Review
CLINICAL TRIALS AND INVESTIGATIONS

Obesity

Correlates of Weight Stigma in Adults with Overweight and Obesity: A Systematic Literature Review

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Objective: While evidence regarding associations between weight stigma and biopsychosocial outcomes is accumulating, outcomes are considered in isolation. Thus, little is known about their complex relationships. This article extends existing work by systematically reviewing the biopsychosocial consequences of stigma in adults with overweight/obesity.

Methods: Articles were identified through Medline, CINAHL, PsycINFO, Embase, Web of Science, and Cochrane databases. Independent extraction of articles was conducted using predefined data fields, including data on biopsychosocial correlates in each study.

Results: Twenty-three studies published from 2001 and addressing correlates of stigma in adults with overweight/obesity (body mass index $\geq$25 kg m^{-2}; 18-65 years) were identified. Numerous biopsychosocial correlates of weight stigma were studied, particularly in treatment-seeking individuals. Available research shows that weight stigma is consistently associated with medication non-adherence, mental health, anxiety, perceived stress, antisocial behavior, substance use, coping strategies, and social support. Biopsychosocial correlates were not considered in combination in research. Psychological correlates were well documented in comparison to biological and social correlates for each weight stigma type. There were some indications that associations are stronger once stigma is internalized.

Conclusions: While there is evidence for biopsychosocial correlates of weight stigma, these are not considered in combination in research; thus their inter-relationships are unknown. Conclusions from the review are limited by this and the small number of studies, types of designs, and variables considered.

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Introduction

Overweight/obesity places individuals at risk for additional health-compromising conditions including biological (e.g., hypertension), psychological (e.g., depression), and social (e.g., social isolation) consequences. The stigma attached to obesity also plays a part in the development and course of adverse biopsychosocial health outcomes and may contribute to the correlates of obesity. Weight stigma is negative attitudes and beliefs directed toward individuals due to weight and is usually expressed though stereotypes (e.g., overweight individuals are lazy), prejudicial attitudes (e.g., negative attitudes from employers), and discriminatory behaviors (e.g., ignoring overweight individuals) (1). It occurs in various settings (e.g., education and healthcare settings), from many sources (e.g., friends and obese individuals themselves) (1).

Two distinct weight stigma constructs are commonly used, experienced weight stigma (i.e., reports of frequent weight stigma experiences), which is often used interchangeably with perceived weight discrimination, and internalized weight stigma (IWS; i.e., acceptance of stereotypes to be true of oneself) (2). These constructs are generally measured using self-report questionnaires such as the Stigmatizing Situations Inventory (SSI) and Weight Bias Internalization Scale (WBIS) or different methodological approaches including qualitative/quantitative interviews, surveys, interviews, experimental manipulations involving vignettes/photographs, field studies, and implicit/explicit attitude tests (3). Although these different approaches focus on different aspects of weight stigma, they generally conceptualize weight stigma as the experience of negative attitudes about individuals with overweight/obesity. For instance, research demonstrates that individuals who are obese are considered to be lazy and unintelligent and to lack self-discipline (1,4). Individuals with overweight/obesity may experience unreasonable judgments formed about weight, but with continued stigmatization, individuals may begin to accept negative attitudes and view themselves as deserving of their devalued body size/shape. This is consistent with Goffman's sociological notion of obesity as a visible and socially discredited stigma (5). Goffman states that obesity stigma

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results in prejudicial stereotypes, attitudes, and discrimination from any person, and the discomfort from social interactions can lead to victims internalizing feelings of shame and inferiority (5). The individual's acceptance of having an undesirable body appearance and its implied negative qualities may lead to impaired social interaction and quality of life in individuals who are obese.

Rising obesity rates in recent decades have been accompanied by an increase in weight stigma prevalence (6,7), with explicit anti-fat attitudes intensifying significantly (8). The most comprehensive study of weight stigma, a US nationally representative adult sample from two waves, 1995-1996 and 2004-2006, demonstrated the prevalence of weight stigma increased by 66% (7). This may be partly due to the rise in obesity prevalence which has nearly doubled worldwide between 1980 (5% for men; 8% for women) and 2008 (10% of men; 14% of women) (6). Additional contributors include obesity prevention social marketing campaigns depicting overweight individuals as lazy and weak-willed, negative public health messages shaming obesity, and the promotion of thin ideals as indicating success and social desirability (9). This may be partly attributed to beliefs that the onset and reversibility of obesity are within the control of the affected person and that an individual's excess weight is due to internal factors (e.g., lack of exercise, poor eating habits) (10). Further, weight stigma is socially acceptable and rarely challenged (1), and this feature makes weight stigma unique among other types of stigma (e.g., sexism, race, disability). Additionally, while there are some benefits to identifying with other stigmatized groups (e.g., race, gender), this is not currently the case for obesity. For instance, research examining the relationship between stigmatization and well-being has suggested that identification with their stigmatized group (e.g., race) can buffer individuals from the adverse effects of stigma (11,12). In contrast, social identification with stigmatized obese groups is not necessarily positive such that obese individuals themselves hold negative anti-fat attitudes (13), suggesting that no protective in-group bias exists. Furthermore, research has shown that weight stigma is more common than other socio-demographic variables such as racial discrimination, ethnicity, sexual orientation, and physical disability (14). This highlights the importance of addressing weight stigma as a public health priority. While the experience of discrimination among different stigmas (e.g., sexism, race, disability) may be associated with similar consequences (e.g., depression), these characteristics are legally protected. Despite support for policy strategies to address weight stigma at a population level (15), legal remedies and social policies are lacking to protect against weight stigma experiences. The main premise behind obesity prevention social marketing campaigns is that stigmatizing obesity and the resultant body dissatisfaction will motivate persons with overweight/obesity to adopt healthy lifestyle behaviors (1). However, weight stigma is actually associated with unhealthy lifestyle behaviors (e.g., binge eating, less exercise motivation) (16) which impairs weight loss attempts and may reinforce additional weight gain and stigma (1). This has serious implications for biopsychosocial health (1).

Numerous biological correlates of weight stigma have been examined in addition to body mass index (BMI) (17-19) including stress-induced pathophysiology including higher levels of cortisol and oxidative stress (20), increased stress perceptions and blood pressure (21), and higher levels of C-reactive protein, a marker of systemic inflammation (22). This is consistent with research on racial discrimination which is linked with physiological consequences such as excess body fat accumulation (23), increased diastolic and systolic blood pressure (24), and elevated ambulatory blood pressure (25).

Research examining psychological (including behavioral) consequences of weight stigma include symptoms of depression and anxiety (16,17), suicidal thoughts and behaviors (26), desire for thinness, body dissatisfaction, bulimic symptoms, and poor self-esteem (27). Adults with obesity tend to react to weight stigma by internalizing negative attitudes, which has been found to be related to poor psychological functioning (28). These associations also occur irrespective of BMI (29), suggesting that the stigmatizing experience itself, rather than body weight alone, may contribute to adverse psychological outcomes.

Examined social correlates of weight stigma include disadvantages in domains of employment, living, education, healthcare, and interpersonal relationships (1). The most frequent sources of weight stigma include family members and health professionals followed by friends and spouses (16). Thus, weight stigma may be associated with poor social support within interpersonal relationships. This is consistent with research indicating that individuals who are overweight report higher levels of relationship strain and lower levels of support from family members compared to thinner individuals (30). Thus, stigmatized individuals are likely to be socially discredited and experience social exclusion, which may compromise health and well-being.

