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Weight Bias/Health

Weight bias internalization and health: a systematic review

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Summary

A robust literature has documented the negative health effects of being the target of weight bias. Weight bias internalization (WBI) occurs when individuals apply negative weight stereotypes to themselves and self-derogate because of their body weight. Compared with experiences of weight bias, less is known about the relationship between WBI and mental and physical health, although more literature on this topic has emerged in recent years. The current systematic review identified 74 studies assessing the relationship between WBI and health and interventions designed to reduce WBI and improve health. Over half of identified studies were published from 2016 to 2017. Results showed strong, negative relationships between WBI and mental health outcomes. Fewer studies have examined the relationship between WBI and physical health, and results were less consistent. Key directions for future research are highlighted, including the need for prospective and experimental studies with greater sample diversity.

Keywords: Health, obesity, stigma, weight bias internalization.

Introduction

Weight bias refers to negative attitudes directed toward individuals who are perceived to have excess body weight. These prejudicial attitudes are rooted in negative stereotypes, including views that people with obesity are lazy, incompetent and lack willpower (1). Weight bias can lead to overt forms of unfair treatment (i.e. discrimination) in employment, education and health care, as well as stigma in interpersonal relationships and the mass media (2). Thus, individuals with obesity are vulnerable to social stigma – or societal devaluation and derogation – due to their weight in an array of settings and from multiple sources. Several systematic reviews and meta-analyses have described the prevalence and negative health consequences of experiencing weight discrimination and stigma (3–6).

The internalization of negative weight stereotypes and subsequent self-disparagement – known as *weight bias internalization* (WBI) or self-directed weight stigma (7) – has received less empirical attention than weight bias and stigma as expressed and enacted by others (8). Internalized stigma is broadly defined as (i) awareness of negative stereotypes about one's social identity; (ii) agreement with these stereotypes; (iii) application of these stereotypes to oneself; and (iv) self-devaluation due to one's social identity (9). Recent estimates suggest that 40% of US adults with overweight and obesity have internalized weight bias, and 20% show high levels of WBI (10). Considering that two thirds of US adults (11) and one third of youth (12) have overweight/obesity, the pervasiveness of WBI is striking.

Prior research on other stigmatized social identities (due to mental illness, sexual orientation and race) suggests that internalized stigma is associated with negative mental and physical health outcomes (13–15). To date, no systematic review has been conducted to comprehensively synthesize and evaluate the evidence on WBI and health. To address this gap, we critically reviewed existing literature examining the relationship between WBI and mental and physical health, as well as interventions to reduce WBI and improve health. In addition, our review identifies limitations of prior research and highlights key research needs that can inform priorities for future studies.

Methods

Data collection and synthesis for this literature review were conducted in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for systematic reviews (16).

Eligibility criteria

Studies were required to include at least one measure of WBI and at least one measure of mental or physical health. Measures of WBI were required to adequately assess the construct as defined earlier; measures that only assessed one aspect of WBI (e.g. stereotype awareness or agreement) were excluded. Other inclusion criteria included: published in a peer-reviewed journal; written in English; and included quantitative analysis of the relationship between WBI and health. Review papers, conceptual and commentary pieces, and qualitative studies were excluded. Abstracts from conference proceedings, dissertations/theses and chapters were also excluded from this review.

Search strategy

Five electronic databases (PubMed, SCOPUS, ScienceDirect, EMBASE and PsycInfo) were searched in November 2017. Searches were conducted to include articles with any of the following terms in the title, abstract or keywords: weight bias internalization; weight bias internalisation; internalized weight bias; internalised weight bias; internalized weight stigma; internalised weight stigma; self-directed weight stigma; self-directed weight bias; weight self-stigma.

Study selection

Duplicate studies were removed before screening titles and abstracts for exclusion/inclusion criteria. As depicted in Fig. 1, initial screening eliminated review/conceptual/commentary papers, papers not published in English, papers that were not related to weight or weight bias and publications that were not full-text articles (e.g. abstracts only). More thorough screening was used for the remaining articles to further exclude papers that did not include quantitative analyses of measures of WBI and health. Additional articles identified during the course of screening the selected studies were also included.

Data abstraction and synthesis

We extracted the following data across all studies: country of origin; sample size, type (e.g. community versus clinical) and demographic characteristics; study design; study measures; and main study outcomes. Studies were divided into four categories: (i) WBI and adult mental health outcomes; (ii) WBI and adult physical health outcomes; (iii) studies of WBI in youth; and (iv) interventions to reduce WBI.

