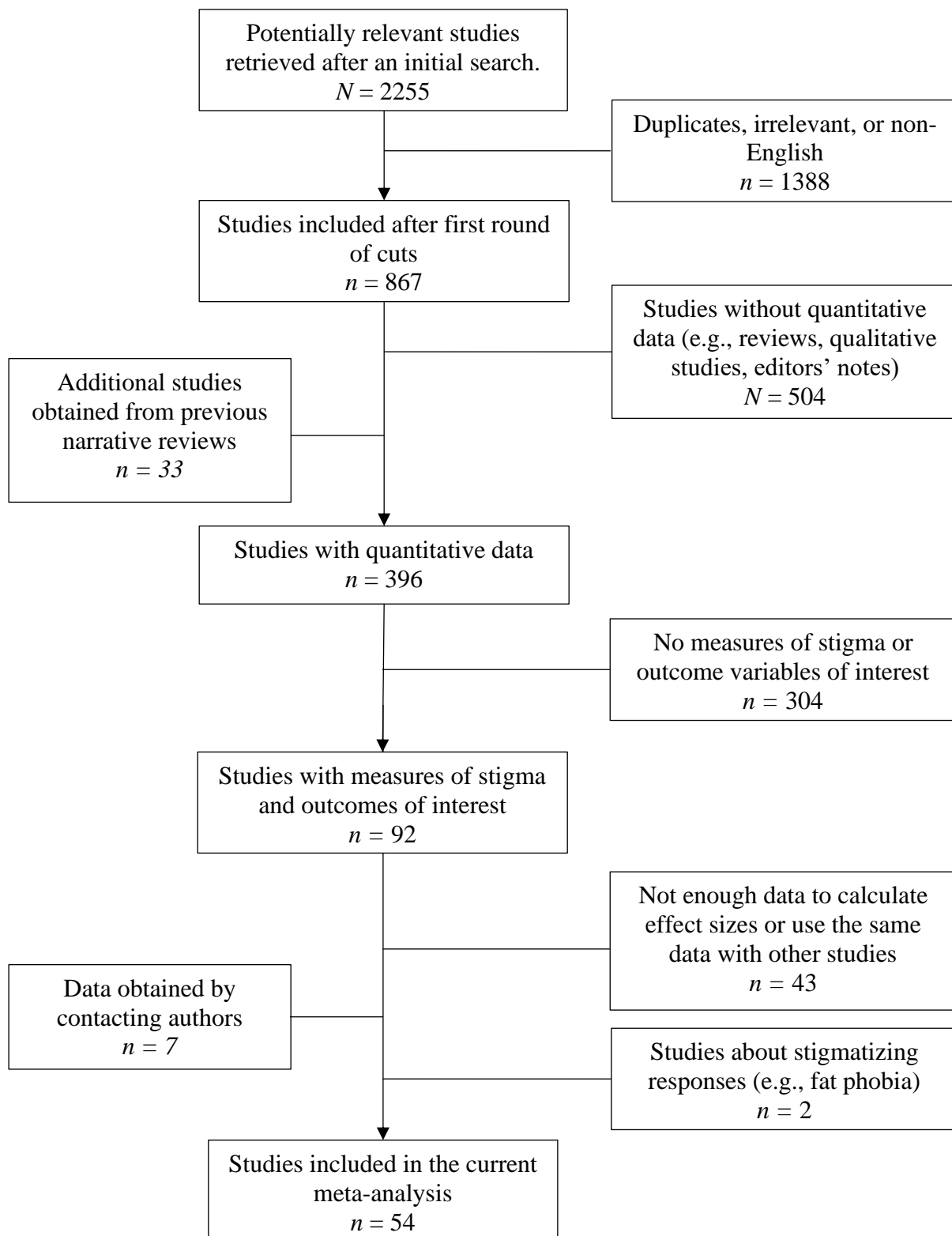
everyday life: Implications for health motivation. *Stigma and Health*, 3(2), 85–92.