The literature suggests being a target of weight stigma is detrimental to all aspects of health. Given that physical and psychosocial risks already accompany overweight/obesity, additional consequences produced from weight stigma are concerning. Thus, more comprehensive understanding of the correlates of weight stigma is needed. While there are some reviews, including one systematic review (1), of the sources, causes, and consequences of weight stigma (4), they consider weight stigma across the weight spectrum. In contrast, the current review aims to understand stigma in adults with overweight/obesity as they are at most risk of weight stigma and, because of their greater weight, they likely experience more (and perhaps different) stigma than the general population (31). Thus, there is value in considering this group separately. Further, the consequences of weight stigma for treatment-seeking individuals will be reviewed separately from community samples as these groups are qualitatively different. Treatment seeking populations often experience greater distress and psychopathology than community samples due to weight (32). Although some biological, psychological, and social correlates of stigma have been examined, they are typically investigated individually so little is known about their complex relationships. Systematic and comprehensive assessment of all correlates of weight stigma is required to advance understanding and inform prevention and treatment efforts. The aim of this systematic review is to examine the biopsychosocial correlates of stigma in adults with overweight/obesity.

Methods

The current review was conducted and reported consistent with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; see Supporting Information Table S1) (33). Articles were identified through Medline, CINAHL, PsycINFO,

1. (MH "Obesity") or (MH "Overweight")
2. TI (obes* or over-weight or overweight) or AB (obes* or over-weight or overweight)
3. S1 or S2
4. TI excess or AB excess
5. TI adiposity or AB adiposity
6. S4 and S5
7. S3 or S6
8. (MH "Social Stigma") OR (MH "Social Discrimination") OR (MH "Prejudice") OR (MH "Stereotyping") OR (MH "Shame") OR (MH "Bullying")
9. TI (stigma* OR discriminat* OR prejudic* OR stereotyp* OR shame OR bully* OR bias* OR blam* OR teas* OR harassment OR unfair OR victim* OR attitude*) OR AB (stigma* OR discriminat* OR prejudic* OR stereotyp* OR shame OR bully* OR bias* OR blam* OR teas* OR harassment OR unfair OR victim* OR attitude*)
10. S8 OR S9
11. TI unfair OR AB unfair
12. TI treatment OR AB treatment
13. S11 AND S12
14. S10 OR S13
15. S7 AND S14
16. (S7 AND S14) NOT rat* or mice Limiters - Published Date: 20010101-20141231; English Language

Figure 1 Example Medline search strategy.

Embase, Web of Science, and Cochrane electronic databases using combinations of the following keywords, title, and abstract words: obesity, overweight, excess adiposity, stigma, discrimination, prejudice, stereotype, shame, bullying, attribution, bias, blame, teasing, harassment, unfair, victim, attitude, and unfair treatment (see example search in Figure 1; See Supporting Information Table S2 for remaining searches). The literature search was last updated 14 January 2015.

Publication date, language restrictions, and non-animal subjects were applied as automatic limits across databases. Publication date restriction was applied to studies published before 2001, since weight stigma was highly recognized at this time as a major public health issue facing the US (4,34). Conference proceedings, theses, chapters, dissertations, reviews, abstracts, and presentations were excluded from review. The review includes original quantitative papers reporting at least one biological, psychological, or social correlate and some form of weight-related stigma in adults (18-65 years) with overweight or obesity (BMI $\geq$ 25). Studies with children or participants above the age of 65 were excluded from this review, as these populations are qualitatively different from the adult population. As the goal of this review was to examine weight stigma as it occurs in society, experimental studies (including intervention and qualitative papers) which manipulate weight stigma were excluded.

These criteria were used to identify potentially relevant abstracts. If abstracts indicated that the papers may be eligible for inclusion, full papers were obtained and assessed. Papers meeting specified inclusion criteria were included in the quantitative analysis (see Figure 2 for flowchart). Data relating to sample characteristics, setting, measures, correlates, significance levels, and adaptations were extracted (Table 1).

Results

Twenty-three articles addressing weight stigma and biological, psychological, and/or social correlates in adults with overweight/obesity were identified. Eleven studies examined two biological correlates, almost all studies ($n = 22$) examined all eleven psychological correlates, and only one study examined one social correlate associated with weight stigma. Socio-demographic variables were analyzed in seven studies. Results are categorized by community samples and treatment-seeking populations (see Table 1 for results summary of sample characteristics, settings, measures and constructs, correlates, significance levels, and adaptations).

Biological correlates

BMI. **Treatment seeking.** Eight studies assessed the relationship between frequent experiences of weight stigma and BMI in a weight loss treatment-seeking sample. Five found that BMI was positively related to frequent experiences of weight stigma (29,31,36,40,43). Of the three studies which found no such association (18,19,45), two found significant positive associations between specific experiences of stigma (e.g., being stared at) and BMI.

Community sample. No significant association was found between IWS and BMI in the two studies of adults with overweight/obesity recruited from the community (37,41). This suggests that acceptance of negative weight-related stereotypes is not associated with weight.

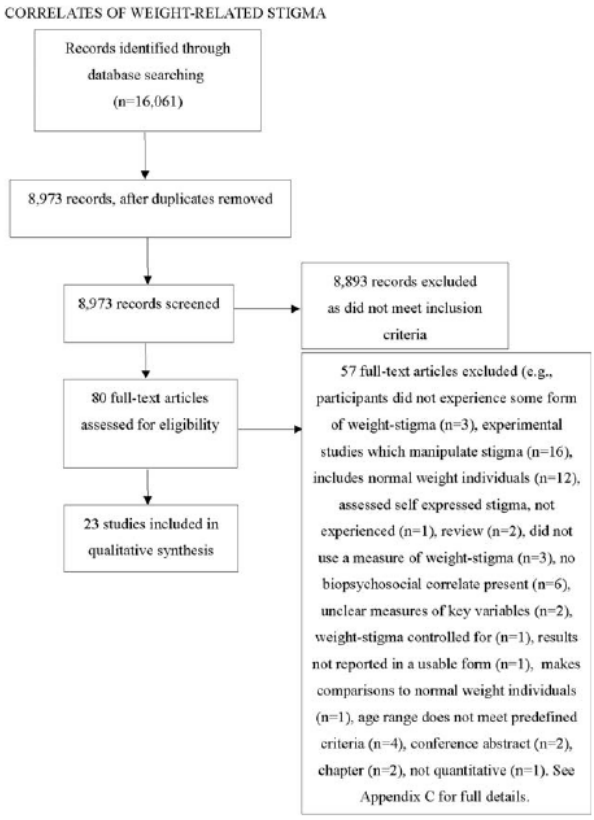

Figure 2 Flowchart of literature search performed. Adapted from ref. 33, "Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement," by D. Moher, A. Liberati, J. Tetzlaff, D.G. Altman, The PRISMA Group, 2009. PLoS Medicine 6, p. e1000097. Copyright 2009 by Moher et al.

TABLE 1 Studies exploring the biopsychosocial correlates of stigma in adults with overweight and obesity