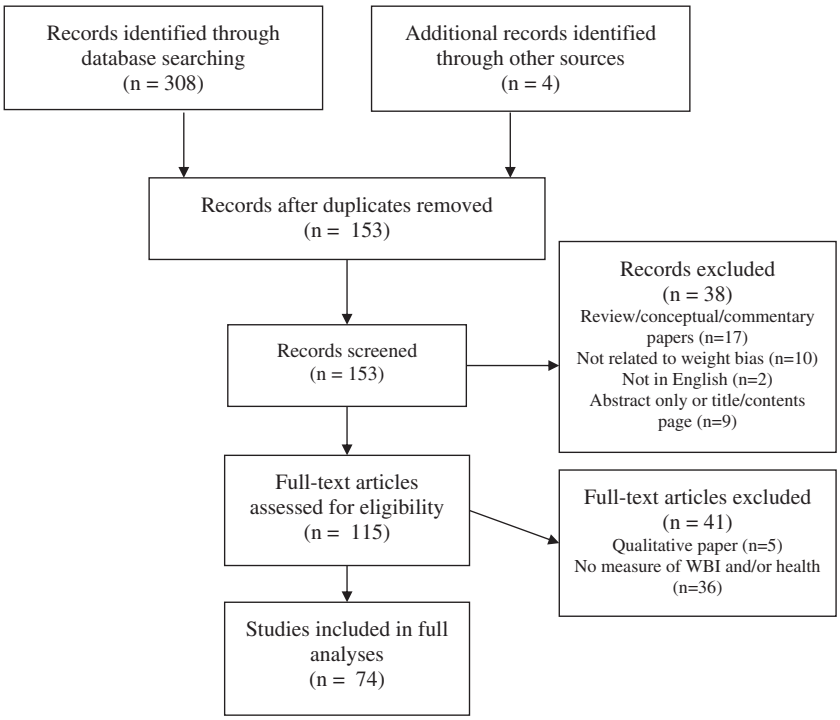

Figure 1 Flow diagram for study selection. WBI, weight bias internalization.

Descriptive statistics were computed for the number of studies published per year, basic characteristics of the studies, measures included in the studies and main findings regarding WBI and health. Effect sizes (e.g. *r* values from correlations) and other relevant statistical coefficients (e.g. *p* values) were abstracted for key findings.

Quality assessment

A priori sources of bias were identified based on criteria from established quality assessment checklists (17,18). However, due to the limited number of rigorous research designs (e.g. longitudinal or experimental) in the current literature, criteria were modified based on the authors' prior knowledge of research on WBI. Quality assessment of studies included in this review addressed the following factors: sample diversity, with respect to race/ethnicity and gender; cross-sectional versus longitudinal study design; observational versus experimental design; self-report versus objective measurement; and validity of the WBI measure.

Results

Figure 1 presents the study selection flow. Across all five databases, 308 studies were identified. Four additional studies were identified during the process of screening the selected studies (e.g. identifying relevant studies in the listed references of articles). After duplicates were removed, 153 titles and abstracts were screened, after which 115 full texts were reviewed for final evaluation of inclusion/exclusion criteria. Forty-one of these studies were excluded for lack of measures assessing WBI and/or health (n = 36), or for being strictly qualitative (n = 5), resulting in 74 studies that comprised the total sample for final analyses.

Characteristics and quality of studies

Figure 2 displays the number of studies published per year. The first study was published in 2008, and the majority of studies (59.5%) were published between 2016 and 2017. Over half (52.7%) of study samples consisted of ≥75% women, and 22.2% did not include men at all. More than one third of samples (37.5%) consisted of ≥75% White participants, and an additional 23.0% of studies did not report race but were conducted in predominantly White countries (e.g. sample comprised 100% German nationality). Thus, over 60% of the study samples were limited in racial and ethnic diversity.

Three quarters (75.7%) of studies were cross-sectional. Most longitudinal or experimental studies reported baseline associations between WBI and health outcomes as well. Therefore, the vast majority of published evidence relies heavily on cross-sectional data. Five studies presented data from behavioural weight loss or healthy eating trials

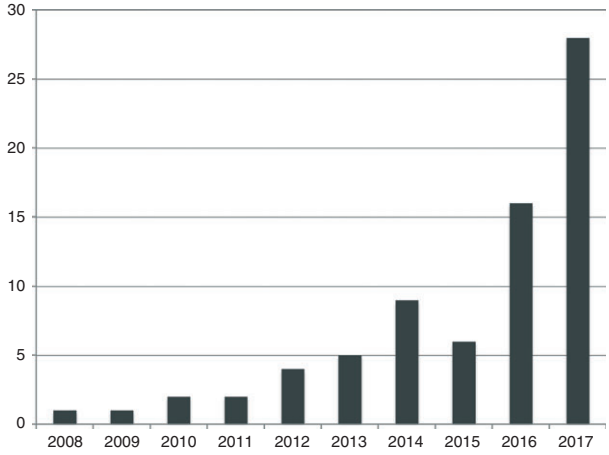

Figure 2 Number of published studies on weight bias internalization and health per year.