<https://doi.org/10.1037/sah0000077>

Vartanian, L. R., & Porter, A. M. (2016). Weight stigma and eating behavior: A review of the

literature. *Appetite*, 102, 3–14. <https://doi.org/10.1016/j.appet.2016.01.034>

- Vartanian, L. R., & Smyth, J. M. (2013). Primum Non Nocere: Obesity stigma and public health. *Journal of Bioethical Inquiry*, 10(1), 49–57. <https://doi.org/10.1007/s11673-012-9412-9>
- Viechtbauer, W. (2010). Conducting meta-analyses in *R* with the metafor package. *Journal of Statistical Software*, 36(3), 1-48. <https://doi.org/10.18637/jss.v036.i03>
- \*Weineland, S., Lillis, J., & Dahl, J. (2013). Measuring experiential avoidance in a bariatric surgery population—Psychometric properties of AAQ-W. *Obesity Research & Clinical Practice*, 7(6), e464–e475. <https://doi.org/10.1016/j.orcp.2012.06.002>
- \*Wott, C. B., & Carels, R. A. (2010). Overt weight stigma, psychological distress and weight loss treatment outcomes. *Journal of Health Psychology*, 15(4), 608–614. <https://doi.org/10.1177/1359105309355339>
- \*Zuba, A., & Warschburger, P. (2017). The role of weight teasing and weight bias internalization in psychological functioning: A prospective study among school-aged children. *European Child & Adolescent Psychiatry*, 26(10), 1245–1255. <https://doi.org/10.1007/s00787-017-0982-2>



**Figure 1.** Summary of selection and inclusion process.

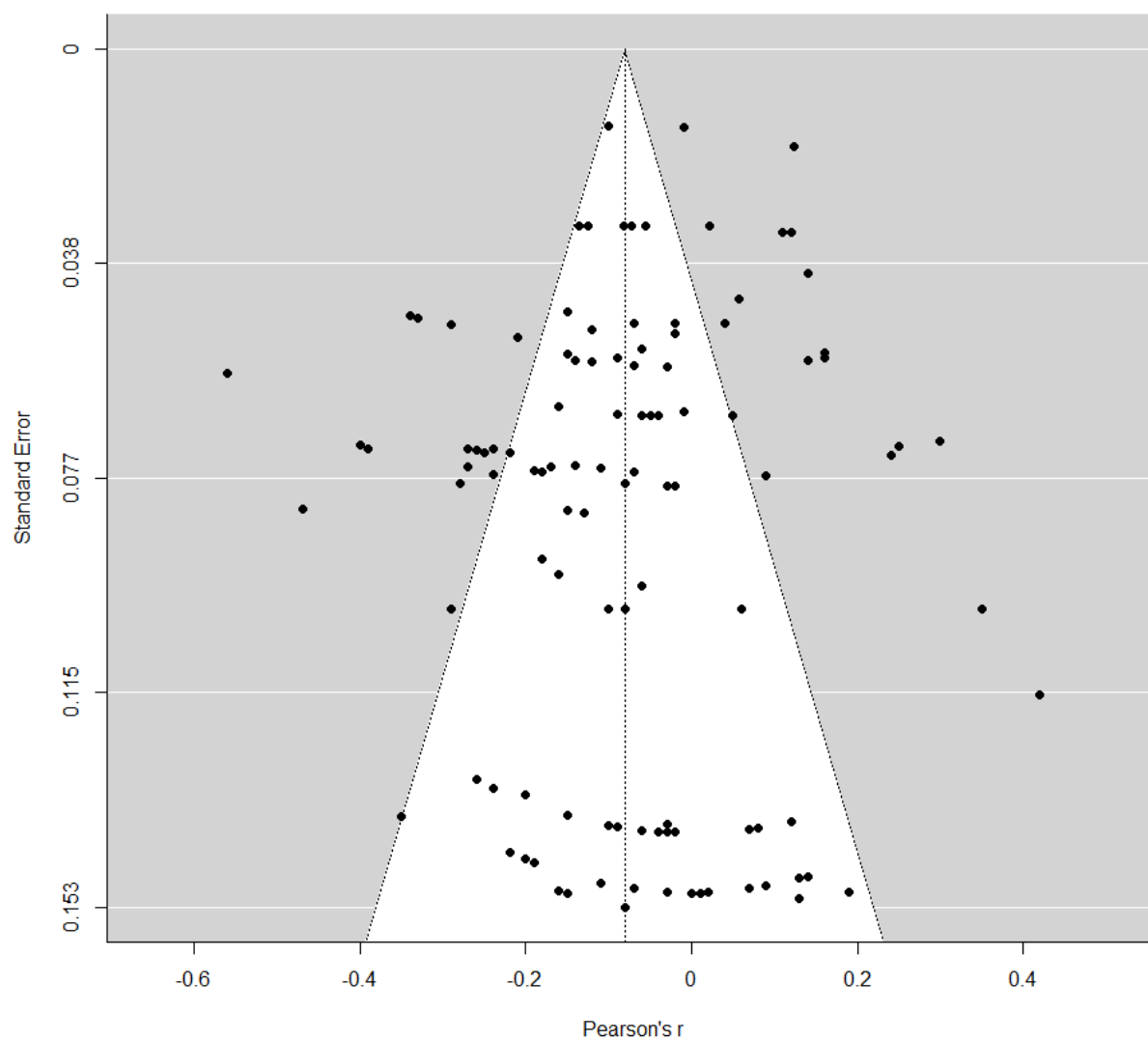
**Table 1.** Study and sample characteristics