Citation	Sample	Setting/ inclusion criteria	Measure of weight stigma (construct measured)	Biological		Psychological		Social		Socio-demographics		Variables controlled for
				Corre-late(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	
Almeida, Savoy, and Boxer (35)	*N* (clinical sample) = 99 F = 94% Age = 35.44 (8.70) BMI = 33.51 (7.30) Mainly African Americans, USA	Bariatric weight control clinic	Stigmatizing Situations Inventory (SSI): frequency of stigmatizing experiences			Binge eating	*Binge eating:* $b = 1.07$, $P = 0.265$			Gender	*Gender:* $r = 0.04$	
Ashmore, Friedman, Reishmann, and Musante (36)	*N* = 93 F = 69 Age= 53.56 (12.53) BMI = 42.32 (8.67) Mainly Caucasian, USA	Residential weight loss facility	Stigmatizing Situations Inventory (SSI): frequency of stigmatizing experiences	BMI	BMI: $r = 0.29$, $P < 0.01$	Psychological distress Binge eating behavior	Psychological distress: $\beta = \mathbf{0.43}$, $\boldsymbol{P < 0.001}$ Binge eating behavior: $\beta = \mathbf{0.45}$, $\boldsymbol{P < 0.001}$					
Durso and Latner (37)	*N*= 198 F= 164 Age = 30.53 BMI = 33.21 (8.58) Mainly Caucasian, USA	Online questionnaire service	Weight Bias Internalization Scale (WBIS): degree of belief in negative stereotypes	BMI	*BMI:* $r = 0.15$	Self-esteem Drive for thinness Body image concern Mood disturbance (depression, anxiety, stress) Eating disturbance	Self-esteem: $\boldsymbol{sr^2 = -0.67}$, $\boldsymbol{P < 0.01}$*; $\beta = \mathbf{-0.64}$, $\boldsymbol{P < 0.01}$ Drive for thinness: $\boldsymbol{sr^2 = 0.48}$, $\boldsymbol{P < 0.01}$* Body image concern: $\boldsymbol{sr^2 = 0.75}$, $\boldsymbol{P < 0.01}$*; $\beta = \mathbf{0.77}$, $\boldsymbol{P < 0.01}$ Mood disturbance: $\boldsymbol{sr^2 = 0.50}$, $\boldsymbol{P < 0.01}$*; $\beta = \mathbf{0.49}$, $\boldsymbol{P < 0.01}$ Binge eating: 3 months - $\boldsymbol{sr^2 = 0.24}$, $\boldsymbol{P < 0.01}$*; $\beta = \mathbf{0.21}$, $\boldsymbol{P < 0.01}$, 6-months - $\boldsymbol{sr^2 = 0.31}$, $\boldsymbol{P < 0.001}$*; $\beta = \mathbf{0.31}$, $\boldsymbol{P < 0.01}$					BMI*
Durso et al. (28)	*N* = 100 F= 65% Age= 47.65 (8.34) BMI= 40.58 (6.63) Mainly Caucasian, USA	Medical school-based specialty clinic/met full DSM-IV diagnostic criteria for binge eating disorder, eat uncontrollably, motivated to lose weight	Weight Bias Internalization Scale (WBIS): degree of belief in negative stereotypes	BMI	*BMI*	Self-esteem Depression Eating disorder psychopathology	Lower self-esteem: $r = -0.68$, $P < 0.01$ Higher depression: $r = 0.65$, $P < 0.01$ Total eating disorder psychopathology: $r = 0.43$, $P < 0.01$; $\beta = \mathbf{0.45}$, $\boldsymbol{P < 0.01}$ Eating concern: $r = 0.37$, $P < 0.01$; $\beta = \mathbf{0.32}$, $\boldsymbol{P < 0.05}$					

TABLE 1. (continued).

Citation	Sample	Setting/ inclusion criteria	Measure of weight stigma (construct measured)	Biological		Psychological		Social		Socio-demographics		Variables controlled for
				Corre-late(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	
							Shape concern: $r = 0.48$, $P < 0.01$; $\beta =$ **0.49, $P <$ 0.01** Weight concern: $r = 0.37$, $P < 0.01$; $\beta =$ **0.32, $P <$ 0.05** Over-evaluation of weight and shape: $r = 0.53$, $P < 0.01$; $\beta =$ **0.50, $P <$ 0.01** *Eating restraint* *Binge eating frequency*					
Fettich and Chen (38)	$N = 234$ F = 100% Age = African Americans: 42.24 (9.68), Caucasians: 45.73 (11.58) BMI = 49.21 (9.00) Mainly Caucasian, USA	University/seeking bariatric surgery, African American, Caucasian	Stigmatizing Situations Inventory (SSI): frequency of stigmatizing experiences			Depression	Depression: **$R^2 = 16.4\%$, $P <$ 0.001**			Ethnicity	Ethnicity: 16.4% and 25.9% of variance in depression for whites and African Americans, respectively	
Friedman, Ashmore, and Applegate (18)	$N = 94$ F = 69 Age = 47.8 (11.8) BMI = 47.8 (8.0) Mainly Caucasian, USA	University-affiliated weight loss clinic/ seeking weight loss surgery	Stigmatizing Situations Inventory (SSI): frequency of stigmatizing experiences	BMI	BMI (aggregated score of weight stigma): $r = 0.13$, $P = 0.22$	Self-esteem Depression Anxiety Body image disturbance Binge eating disorder	Lower self-esteem: $\beta = -$**0.23**, $P =$ **0.02*** Body image disturbance: $\beta =$ **0.40**, $P <$ **0.0001*** Higher depression: $\beta =$ **0.41**, $P <$ **0.0001*** Phobic anxiety: $\beta =$ **0.45, $P <$ 0.0001*** Anxiety: $\beta =$ **0.35, $P <$ 0.001*** Binge eating: $b =$ **0.29, $P <$ 0.001** ($\chi^2 1 = 5.27$, P = 0.027,odds ratio = 3.3) *Depression diagnosis* *Anxiety diagnosis*					Age* Gender* BMI*
Friedman et al. (31)	$N = 93$ F = 69 Age = F: 54.2 (12.5), M: 51.8 (12.7) BMI = F: 42.4 (9.0), M: 42.1 (7.9) Mainly Caucasian, USA	Residential weight loss facility/seeking weight loss surgery	Stigmatizing Situations Inventory (SSI): frequency of stigmatizing experiences	BMI	BMI: $r = 0.29$, $P < 0.01$	Depression General psychiatric symptoms Body image disturbance Self-esteem	Depression: $r = 0.39$, $P < 0.001$; $\beta =$ **0.41, $P <$ 0.001*** General psychiatric symptoms: $r = 0.43$, $P < 0.001$; $\beta =$ **0.38, $P =$ 0.002***			Age	Age: −0.43, $P < 0.001$	Age* Gender* Age of onset of obesity* BMI*

TABLE 1. (continued).

Citation	Sample	Setting/ inclusion criteria	Measure of weight stigma (construct measured)	Biological		Psychological		Social		Socio-demographics		Variables controlled for
				Corre-late(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	
							Body image disturbance: $r = 0.41$, $P < 0.001$; $\beta = \mathbf{0.43}$, $\boldsymbol{P < 0.001}$* Self-esteem: $r = -0.34$, $P < 0.001$; $\beta = \mathbf{-0.27}$, $\boldsymbol{P = 0.020}$*					
Hatzenbuehler, Keyes, and Hasin (39)	$N = 22{,}231$ F = 43.23 (0.4) Age = 48.2 BMI = 26.6 Mainly Caucasian, USA	Not deported, mentally or physically impaired	Perceived weight discrimination: frequency of discriminating experiences			Perceived stress Current psychopathology	Odds ratios -Perceived stress: 3.21, CI = 2.42-4.26 Psychiatric comorbidity (3 psychiatric diagnoses): 2.41, CI = 1.80-3.24 Depressive disorder: 2.75, CI = 2.25-3.36* Major depressive episode: 2.68, CI = 2.12-3.40* Manic/hypomanic episode: 2.74, CI = 1.98-3.79* Dysthymia: 2.55, CI = 1.32-4.93* Anxiety disorder: 2.92, CI=2.36-3.60* Generalized anxiety disorder: 2.88, CI=1.88-4.40* Social phobia: 3.68, CI = 2.56-5.29* Post-traumatic stress disorder: 2.67, CI = 2.11-3.38* Panic disorder: 3.11, CI=2.13-4.54* Substance disorder: 1.58, CI = 1.24-2.01* Nicotine dependence: 1.49, CI = 1.14-1.94* Alcohol abuse: 0.67, CI = 0.37-1.18* Alcohol dependence: 2.12, CI = 1.38-3.27*	Social support	Social support: odds ratio=0.36, CI=0.16-0.81 Social support with perceived discrimination and psychopathology: interaction not significant	Gender Relationship status Age Income Ethnicity	Odds ratios-Women: 3.15, CI=2.4-4.1 Never married/ widowed/separated/ divorced vs. married: 1.68, 1.60 respectively Age: 0.10, CI=0.1-0.2 Income: 0.53, CI=0.3-0.8 Blacks: 0.67, CI=0.5-0.9; Asians: 0.06, CI= 0.02-0.23; Hispanics: 0.57, CI=0.41-0.78	BMI*

TABLE 1. (continued).