(19–23), and seven tested interventions targeting WBI with up to 3-month follow-up (24–30). Aside from these intervention trials, only two experimental studies tested the causes and consequences of WBI (31,32). Three additional studies were observational, longitudinal studies (33–35), and one study used ecological momentary assessment to determine the relationship between WBI and health following experiences of weight stigma (36).

Measurement of weight bias internalization and health

To assess WBI, studies predominantly used the Weight Bias Internalization Scale (WBIS; n = 53, 73.6%) or the Weight Self-Stigma Questionnaire (WSSQ; n = 20, 27.0%). One study used the Weight Stigma Questionnaire (an older, one-factor version of the WSSQ), and two used the Acceptance and Action Questionnaire (AAQ) as a measure of WBI (e.g. with use of the weight-related self-stigma subscale) (37,38). Of note, some studies used the AAQ or body image subscale as a process or outcome measure rather than as the core measure of WBI (24,26,39).

Overall, the WBIS and WSSQ showed good psychometric properties and validity. Both scales have been translated into several other languages, including Chinese, German, French, Italian, Iranian, Portuguese and Spanish. Modifications to the WBIS have been made in order to administer the scale to persons of varying weight statuses (WBIS – Modified[M]) (40), and both scales have been validated for use with youth (35,41–43). However, some inconsistencies were found with regard to item loadings. Several studies have dropped one or more items to improve the psychometric properties of the WBIS, thus creating variability in the literature with regard to how this scale is used and interpreted. With regard to the WSSQ, a total score

was reported in some studies, whereas others reported separate scores for one or both of the subscales (Self-Devaluation and Fear of Enacted Stigma). In this review, we focused primarily on associations between health outcomes and the total WSSQ score; of the studies that did not provide a total score, we only included those that, at a minimum, reported outcomes associated with the Self-Devaluation subscale.

The vast majority of studies included at least one previously published and/or validated measure of health (versus a measure created for the study). Only 33.8% of studies reported that weight and height were measured objectively. A total of five studies included other objective measures of health, such as accelerometry data (to measure physical activity) (25), blood pressure (24,44), blood glucose (44), cholesterol (29,44), heart rate (36), triglycerides(44) and waist circumference (29,44). Table 1 summarizes all selected studies of WBI and health in adults (excluding studies of youth and interventions to reduce WBI, which are discussed separately below).

Mental health outcomes in adults

The emergence of research on WBI in recent years has included a considerable number of studies that examine links between WBI and mental health outcomes, of which findings suggest that WBI may be detrimental to a range of indices of psychological health. This literature is summarized below focusing on associations between WBI and depression, anxiety, self-esteem, body image, eating disorder psychopathology, other psychological disorders and distress and health-related quality of life (HRQOL).

Depression

Links between depressive symptoms and WBI have been examined in 30 studies (7,19,21,33,37,40,44–67). WBI was significantly and positively associated with depressive symptoms in 28 of the 30 studies; only two did not find a significant association (19,50). Bivariate correlations ranged from $r = 0.24$ to $r = 0.66$, with 25 studies reporting moderate ($r \geq 0.30$) or strong correlations ($r \geq 0.50$). Only one study compared links between depression and two different measures of WBI; among preoperative bariatric patients, both the WBIS and WSSQ were significantly associated with depression, with medium-sized effects for the WSSQ ($\beta = 0.43$, $P < 0.01$) and larger effects for the WBIS ($\beta = 0.52$, $P < 0.001$) (62).

Correlations between WBI and depressive symptoms were present across both community and treatment-seeking samples and among individuals of different body weight categories. It is noteworthy that strong correlations were observed in both lean adults (49) and among individuals with obesity (58,59), suggesting that WBI is present and associated with emotional distress for individuals across diverse body sizes. Importantly, WBI remained significantly associated with depressive symptoms after controlling for body mass index (BMI) (40,49,52,55), and some studies found no relationship between BMI and depression (54,56,60,64). Given other evidence that WBI is associated with having a higher BMI (described in more detail below), these findings suggest a distinction between WBI and depression. While studies generally documented links between WBI and depression for both women and men, several studies observed stronger correlations between these variables for women compared with men (45,46), although other work found that gender did not moderate this relationship (40). However, few of the 30 studies examined gender differences, and more research is needed to determine whether links between WBI and emotional distress differ for women and men.