NO	1 <sup>st</sup> author	Year	N	CT	<i>M</i> <sub>age</sub>	<i>SD</i> <sub>age</sub>	F%	W%	AA%	HL%	CA	PR	BMI
1	Almenara	2017	111	CA	40.9	10.2					N	N	100% BMI > 30
2	Burmeister	2013	57	US	47.4	13.7	68.4	84.2			N	Y	38.20 (8.10)
3	Burmeister	2014	116	US	45.3	13.5	74	84.3	3.5	6.1	N	Y	38.5 (8.8)
4	Carels	2010	44	US	47.4	11.7	82	89.0			N	Y	37.20 (6.70)
5	Douglas	2016	104	US	19.5	2.9	72.1	70.2	11.5	1.9	N	N	26.05 (6.77)
6	Duarte	2017	2236	UK	41.7	12.3	100				N	Y	35.28 (6.49)
7	Durso	2012	100	US	47.7	8.3	65.0	79.0	14.0	4.0	N	Y	40.58 (6.63)
8	Durso	2012	381	US	H:39.1 L:29.8	H:11.5 L: 9.1	81.7	79.5	3.4	4.6	N	N	57% BMI >=25
9	Essayli	2017	113	US			100	23.0		2.7	N	N	
10	Fung	2019	325	CN	21.6	3.0	61.2				N	N	22.39 (4.03)
11	Gómez-Pérez	2020	383	CL	45.0	8.8	59				N	N	28.05 (4.49)
12	Greenleaf	2014	1419	US	12.4	1.0	55.1	58.8	11.6	26.3	Y	N	21.31 (4.82)
13	Hayden-Wade	2005	70	US	12.3	1.3	70	80.0	4.0	4.0	Y	N	33.1 (6.2)
14	Himmelstein	2018	912	US	40.3	15.6	53.9	64.9	13.0	15.8	N	N	28.66 (6.03)
15	Horenstein	2021	603	US	20.8	4.0	72	60.5	15.4	3.2	N	N	24.70 (5.50)
16	Innamorati	2016	386	IL	P:42.8 I:50.3	P:12.1 I:13.6	76.8				N	Y	P:29.79 (4.62) I:44.82 (8.32)
17	Koball	2016	242	US	65.7	14.4	55.6	98.7			N	N	68% BMI >=25
18	Lambert	2019	172	UK	41.0	14.3	100				N	N	30.2 (8.3)
19	Lessard	2020	17112	US	15.6	1.3	72.3	61.9	5.8	11.4	Y	N	