Citation	Sample	Setting/ inclusion criteria	Measure of weight stigma (construct measured)	Biological		Psychological		Social		Socio-demographics		Variables controlled for
				Corre-late(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	
							Drug abuse: 1.92, CI = 0.99-3.72* Drug dependence: 4.18, CI = 1.98-8.84*					
Koball and Carels (40)	*N* = 54 F = 79.6% Age = 47.78 (11.46) BMI = 37.20 (6.73) Mainly Caucasian, USA	University-affiliated weight loss intervention program/seeking weight loss surgery	Stigmatizing Situations Inventory (SSI): frequency of stigmatizing experiences	BMI	BMI: $r = 0.6$, $P < 0.01$	Depression Coping strategies	Depression: $r = 0.39$, $P < 0.001$ Adaptive coping: $r = 0.32$, $P < 0.05$ (t=1.61, $P < 0.05$) Maladaptive coping: $r = 0.68$, $P < 0.001$ ($t = 1.96$, $P = 0.03$)					
Latner, Barile, Durso, and O'Brien (41)	*N* = 81 F = 81 Age = 41.1 (10.92) BMI = 43.40 (15.38) Mainly Caucasian, USA	Online survey	Weight Bias Internalization Scale (WBIS): degree of belief in negative stereotypes	BMI	*BMI*: r=-0.08	Physical and mental health quality of life	Physical health: $r = 0.45$, P= <0.001 ($\beta = -0.21$, SE =0.10, $P < 0.05$) Mental health: $r = 0.61$, $P < 0.001$					
Latner, Durso, and Mond (42)	*N* = 120 F = 67.5% Age = 48.31 (13.32) BMI = 35.09 (7.65) Mainly mixed ethnicity, USA	University-affiliated weight loss treatment program/seeking weight loss surgery	Weight Bias Internalization Scale (WBIS): degree of belief in negative stereotypes			Physical and mental health quality of life	Physical health: r = -0.25, $P < 0.01$; $\beta = -$**0.31, *P* < 0.001*** Mental health: $r = -0.48$, $P < 0.001$; $\beta = -$**0.47, *P* < 0.001***					BMI* Age* Exercise* Medical conditions* Medication use*
Latner, Wilson, Jackson, and Stunkard (43)	*N* = 185 F = 83.7% Age = 55.5 (13.7) BMI = Time of treatment initiation: 33.24 (4.13), Current: 27.74 (3.36) Mainly Caucasian, USA	Main location of the behavioral group treatment program for obesity/must be overweight/obese, no diabetes	Stigmatizing Situations Inventory (SSI): frequency of stigmatizing experiences	BMI-I Weight loss	BMI-I: $r = 0.34$, $P < 0.001$ Greater % weight loss: $\beta =$ **0.25, *P* < 0.001** % weight loss (on completion of program): $r = 0.23$, $P < 0.005$ Maintenance % weight loss (6-month follow-up): $\beta =$ **0.23, *P* < 0.01**	Self-esteem Body image Fear of fat/weight gain	Poor body image/body image disturbance: $r = 0.25$, $P < 0.001$ Fear of fat/weight gain: $r = 0.17$, $P < 0.05$	Self-esteem	*Self-esteem:* $r = 0.01$			
Pearl, Puhl, and Dovidio (44)	*N* = 177 F = 177 Age = 35.48 (10.47) BMI = 32.81 (6.92)	University-affiliated research setting/over-weight, obese	Weight Bias Internalization Scale (WBIS): degree of belief in			Exercise self-efficacy Exercise motivation Exercise behavior	Exercise self-efficacy, WBIS: $r = -0.22$, $P < 0.01$*; $\beta = -$**0.21, *P* < 0.05***; WSE: $r = -0.07$*					BMI*

TABLE 1. (continued).

Citation	Sample	Setting/ inclusion criteria	Measure of weight stigma (construct measured)	Biological		Psychological		Social		Socio-demographics		Variables controlled for
				Corre-late(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	
	Mainly Caucasian and Hispanic, USA		negative stereotypes Weight stigma experiences (WSE): yes/no format				Exercise motivation, WBIS: $r = 0.21$, $P < 0.01$*; $\beta = -$**0.17, $P <$ 0.05***; WSE: $r = -0.11$* *Exercise behavior, WBIS*: $r = -0.10$, $\beta = -$**0.15, $P =$ 0.046*** (F(3, 173) = 10.47, $P < 0.001$; Model $R^2 = 0.15$*); WSE: $r = 0.22$, $P < 0.001$*; $\beta =$ **0.42, $P <$ 0.001***					
Pearl, White, and Grilo (45)	$N = 245$ F = 172 Age= 48.00 (9.89) BMI= 39.49 (5.92) Mainly Caucasian, USA	Medical school-based specialty clinic/seeking weight loss surgery, met DSM-5 diagnostic criteria for binge eating disorder	Weight Bias Internalization Scale (WBIS): degree of belief in negative stereotypes	BMI	*BMI*	Self-esteem Over-evaluation of shape and weight Binge eating frequency	Self-esteem: $r(243) = -0.67$, $P < 0.001$ Over-evaluation of shape and weight: $r(243) = 0.54$, $P < 0.001$ (−0.04,-0.02, $R^2 = 0.53$) *Binge eating frequency*			Gender		Females: *M*=4.79 (*SD*=1.20), Males: *M*=4.29 (*SD*=1.22)
Pearl, White, and Grilo (46)	$N = 255$ F = 182 Age= 47.94 (9.94) BMI= 39.29 (6.03) Mainly Caucasian, USA	Medical school-based specialty clinic/seeking weight loss surgery, met DSM-5 diagnostic criteria for binge eating disorder	Weight Bias Internalization Scale (WBIS): degree of belief in negative stereotypes	BMI	*BMI*	Depression Mental and physical health quality of life Binge eating disorder symptoms	Depression as mediator: Mental health component (vitality: $\beta = -$**1.38*****; Social functioning: $\beta = -$**1.68*****; role-emotional: **=-2.44*****; mental health: $\beta = -$**1.17***) Depression as mediator: Physical health component (Physical functioning: −1.31***; Role-physical: −2.31***; Bodily pain: −1.40***; General health: −0.98***) IWS as mediator: Mental health component: $\beta =$ **−0.53, $P <$ 0.001** (Vitality: −7.50, −4.57; Social functioning: −9.47, −5.28; Role-emotional: −13.45, −7.42; Mental health: −6.40, −3.70) IWS as mediator: *Physical health component*:			Gender		Gender: F(1, 253) 57.74, *P*=0.006, Male *M*=4.29, *SD*=1.22, Female *M*=4.76, *SD*=1.20

TABLE 1. (continued).