Anxiety

Eleven studies examining psychosocial correlates of WBI have assessed anxiety (7,21,37,40,54,55,61–64,67). WBI was significantly and positively correlated with symptoms of anxiety in 10 studies; one study of adults enrolled in a behavioural weight loss program did not find a significant association between WBI and anxiety (measured with the Depression Anxiety Stress Scales [DASS] anxiety subscale), despite significant correlations observed between WBI and DASS subscales of depressive symptoms and stress (54). In the remaining 10 studies reporting significant associations, bivariate correlations were weak to moderate, with *r* values ranging from 0.23 to 0.55. Stronger correlations were typically observed when anxiety was measured with the DASS compared with other scales. As with depression, significant correlations between anxiety and WBI were observed in adults of varying weight statuses. In addition, correlations observed between WBI and anxiety have been documented in both community and clinical samples. Importantly, several studies found that WBI predicted anxiety over and beyond the variance accounted for by participants' BMI (7,40). Of note, half of the current studies examining links between WBI and anxiety were conducted outside of North America, in Australia (55), Germany (61,62), Spain (64), Sweden (37) and Turkey (67).

Self-esteem

Self-esteem has been assessed as a correlate of WBI in 11 studies (7,32,40,51,54,59,61,67–70). Across all 11 studies, WBI was significantly correlated with self-esteem, indicating that higher internalization of weight bias was related to lower self-esteem. Bivariate correlations were moderate to strong (*r* values ranged from −0.40 to −0.68) in both community and clinical samples of adults with overweight and obesity. WBI was also found to be a significant and independent predictor of self-esteem over and above BMI (7,40,54). One recent experimental study of 260 women with

Table 1 Summary of published studies examining weight bias internalization (WBI) and health among adults

Author (year, country, study design)	Sample size and type	Sample characteristics (gender, race, mean age, mean BMI ± SD)	Measure of WBI	Measure(s) of mental and/or physical health	Main associations between WBI and health
Almenara *et al.* (2017; Canada; cross-sectional)	*N* = 111; clinical – weight loss treatment	100% women; race not reported (French Canadian); 40.9 years; mean BMI not reported (all BMIs ≥30 kg m^{-2})	WSSQ Self-Devaluation Subscale (French)	EDE-Q, FNAES, RSE	Lower self-esteem; higher fear of negative appearance evaluation, dietary restraint and shape, weight and eating concerns.
Baldofski *et al.* (2016; Germany; cross-sectional)	*N* = 240; clinical – prebariatric surgery	68% women; race not reported (German); 45.1 years; 48.6 ± 7.5 kg m^{-2}	WBIS-10 item version (German)	BMI, DEBQ, DERS, EAH, EDE-Q, YFAS	Higher levels of eating disorder symptoms, food addiction, emotional eating and eating in the absence of hunger. No association with BMI.
Barber *et al.* (2011; USA; cross-sectional)	*N* = 70; clinical – patients with schizophrenia	59% women; 57% black, 34% white, 7% Hispanic; 45.4 years; 36.8 ± 7.0 kg m^{-2}	WBIS	BDI, MARS, Q-LES-Q-18	Lower QOL and depression. Not associated with attitudes toward medication adherence or BMI.
Becker *et al.* (2017; USA; cross-sectional)	*N* = 503; community – food pantry patrons	77% women; 11.3% White, 64.6% Hispanic, 16.5% Black, mean age not reported (41.6% under age 50 years); BMI not reported	WSSQ	RCFIM	Higher in adults reporting household child hunger.
Boswell and White (2015; USA; cross-sectional)	*N* = 664; online community	88% women; race not reported; 37.7 years; 34.5 ± 7.6 kg m^{-2}	WBIS	BDI, BMI, EDE-Q, QEWP-R	Higher BMI, depression, binge eating and shape/weight concerns. In women only, greater purging, dietary restraint and weight cycling. WBI more strongly associated with depression in women than men and with binge eating in men than women. WBIS in women occurred at lower BMIs than men.
Burmeister and Carels (2014; USA; cross-sectional)	*N* = 116; clinical – weight loss treatment	74% women; 84.3% White, 6.1% Hispanic, 3.5% Black, 3.5% Asian American; 43.5 years; 38.5 ± 8.8 kg m^{-2}	WBIS	BES, BMI, CES-D, MBSRQ, SRHI, television use	Greater binge eating and depression and poorer body image. Not associated with BMI, television use or physical activity.
Burmeister *et al.* (2013; USA; cross-sectional and stepped care trial)	*N* = 57; clinical – weight loss treatment	68% women; race not reported; 47.4 years; 38.2 ± 8.1 kg m^{-2}	WBIS	BES, BMI, CES-D, DEBQ, ESES, MBSRQ, OBCS-Shame, YFAS	Greater symptoms of food addiction, binge eating, depression and body dissatisfaction; less eating self-efficacy. Not correlated with BMI or weight loss after 7 weeks.