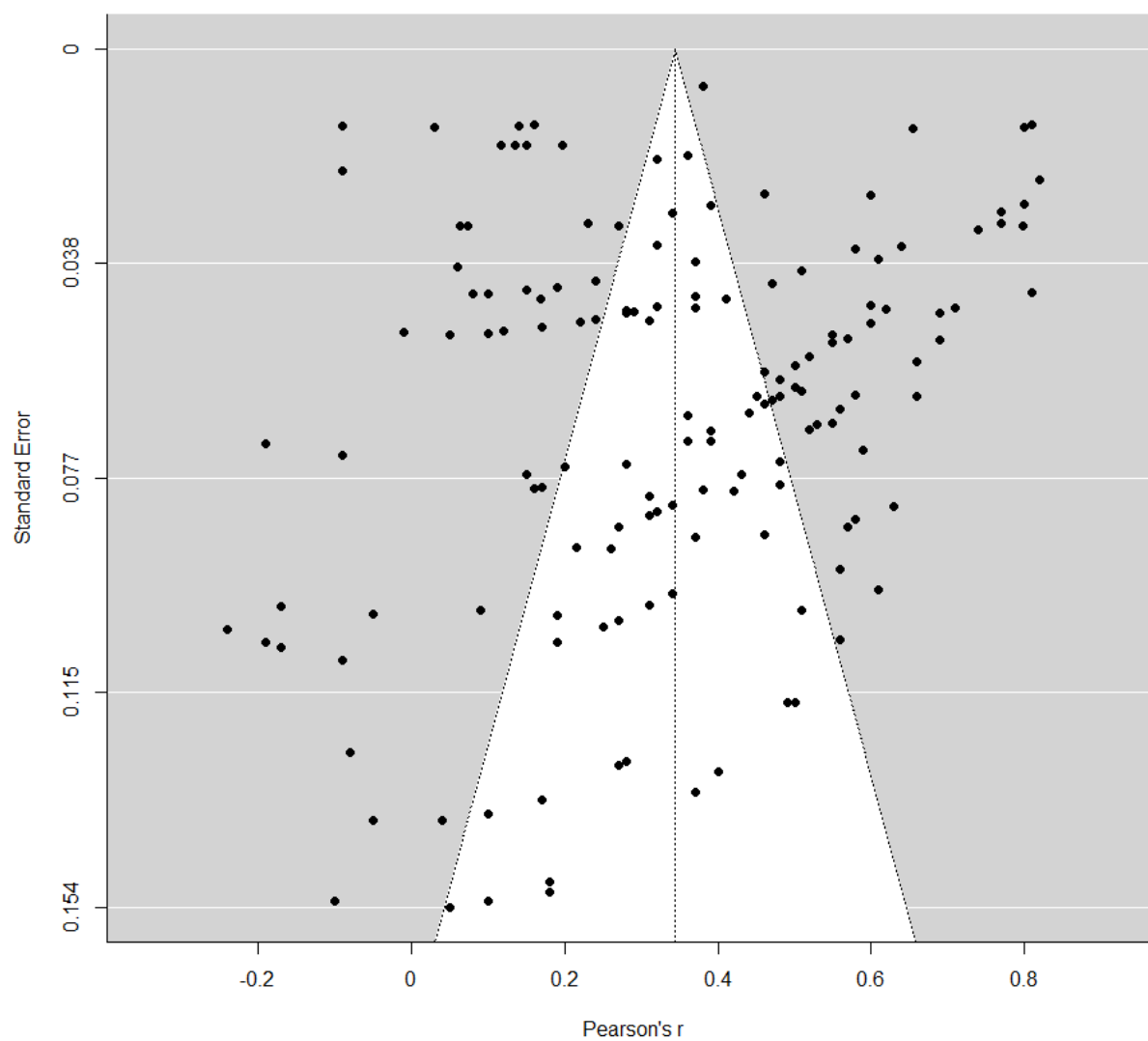
20	Lillis	2010	85	US	43.0	12.2	44	45.0	21.0	20.0	N	Y	30.4 (5.7)
21	Lillis	2020	188	US	55.0	11.0	76				N	Y	35.71 (12.05)
22	Lin	2019	104	CN	22.1	3.0	37.5				N	N	26.98 (3.66)
23	Maïano	2018	144	CA	16.3	0.8	47.9				Y	N	
24	Maïano	2019	156	CA	16.3	0.9	48.1				Y	N	
25	Major	2014	93	US	19.2		100	45.2	3.2	23.7	N	N	35% BMI >= 25
26	Myre	2020	54	CA	44.0	13.0	100				N	N	41 (8.8)
27	Myre	2020	47	CA	48.0	11.0	100				N	Y	45 (8.3)
28	O'Brien	2016	514	AU	19.5	2.3	73.4	60.0	6.0		N	N	20.96 (2.07)
29	O'Brien	2016	117	AU	20.4	5.4	73.4	60.0	6.0		N	N	28.96 (4.65)
30	Olson	2017	44	US	37.9	7.6	71	18.0			N	N	30.50 (2.9)
31	Palmeira	2016	282	PT	44.2	11.3	100				N	N	31.40 (4.53)
32	Palmeira	2017	125	PT	41.1	8.7	100				N	N	34.55 (5.51)
33	Panza	2018	55	US	25.0	9.3	100	54.5	7.3	9.1	N	N	32.42 (4.94)
34	Pearl	2014	148	US	35.6	12.0	50	79.1			N	N	28.97 (7.27)
35	Pearl	2015	177	US	35.5	10.5	100	80.8			N	N	57% BMI >= 30
36	Puhl	2017	314	US	46.1	16.2	54.1	70.1	8.9	13.4	N	Y	57% BMI >= 25
37	Puhl	2017	235	US	37.1	14.3	65.5	62.1	14.5	17.4	N	N	72% BMI >= 25
38	Puhl	2018	148	US	15.9	1.3	50	90.5	2.0	4.7	Y	Y	27.06 (4.39)
39	Puhl	2019	1316	US	48.4	13.8	77.1	89.4	2.9	4.1	N	Y	32.99 (7.49)
40	Puhl	2020	584	US	24.6	2.0	64.2	30.2	16.8	17.1	N	N	28.2
41	Potter	2018	45	US	27.5	9.8	56	74.6	11.1	11.1	N	N	32.06 (6.39)