Citation	Sample	Setting/ inclusion criteria	Measure of weight stigma (construct measured)	Biological		Psychological		Social		Socio-demographics		Variables controlled for
				Corre-late(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	
							$\beta = -0.08$ (Physical functioning: −7.51, −3.94; Role-physical: −13.03, −7.15; Bodily pain: −8.07, −3.81; General health: −5.83, −2.79) *Binge eating disorder symptoms*					
Puhl, Moss-Racusin, and Schwartz (47)	$N = 1013$ F = 100% Age = 49.33 (13.47) BMI = 37.66 (9.47) Mainly Caucasian, USA	Answered appropriate questions regarding perceptions of whether common weight based stereotypes are true or false	Stigmatizing Situations Inventory (SSI): frequency of stigmatizing experiences Internalization of stereotypes: beliefs about stereotypes being true of oneself	Weight loss strategies	*Weight loss strategies*	Coping responses Self-esteem Depression Binge eating frequency	Refusal to diet: $F(2,394) = 3.49$, $P < 0.05$ Binge eating frequency: $r = 0.11$, $P < 0.05$ Degree of belief of stereotypes to be true/false (i.e., internalized stigma) not related to self-esteem, depression, binge eating disorder status: ns					
Richardson et al. (48)	N =780 F = 70.9% Age = 53.7 (9.9), ≥19 BMI= 210 (52.8) lbs All African American, Alabama, USA	Cooper Green Mercy Hospital/hypertension, primary care patients able to provide consent, not pregnant	Experience of Discrimination Questionnaire (EOD): social situations stigmatized in identified and intensity of discrimination rated	Weight medication non-adherence fits here??		Medication non-adherence Self-efficacy	Medication non-adherence: OR: 1.94, 95% CI: 1.41-2.67* Self-efficacy: 95% CI: 19.0-79.0%					Age* Sex* Income* Education* Weight*
Rosenberger, Henderson, Bell, and Grilo (49)	$N = 174$ F = 75% Age = 42.9 (11.1) BMI= 50.2 (8.2) Mainly Caucasian, USA	Yale Gastrointestinal Surgery Clinic/ considering Roux-en-Y gastric bypass surgery	Childhood Weight, Dieting, and Teasing History Questionnaire: extent to which participants were teased about weight as a child			Eating concerns Self-esteem Depression Body dissatisfaction Internalized shame	Eating concerns: $P = 0.054$* Weight concerns: $P = 0.028$* Shape concerns: $P = 0.017$* Lower self-esteem: $P = 0.044$* Higher depression: $P = 0.009$* Higher body dissatisfaction: $P = 0.038$*					Childhood onset of obesity*

TABLE 1. (continued).

Citation	Sample	Setting/ inclusion criteria	Measure of weight stigma (construct measured)	Biological		Psychological		Social		Socio-demographics		Variables controlled for
				Corre-late(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	
							Internalized shame: $P = 0.003$* *Frequency of binge eating, dietary restraint*					
Sarwer, et al. (19)	$N = 117$ F = 79.49% Age = 46.7 (23.3) BMI = 48.2 (7.5) Mainly Caucasian, USA	University-affiliated hospital/seeking weight loss surgery	Stigmatizing Situations Inventory (SSI): frequency of stigmatizing experiences	BMI	*BMI:* $r = 0.16$, $P = 0.12$	Weight-related quality of life Depression	Depression: $r = 0.26$, $P < 0.05$ Quality of life: $r = 0.41$, $P < 0.05$ Comments from children: $r = 0.36$, $P = 0.00$ Negative assumptions by others: $r = 0.20$, $P = 0.03$ Physical barriers: $r = 0.45$, $P = 0.00$ Being stared at: $r = 43$, $P = 0.00$ Inappropriate comments from doctors: $r = 0.14$, $P = 0.18$ Loved ones being embarrassed by your size: $r = 0.26$, $P = 0.01$ Being physically attacked: $r = 0.07$, $P = 0.48$ Nasty comments from others: $r = 0.19$, $P = 0.04$ *Nasty comments from family:* $r = -0.02$, $P = 0.84$ *Being excluded/avoided/ ignored:* $r = 0.11$, $P = 0.24$ *Job discrimination:* $r = 0.04$, $P = 0.72$					
Savoy, Almeida, and Boxer (50)	N (clinical sample)= 199 F = 93 Age = 35.4 (8.7) BMI = clinical sample: 33.51 (7.30) Mainly African American, USA	Bariatric weight control clinic	Stigmatizing Situations Inventory (SSI): frequency of stigmatizing experiences			Depression Anxiety Antisocial behavior Coping strategies	Depression: $r = 0.51$, $P < .05$ Anxiety: $r = 0.39$, $P < 0.01$ Anti social behavior: $r = 0.21$, $P < 0.05$ Disengagement coping: $r = -0.23$, $P < 0.05$ *Problem-focused coping:* $r = 0.19$ *Emotion-focused coping:* $r = 0.00$			Age Education	Age: r=-0.07 Education: r=0.09	

TABLE 1. (continued).

Citation	Sample	Setting/ inclusion criteria	Measure of weight stigma (construct measured)	Biological		Psychological		Social		Socio-demographics		Variables controlled for
				Corre-late(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	Correlate(s) explored	Correlates (results, sig/non-sig)	
Vartanian and Shaprow (17)	*N* = 100 F = 100% Age = 20.1, 18-25 BMI= ≥25 Mainly Caucasian, USA	Private university	Stigmatizing Situations Inventory (SSI): frequency of stigmatizing experiences			Avoidance motivation	Avoidance motivation: $r = 0.25$, $P = 0.034$					
Womble et al. (51)	*N* = 808 F = 54.95% BMI= Females: 27.36 (6.5), Males: 29.1 (5.9) USA	Binge eating disorder	Perception of Teasing Scale Revised- Weight-Related Teasing Factor			Binge eating	F: $R^2 = 70\%$ *M*: $R^2 = 61\%$; 0.21, $P < 0.05$ (0.16, $P < 0.05$) Path between teasing and binge eating for females: ns					
Wott and Carels (29)	*N* = 55 F = 81.8% Age = 47.4 (11.7), 25-73 BMI= At baseline 37.2 (6.7), 27.4-56.0 Mainly Caucasian, USA	Overweight/obese, non-smokers, free from cardiovascular disease and insulin-dependent diabetes	Stigmatizing Situations Inventory (SSI): frequency of stigmatizing experiences Interpersonal stigma (IPS) Institutional stigma (IS)	BMI Weight loss treatment outcomes	Greater BMI: $r = 0.66$, $P < 0.001$ Weight loss during intervention: $t(45) = -1.5$, $P < 0.05$ Caloric expenditure through physical activity: $t(44) = -2.37$, $P = 0.01$* Daily caloric intake: $t(45) = 1.60$, $P = 0.06$ SSI and IS with weight loss: ns	Depression Binge eating	Greater depression: $r = 0.40$, $P \leq 0.01$ Greater binge eating behavior: $r = 0.24$, $P \leq 0.05$ *Changes in depression* *Changes in binge eating*					BMI*

Note. Where results are not reported, data were not available; data are reported as presented in each article; BMI = body mass index; BMI-I = body mass index class 1; SES = socioeconomic status; CI = confidence interval; ns = not significant; OR = odds ratio; multivariate results shown in boldface; mediation results shown in parentheses; non-significant results shown in italics. Variables controlled for "*".

Weight loss. **Treatment seeking.** The relationship between different types of weight stigma and weight loss was explored in one longitudinal study and two cross-sectional studies. One study examined weight stigma (frequent experiences, institutional stigma, interpersonal stigma) and weight loss treatment outcomes in a behavioral weight loss program (29). Frequent experiences of weight stigma and institutional stigma (e.g., physical barriers such as being unable to fit in airplane seats) were not significantly associated with weight loss and behaviors consistent with weight loss. However, interpersonal stigma (e.g., nasty comments from family) was significantly associated with decreased weight loss and less engagement in behaviors consistent with weight loss (i.e., increased caloric intake and decreased caloric expenditure) during the intervention. One study (47) found that IWS and frequent weight stigma experiences did not predict use of weight loss strategies in individuals receiving weight loss support, while another (43) found that, in individuals undergoing behavioral obesity treatment (of note, 31% of enrolled participants had already met 90% of their weight loss goal at the time of assessment), IWS was significantly correlated with greater percentage weight loss on completion of obesity treatment and at 6-month follow-up. Conclusions are limited as no consistent pattern emerges.

Psychological correlates

Medication non-adherence. **Treatment seeking.** One study with African American adults with hypertension found that frequent experiences of weight stigma were positively associated with medication non-adherence, and self-efficacy mediated this relationship (48). Conclusions are limited due to the sparse evidence available assessing this relationship.

Overall mental health. **Treatment seeking.** Four cross-sectional studies investigating the relationship between weight stigma and overall mental health used scales providing a global measure of various psychiatric symptoms (e.g., depression/anxiety/stress). Among weight loss treatment seekers, frequent experiences of weight stigma were positively associated with general psychiatric symptoms in one study (31) and psychological distress in another study (36) suggesting that global psychological symptoms may be associated with weight stigma in clinical samples.

Community sample. Two cross-sectional studies with overweight/obese adults from the general population controlled for BMI and found that IWS was correlated with mood disturbance (e.g., higher anxiety) (37), and individuals who reported perceived weight stigma were more likely to have more than three psychiatric diagnoses (e.g., depressive/anxiety/substance disorders) (39). These studies indicate that IWS is associated with mental health, the risk of psychiatric comorbidity is higher among adults with overweight/obesity who perceive weight discrimination, and the extent of overweight/obesity does not influence this.

Anxiety. **Treatment seeking.** The relationship between frequent experiences of weight stigma and self-reported anxiety symptoms was investigated in two cross-sectional studies with treatment-seeking patients (18,50). Significant and positive relationships were found suggesting that increased experiences with weight stigma are associated with higher levels of anxiety symptoms.

Community sample. One study found that perceived weight stigma increased the likelihood of a clinical diagnosis of anxiety (e.g., generalized anxiety disorder), even after controlling for BMI, in adults with overweight/obesity from the general population (39). This suggests that perceived weight discrimination is associated with poor mental health in the general population, and the extent of overweight/obesity does not influence this.

Depression. **Treatment seeking.** Ten studies investigated the relationship between weight stigma and depression. One intervention study (29) found that frequent weight stigma experiences were significantly related to higher depression at baseline but unrelated to change in depressive symptoms following a behavioral program for weight loss. Six cross-sectional studies (18,19,31,38,40,50) found that frequent experience of weight stigma was significantly positively associated with depression, even after controlling for BMI (31), and a clinical diagnosis for depression (18). One study (49) found that bariatric patients reporting childhood history of weight-based teasing had significantly higher depression compared to those who did not, even after controlling for variables (e.g., age onset of obesity).

IWS and its association with depression was investigated in three studies. Two studies sampling obese binge eating disorder (BED) patients found that IWS was significantly associated with higher depression levels (28) and that depression mediated the relationship between IWS and quality of life (45). IWS also mediated the relationship between depression and physical and mental quality of life subscales in the last study. One study (47) found no association with degree of IWS and depression with adults receiving weight loss support. More studies are needed to clarify the relationship between depression and different types of weight stigma as no consistent pattern emerges.

Community sample. One study of adults with overweight/obesity from the general population found that perceived weight discrimination increased the likelihood of being classified with a clinical diagnosis of depression (e.g., major depressive episode), even after controlling for BMI (39). This suggests weight stigma is associated with depression irrespective of weight.

Health-related quality of life. **Treatment seeking.** Three cross-sectional studies investigated the relationship between weight stigma and health-related quality of life in treatment-seeking adults. Sarwer et al. (19) found that frequent weight stigma experiences were significantly associated with poor weight-related quality of life outcomes (e.g., physical functioning) prior to weight loss surgery. Three studies found that IWS was significantly correlated with poor health-related quality of life (41,42,45), while the last study found no association with the physical health quality of life domain. Physical health quality of life also mediated the relationship between BMI and IWS in one study (41). Results suggest that weight stigma may contribute to poor health-related quality of life.

Self-esteem. **Treatment seeking.** Eight cross-sectional studies investigated the relationship between weight stigma and self-esteem. Four studies assessing various types of weight stigma in different samples showed that IWS with obese BED patients (28,45), frequent experiences of weight stigma with weight loss treatment-seeking

individuals (18), and a history of childhood teasing with bariatric surgery patients were negatively associated with self-esteem (even after controlling for variables e.g., age) (31). Two studies (43,47) found no IWS–self-esteem association among adults with overweight/obesity receiving weight loss support. However, limited conclusions can be made as the first study documenting no association used an atypical sample who already met 90% of their weight loss goal at the time of assessment.

Community sample. In the one cross-sectional study assessing self-esteem in a community sample of adults with overweight/obesity, IWS showed negative partial correlations with self-esteem after controlling for BMI (37). This suggests that weight stigma is associated with decreased self-esteem independent of weight.

Perceived stress. **Community sample.** One cross-sectional study found that adults with overweight/obesityin the general population who perceived weight discrimination were more likely to be in the highest quartile of perceived stress (39). More work is needed to examine this relationship as no firm conclusions can be made.

Antisocial behavior. **Treatment seeking.** One cross-sectional study (50) exploring a clinical sample of bariatric patients found a significant and positive association between frequent experiences of weight stigma and antisocial behavior. More work is needed to clarify this relationship due to the limited evidence available.

Adaptive/maladaptive coping. **Treatment seeking.** Coping with weight stigma was investigated in two cross-sectional studies. One study (40) found frequent experiences of weight stigma were related to greater adaptive coping responses (e.g., positive self-talk) and maladaptive coping responses (e.g., isolating oneself), and both coping strategies mediated the relationship between weight stigma and depression. Another study (50) found frequent experiences of weight stigma were negatively related to disengagement coping, but unrelated to problem- and emotion-focused coping, suggesting that poor psychological adjustment may be associated with weight stigma.

Substance use. **Community sample.** One cross-sectional study (39) found that adults with overweight/obesity from the general population who perceived weight discrimination were more likely to have a substance use diagnosis (e.g., nicotine dependence), even when controlling for BMI. Further research is required to confirm this relationship.

Exercise behavior. **Community sample.** Two cross-sectional studies investigated the relationship between weight stigma experiences and exercise behavior in adults with overweight/obesity from the general population. One study (17) found a positive association between frequent experiences of weight stigma and avoidance of (and reduced motivation) to exercise in overweight/obese adults. Another study (44) explored different types of weight stigma (i.e., frequent experiences of weight stigma, IWS) and presented five major findings. Frequent experiences of weight stigma were associated with less engagement in current exercise behavior, but not associated with exercise motivation or confidence in the ability to exercise in the presence of a range of barriers (i.e., exercise self-efficacy). Additionally, IWS was significantly and negatively associated with all exercise variables (i.e., engagement in current exercise behavior, exercise motivation, exercise self-efficacy), suggesting that acceptance of negative weight-based stereotypes is associated with reduced engagement in physical activity, motivation to exercise, and belief in the ability to exercise in the presence of various barriers. Finally, IWS mediated the relationship between weight stigma experiences and current exercise behavior. These five major findings held even after controlling for BMI, suggesting that weight stigma may impair physical activity independent of weight.

Eating disorder psychopathology. Twelve studies investigated the relationship between weight stigma and eating disorder psychopathology (e.g., binge eating, body image disturbance/concern, overevaluation of shape and weight, drive for thinness, fear of fatness/weight gain).

Binge eating. The relationship between weight stigma and binge eating was analyzed with 8 cross-sectional studies and one intervention study.

Treatment seeking. In an intervention study with treatment-seeking individuals, one study (29) found that frequent experiences of weight stigma were related to binge eating at baseline, but unrelated to change in binge eating following a behavioral weight loss program. Frequent experiences of weight stigma were associated with a higher likelihood of having a clinical diagnosis of BED in one study (18) and predicted severity of binge eating symptoms in two treatment-seeking obese samples (18,36). However, two studies with treatment-seeking individuals (35,36), including one that controlled for age, gender, and BMI (36), found no significant association between frequent experiences of weight stigma and binge eating. One study (47) found no association with degree of IWS and binge eating frequency or refusal to diet in adults receiving weight loss support. One study (49) found that bariatric surgery patients reporting a childhood history of teasing did not differ significantly in current frequency of binge eating or dietary restraint from those who did not report such teasing when controlling for childhood onset of obesity. Another study (51) found that an interaction of variables including history of weight teasing predicted binge eating in men and women. However, the path between history of weight teasing to binge eating was only significant for males. More work is needed to clarify the weight stigma–binge-eating relationship as no consistent pattern emerges.

Community sample. IWS was significantly and positively associated with binge eating frequency, after controlling for BMI, in one study of adults with overweight/obesity from the general population (37). This suggests that acceptance of negative weight-based stereotypes may increase maladaptive eating behaviors irrespective of weight.