42	Raves	2016	298	US	52.7	11.9						N	Y	30.54 (6.54)
43	Remmert	2019	85	US	50.3	12.8	82.4	50.6	36.5	3.5		N	Y	34.9 (4.9)
44	Roberto	2012	65	US								Y	N	100% BMI > 35
45	Sattler	2018	439	AU	42.9	8.1	73.6					N	N	32.18 (4.09)
46	Schvey	2013	656	US	37.6	12.4	85.7	78.4	7.9	2.9		N	N	34.28 (7.74)
47	Schvey	2015	197	US	31.6	10.9	89.3	77.2	1.0	3.6		N	N	22.28 (1.89)
48	Schvey	2017	389	US	33.0	11.3	75	53.0	2.1	11.0		N	N	35.59 (7.66)
49	Sevincer	2017	120	TR								N	N	
50	Sienko	2016	172	US	21.2		100	70.3				N	N	29.71
51	Sutin	2016	5129	US	44.6	15.3	50	54.0	19.0	16.0		N	N	63% BMI >= 25
52	Sutin	2020	2955	AU	14.4	0.5	48					Y	N	26% BMI >= 25
53	Tauber	2018	348	US	37.2	11.2	52					N	N	26.78 (6.78)
54	Vartanian	2011	111	US	M:28.5 F:36.6	M:15.9 F:13.8	75.7	71.0				N	N	82% BMI >= 25
55	Weineland	2013	178	SE	41.5	8.9	89.8					N	Y	27.50 (3.20)
56	Wott	2010	55	US	47.4	11.7	81.8	89.0				N	N	37.2 (6.7)
57	Zuba	2017	130	DE	9.04	0.86	49.2					Y	N	
58	Zuba	2017	917	DE	9.04	0.90	52.4					Y	N	

**Notes:** CT = Country, F% = % of female participants, W% = % of White participants, AA% = % of African American participants; HL% = % of Hispanic or Latino participants; CA = Whether or not a sample included children or adolescents; PR = whether or not a sample included participants who used to, are currently involving in, or are seeking weight management programs. BMI = Body Mass Index (kg/m<sup>2</sup>); AU = Australia, CA = Canada, CL = Chile, CN = China, DE = Germany, IL = Italy, PT = Portugal, SE = Sweden, TR = Turkey, UK = the United Kingdom, US = the United States; M = male, F = female, P = outpatients, I = inpatients, H = higher weight participants; L = lower-weight participants.