Body image disturbance/concern. **Treatment seeking.** Three studies in weight loss treatment-seeking samples showed that frequent experiences of weight stigma (18,31,43) were significantly and positively associated with body image disturbance. Durso et al. (28) found that IWS in BED patients was associated with total eating disorder psychopathology (e.g., shape concern) even after controlling for variables such as BMI. Another study (49) showed that clinical patients with a weight-related teasing history had significantly higher eating disorder concerns (e.g., weight concerns), higher body dissatisfaction, and shame even after controlling for childhood

onset of obesity. This suggests that acceptance of negative weight-based stereotypes is associated with body image concerns independent of weight.

Community sample. IWS was associated with body image concern in one study of adults with overweight/obesity from the general population, after controlling for BMI (37). This suggests that acceptance of negative weight-based stereotypes is associated with body image concerns independent of weight.

Drive for thinness. **Community sample.** One cross-sectional study (37) found that IWS was associated with increased drive for thinness, even when controlling for BMI, in adults with overweight/obesity from the general population. This suggests that weight stigma is associated with poor body image independent of weight.

Over-evaluation of shape and weight. **Treatment seeking.** One cross-sectional study (45) of BED patients with overweight/obesity showed that IWS was positively related to over-evaluation of shape and weight, which also mediated the relationship between self-esteem and IWS. This suggests that acceptance of negative weight-based stereotypes is associated with poor body image.

Fear of fatness and weight gain. **Treatment seeking.** One cross-sectional study (43) showed that frequent experiences of weight stigma were positively related to fear of fatness/weight gain. However, limited conclusions can be made as the study used an atypical sample that already achieved significant weight loss at the time of assessment.

Independent effects of stigma on psychological health. **Treatment-seeking.** Six studies found that, after controlling for BMI (among other variables), perceived weight stigma (39), IWS (37,42), and frequent experiences of weight stigma (18,29,31) significantly and independently predicted impairment in a range of psychological symptoms (e.g., depression) in a treatment-seeking population. This suggests that stigmatizing experiences, as opposed to body weight alone, may contribute to adverse psychological outcomes.

Social correlates

Social support. **Community sample.** One study assessing social support (39) found that, in adults with overweight/obesity from the general population, individuals in the highest quartile of social support were less likely to perceive weight discrimination. Moreover, social support did not interact with perceived weight discrimination to predict psychopathology (e.g., major depressive episode), suggesting that social support may not buffer against the adverse effects of perceived weight discrimination on mental health. More work is needed to strengthen the evidence between weight stigma and social factors.

Socio-demographic factors. Seven studies examined socio-demographic variables including gender, age, ethnicity, income, education, and relationship status.

Gender. **Treatment seeking.** Three cross-sectional studies found that among adults with overweight/obesity, perceived weight stigma (39) and IWS (45,46) are more common among women than men, while one study found no association with gender (35). More work is needed to clarify the weight stigma gender relationship as no consistent pattern emerges.

Age. **Treatment seeking.** Three cross-sectional studies exploring age among adults with overweight/obesity showed that frequent experiences with weight stigma are associated with increased age (31) and another study showed that perceived weight stigma is less common among individuals aged above 65 (39) while another found no relationship with age (50). Further research is required to understand this relationship.

Ethnicity. **Treatment seeking.** Two cross-sectional studies exploring ethnicity among adults with overweight/obesity found that frequent experiences with weight stigma account for a larger proportion of variance in depression in African Americans compared to Caucasians (38), and perceived weight stigma is more common among African Americans, Asians, and Hispanics compared to Caucasians (39). Further research is required to confirm this relationship.

Education. **Treatment seeking.** One cross-sectional study exploring education among adults with overweight/obesity (50) showed that frequent experiences with weight stigma are not related to education. Further research is required to confirm this relationship.

Income. **Treatment seeking.** One cross-sectional study assessing income among adults with overweight/obesity showed that perceived weight stigma is more common among those with higher income compared to lower income (39). Further research is required to confirm this relationship.

Relationship status. **Treatment seeking.** One cross-sectional study assessing relationship status among adults with overweight/obesity showed that perceived weight stigma is more common with those never married or widowed/separated/divorced compared to married couples (39). Further research is required to confirm this relationship.

Discussion

The current review aimed to identify the biopsychosocial correlates of weight stigma separately in community and treatment-seeking samples of adults with overweight/obesity. To date most research has considered weight stigma correlates in isolations and results have not been systematically reviewed. Psychological correlates were more thoroughly examined in the literature than biological or social correlates for all types of weight stigma, and existing research typically uses treatment-seeking populations. Available research shows that weight stigma is consistently associated with medication non-adherence, overall mental health, anxiety, perceived stress, anti-social behavior, substance use, use of coping strategies, and social support (see Table 2 for full details).

BMI and weight loss were the only biological correlates of weight stigma examined in the literature and biomedical variables were unexplored in a sample of purely overweight/obese adults. Results were inconsistent in the ten studies examining BMI. These findings

may reflect a threshold effect, such that there is a relationship between weight stigma and BMI at a population level; however, among individuals with overweight/obesity, being heavier is not associated with increased weight stigma. All studies controlling for BMI found that the stigmatizing experience itself was independently associated with negative outcomes. It may be that weight stigma, rather than weight alone, may contribute to the biopsychosocial problems often attributed to overweight/obesity. Thus, if weight stigma is reduced, some of these problems may be reduced. The relationship between weight stigma and weight loss outcomes were mixed, no firm conclusions can be made due to the limited research available.

No studies examined the relationship between weight stigma and cardiovascular health. Meunnig (52) suggests that stress associated with weight stigma may contribute to adverse metabolic health outcomes. It may be that pathophysiology (e.g., inflammation) arises not from adiposity alone, but also from chronic psychological stress, anxiety, and negative mood associated with weight stigma. Indeed, research examining racial discrimination can inform the weight stigma literature. For example, racial discrimination is associated with physiological consequences such as excess body fat accumulation (23), increased diastolic and systolic blood pressure (24), and elevated ambulatory blood pressure (25). Research assessing the relationship between cardiovascular health and weight stigma (20-22) includes an age and BMI range beyond the scope of this review. These studies found that weight stigma experiences may be associated with increased stress perceptions and blood pressure, high levels of C-reactive protein, and increased cortisol and oxidative stress.

Available evidence indicated that weight stigma is associated with psychological correlates including non-adherence with medication, self-esteem, perceived stress, antisocial behavior, substance use and poor exercise behavior. The study examining non-adherence with medication demonstrates that weight stigma may impair health improvements for adults with overweight/obesity. Unfortunately, the one study examining self-esteem, body image disturbance, and fear of fatness/weight gain used an atypical sample who already achieved significant weight loss; thus results may not be generalizable. The general trend between weight stigma and psychological correlates indicates that stigmatizing overweight/obesity is associated with unhealthy lifestyle behaviors (e.g., binge eating, avoidance of exercise), and negative emotional factors (e.g., depression). This is consistent with previous reviews (1) and empirical research (17,27,47) which challenge the social misconceptions that weight stigma motivates weight loss.

Interestingly, among treatment-seeking individuals, weight stigma was not consistently associated with psychiatric symptoms and diagnoses. Research indicates that treatment-seeking individuals tend to be more psychologically distressed than non-treatment-seeking individuals (32). Current findings suggest that greater experiences of weight stigma do not further increase the risk of psychiatric symptoms within this group. It may be that experiences with weight stigma are high for all treatment seekers and associations are not evident due to limited variability within this group.

The studies assessing IWS primarily assessed psychological variables; thus future research should aim to explore its association with a range of biopsychosocial variables. Of the eight studies assessing IWS, five studies used treatment-seeking individuals. It is suggested that IWS may be able to explain why treatment-seeking individuals experience more psychological distress than community samples who are overweight/obese (31). Only one study assessing exercise engagement in a community sample found that the associations with maladaptive exercise behaviors are stronger when weight stigma is internalized than when it is experienced. Whether IWS is associated with poorer biopsychosocial health in comparison to experienced/perceived weight stigma is largely unexplored which future research should test.

Limited inferences can be drawn regarding social correlates of weight stigma. The one study examining social support found that it did not buffer the adverse effects of weight stigma on mental health. Further, available evidence indicates that weight stigma is consistently associated with a range of socio-demographic characteristics including increased age, ethnicity (i.e., less common among Caucasians), higher income, and relationship status (i.e., less common among married couples). Education was found to be unrelated to weight stigma, and research is mixed on its association with gender. However, limited studies assessed these relationships, preventing firm conclusions to be made which future research should address. The low level of consideration given to social correlates is problematic since weight stigma is socialized, and further understanding of social (including socio-demographic) variables may assist in identifying who is most at risk of experiencing the negative impacts of weight stigma on overall health. These findings are in contrast to the importance of social variables highlighted in previous reviews (1,10). Studies have explored the link between weight stigma and social variables by experimentally manipulating weight stigma experiences (53) or assessing variables across different weight spectrums (30). These studies show that individuals rank obese people as less desirable, and overweight/obese individuals report reduced quality of relationships with loved ones (e.g., spouses). Future research exploring the relationship between weight stigma and social variables as it occurs in society is necessary. In addition to biological and psychological factors, weight stigma may remain a social justice issue as long as social factors (e.g., quality of interpersonal relationships, social support) remain unexplored in the literature.

Strengths/limitations of this review

This is the only systematic literature review to integrate the biopsychosical correlates of weight stigma in adults with overweight/obesity. This review highlights the importance of considering various biopsychosocial variables, not body weight alone, in the comprehensive assessment and treatment of overweight/obesity. Analyzing treatment-seeking and community samples separately is a particular strength of this review as there are qualitative differences in these groups. Furthermore, this review considers different types of weight stigma which is beneficial to improving the understanding about how they distinctly relate to health outcomes. Additional strengths include its comprehensiveness and examination of correlates in their relevant biopsychosocial domains. This facilitated a broad portrait of the current evidence regarding correlates of stigma in adults with overweight/obesity. However, limiting to studies not in English language may overlook important studies which are possibly based on data from Western countries. Also, application of a date range across databases may miss out on potentially important information, though this information was most likely captured in two previously published reviews (1,4). Finally, the data in studies reviewed were insufficient to conduct a meta-analysis, limiting the ability to further integrate information for the present review.

TABLE 2 Summary of key findings in existing weight stigma research

	Weight stigma experience/perception		Weight stigma internalization	
	Treatment seeking	Community sample	Treatment seeking	Community sample
Biological correlates				
BMI	○	-	-	●
Weight loss	○	-	○	-
Medication non-adherence	●	-	-	-
Biomedical variables (e.g., cortisol, oxidative stress, c-reactive protein, high blood pressure, inflammation)	-	-	-	-
Sleep patterns (e.g., sleep apnea, sleep disturbance)	-	-	-	-
Independent effect of weight stigma on biological health	-	-	-	-
Psychological correlates				
Overall mental health/global psychological status (e.g., global measures of depression, anxiety, self-esteem)	●	●	-	●
Anxiety	●	●	-	-
Depression	○	●	○	-
Health-related quality of life	●	-	○	-
Self-esteem	●	-	○	●
Perceived stress	-	●	-	-
Anti social behavior	●	-	-	-
Use of adaptive/maladaptive coping strategies	●	-	-	-
Substance use	-	●	-	-
Exercise behavior	-	○	-	○
Eating disorder psychopathology (e.g., binge eating, body image disturbance/concern, drive for thinness, over-evaluation of weight and shape, fear of fatness and weight gain)	○	●	●	●
Psychological pain	-	-	-	-
Somatic symptoms	-	-	-	-
Independent effect of weight stigma on psychological health	●	-	-	●
Social correlates				
Social support	●	-	-	-
Gender	○	-	●	-
Age	○	-	-	-
Ethnicity	●	-	-	-
Education	●	-	-	-
Income	●	-	-	-
Relationship status	●	-	-	-
Socioeconomic disadvantage (including income, education, employment, living conditions)	-	-	-	-
Interpersonal relationship quality	-	-	-	-
Engagement in social activities/events	-	-	-	-
Independent effect of weight stigma on social health	-	-	-	-

Note. •consistent evidence provided, ○not consistently related, - not explored in the literature.

Strengths/limitations of studies reviewed

The general consistency in tools used to measure weight stigma (including the SSI and WBIS) is a strength of this field, facilitating comparisons across studies. However, some studies created new questionnaires or single-item questions that had not been psychometrically tested to explore key variables. The use of poorly measured variables constrains evaluation of the extent to which weight stigma contributes to negative health outcomes; thus psychometrically sound measures should be used in future studies. Considerable variability exists in terms to describe weight stigma (e.g., weight discrimination, obesity bias). This highlights the need to eliminate the inconsistent use of terminology in the weight stigma literature and

perhaps develop a scale incorporating the different constructs currently considered to be indicative of weight stigma (e.g., experienced, perceived weight stigma). That evidence of specific biopsychosocial correlates of weight stigma is based on few studies; this prevents integration of results and the ability to draw firm conclusions.

Seventeen studies reviewed treatment-seeking individuals whereas only six used community samples in assessing the relationship between biopsychosocial correlates and weight stigma. While this allows for more thorough evaluation of weight stigma in treatment seekers, who are most likely to be suffering from weight stigma and its consequences (32), little is known about these relationships in community samples. Additionally, the studies reviewed were primarily correlational and cross-sectional designs, limiting the ability to make causal inferences which longitudinal research can address. Of the six studies assessing potential mediating variables, only two assessed IWS as a potential mediator in the relationship between key variables. More studies should examine different types of stigma (i.e., experienced, internalized) as a proximal and distal mediator between key variables. Finally, studies did not report confidence intervals which are becoming recognized as important scientific practice (54).

Conclusion

This is the first review to consider a combination of biological, psychological, and social correlates of weight stigma in adults with overweight/obesity. Psychological correlates are more frequently examined in comparison to biological and social correlates for each type of weight stigma (i.e., experienced, internalized). This highlights the need for greater consideration of underrepresented domains. This will further the understanding about what relates to weight stigma, and consideration of correlates in combination will facilitate better understanding of their complex relationships. Available research shows that weight stigma is consistently related to medication non-adherence, overall mental health, anxiety, perceived stress, antisocial behavior, substance use, use of coping strategies, and social support. There is some indication that associations are stronger when weight stigma is internalized. Studies primarily sampled treatment seekers; thus less is known about these relationships in non-treatment-seeking samples. These findings have broader implications for understanding the health consequences often associated with overweight/obesity. Some associations between weight stigma and biopsychosocial outcomes occur independent of BMI. Research often documents a direct link between overweight/obesity and poor health outcomes (55), and this review suggests that weight stigma may be a potential mechanism linking overweight/obesity to poor health outcomes.

The significant gaps identified in the weight stigma literature may be filled by conceptualizing research according to a three-stage generational model proposed by Friedman and Brownell (56). First, research should establish differences in the biopsychosocial consequences associated with weight stigma between overweight/obese individuals and non-overweight/obese individuals. A second generation of studies should identify who is likely to suffer and in what ways. A third generation of studies may specify cause and effect relationships longitudinally and examine whether weight stigma is the mechanism linking overweight/obesity to poor biopsychosocial outcomes.

Understanding biopsychosocial correlates of weight stigma in overweight/obese adults is essential given the biopsychosocial consequences associated with overweight/obesity, and the possible role that weight stigma plays in the development and/or maintenance of these comorbidities. Our findings represent new knowledge about the biopsychosocial consequences of weight stigma in adults with overweight/obesity while highlighting the need for further study of these consequences to reduce weight stigma.O

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