**Figure 2.** Funnel plot showing the distribution of effect sizes between weight stigma and healthy behaviors



**Figure 3.** Funnel plot showing the distribution of effect sizes between weight stigma and unhealthy behaviors

**Table 2.** Meta-analytical results and subgroup analysis

	Healthy Behaviors					Unhealthy Behaviors				
	$n_{\text{study}}$	$n_{\text{es}}$	$r$	95% CI	$I^2$	$n_{\text{study}}$	$n_{\text{es}}$	$r$	95% CI	$I^2$
<b>Total effect</b>										
Weight stigma	28	114	-.06	[-.12, -.01]	89.59%	49	157	.37	[.31, .43]	97.74%
<b>Moderators</b>										
Stigma type										
Self-stigma	15	47	-.10	[-.16, -.05]	73.91%	33	98	.43	[.36, .51]	95.93%
Stigmatization	22	65	-.04	[-.09, .02]	88.71%	24	55	.29	[.21, .37]	97.55%
Outcome activity										
Dietary	11	30	-.06	[-.18, .05]	90.17%	43	142	.37	[.30, .43]	97.72%
Physical activity	22	80	-.08	[-.14, -.02]	89.37%	8	12	.37	[.18, .56]	96.56%
Outcome type										
Behavioral	24	60	-.06	[-.11, -.01]	88.42%	22	45	.34	[.24, .44]	98.31%
Psychological	13	54	-.11	[-.22, .01]	87.38%	33	112	.39	[.32, .45]	96.11%
Sample BMI										
Higher-weight	12	60	-.10	[-.16, -.04]	69.08%	26	93	.35	[.26, .43]	96.23%
Mixed	16	54	-.05	[-.12, .03]	92.83%	25	64	.38	[.28, .47]	98.36%
Sample age										
Children/Adolescents	4	13	-.09	[-.40, .22]	95.46%	10	29	.38	[.23, .54]	98.08%
Adults	23	98	-.06	[-.12, -.01]	86.37%	39	127	.36	[.29, .43]	97.69%

**Notes:** Pearson correlation coefficients were corrected for attenuation when scale reliabilities were available in the publications. BMI = Body Mass Index (kg/m<sup>2</sup>).

$N_{\text{participant}} = 42,105$ ;  $N_{\text{study}} = 54$ ;  $N_{\text{es}} = 273$

## Supplemental Materials

The following search query was used in **PsychINFO, Communication and Mass Media Complete, Business Source Ultimate, and CINAHL**. The search query was repeated for each database.

*((TI stigma\*) OR (AB stigma\*)) AND ((TI “weight” OR TI “overweight” OR TI “obesity” OR TI “Body Mass Index”) OR (AB “weight” OR AB “overweight” OR AB “obesity” OR AB “Body Mass Index”)) AND ((TI “weight loss” OR TI exercis\* OR TI “weight control” OR TI “physical activity” OR TI “weight gain” OR TI diet\*) OR (AB “weight loss” OR AB exercis\* OR AB “weight control” OR AB “physical activity” OR AB “weight gain” OR AB diet\*))*

The following search query was used in **Web of Science**.

*(TI = stigma\* OR AB = stigma\*) AND (TI = (weight OR overweight OR obesity OR “Body Mass Index”) OR AB = (weight OR overweight OR obesity OR “Body Mass Index”)) AND (TI = (“weight loss” OR exercis\* OR “weight control” OR “physical activity” OR “weight gain” OR diet\*) OR AB = (“weight loss” OR exercis\* OR “weight control” OR “physical activity” OR “weight gain” OR diet\*))*

The following search query was used in **SCOPUS**.

*TITLE-ABS(stigma\*) AND TITLE-ABS(weight OR overweight OR obesity OR “Body Mass Index”) AND TITLE-ABS(“weight loss” OR exercis\* OR “weight control” OR “physical activity” OR “weight gain” OR diet\*)*

The following search query was used in **PUBMED**.

*((stigma\*[Title/Abstract]) AND (weight[Title/Abstract] OR overweight[Title/Abstract] OR obesity[Title/Abstract] OR “Body Mass Index”[Title/Abstract])) AND (weight[Title/Abstract] OR exercis\*[Title/Abstract] OR “weight control”[Title/Abstract] OR “physical activity”[Title/Abstract] OR “weight gain”[Title/Abstract] OR diet\*[Title/Abstract])*

The following search query was used in **EMBASE**.

*stigma\*:ab,ti AND (weight:ab,ti OR overweight:ab,ti OR obesity:ab,ti OR “Body Mass Index”:ab,ti) AND (weight loss:ab,ti OR exercis\*:ab,ti OR “weight control”:ab,ti OR “physical activity”:ab,ti OR “weight gain”:ab,ti OR diet\*:ab,ti)*