(*Continues*)

Table 1 (Continued)

Author (year, country, study design)	Sample size and type	Sample characteristics (gender, race, mean age, mean BMI ± SD)	Measure of WBI	Measure(s) of mental and/or physical health	Main associations between WBI and health
Carels *et al.* (2010; USA; RCT)	*N* = 54; clinical – weight loss treatment	81% women; 89% White; 47.4 years; 37.2 ± 6.7 kg m^{-2}	WBIS	BES, BMI, CES-D, MBSRQ, weight loss	Greater binge eating, BMI and appearance concerns. Not associated with depression or weight loss. WBI decreased significantly over time.
Carels *et al.* (2013; USA; cross-sectional)	*N* = 62; clinical – weight loss treatment	79% women; 85% White; 43.7 years; 38.3 ± 7.7 kg m^{-2}	WBIS	BES, BMI, CES-D, MBSRQ	Greater depression, binge eating and body satisfaction. Not correlated with BMI.
Carels *et al.* (2017; USA; stepped-care trial)	*N* = 53; clinical – weight loss treatment	87% women; 62% White, 34% Black, 4% Asian/Pacific Islander; age not reported (>18 years); BMI not reported (≥27 kg m^{-2})	WBIS	Early weight loss success (i.e. need for stepped care), treatment drop-out	No difference in WBI among participants who needed to be stepped up once, twice or not at all. No difference in WBI between participants who completed the programme versus dropped out.
Douglas and Varnado-Sullivan (2017; USA: cross-sectional)	*N* = 104; undergraduate students	72% women; 70.2% White, 11.5% Black, 12.5% other; 19.5 years; 26.1 ± 6.8 kg m^{-2}	WBIS	DERS, EDDS	Greater disordered eating and emotion dysregulation.
Durso and Latner (2008; USA; cross-sectional)	*N* = 198; online community	83% women; 75.4% White, 14.7 Black, 3.7% Hispanic, 30.5 years; 33.2 ± 8.6 kg m^{-2}	WBIS	BMI, BSQ, DASS, EDDS, EDI, RSE	Initial development of the WBIS. Greater binge eating, depression, anxiety, DFT and body image concerns and lower self-esteem. Not associated with BMI.
Durso *et al.* (2012a; USA; cross-sectional)	*N* = 100; clinical – BED treatment	65% women; 79% White, 14% Black, 4% Hispanic; 47.7 years; 40.6 ± 6.6 kg m^{-2}	WBIS	BDI-II, BMI, EDE, RSE	Greater depression, disordered eating, shape/weight concerns and lower self-esteem. Not associated with BMI or binge eating.
Durso *et al.* (2012b; USA; cross-sectional)	*N* = 486; online community	81.7% women; 79.5% White, 5.3% Asian, 4.6% Hispanic, 39.1 years; 37.7 ± 13.2 kg m^{-2}	WBIS	EDDS, EDI-BD, EES	WBI mediated the relationship between perceived weight discrimination and eating disturbances (including binge frequency, emotional eating, body dissatisfaction, DFT and purging behaviours).
Durso *et al.* (2016; USA; cross-sectional)	*N* = 90; clinical – weight loss treatment	64% women; 33% multi-racial, 24% White, 23% Asian, 10% Native Hawaiian/Pacific Islander; 49.7 years; 35.8 ± 7.9 kg m^{-2}	WBIS-9 item version	BMI, BSQ, DASS, RSE	Greater depression and stress and lower self-esteem and body-esteem. Not associated with anxiety or BMI.

(*Continues*)

Table 1 (Continued)

Author (year, country, study design)	Sample size and type	Sample characteristics (gender, race, mean age, mean BMI ± SD)	Measure of WBI	Measure(s) of mental and/or physical health	Main associations between WBI and health
Eisenberg *et al.* (2017; USA; cross-sectional)	*N* = 229; clinical – weight loss treatment	100% women; 35% White, 65% Black; 35.3 years; 35 ± 7.7 kg m^{-2}	WBIS	Single item assessing family weight history	Lower WBI in white (but not black) women who reported a family weight history of overweight/obesity.
Essayli *et al.* (2017; USA; experimental)	*N* = 113; undergraduate students	100% women; 45.1% Asian, 23% White, 16.8% mixed ethnicity; age not reported; BMI not reported (range 21.5–27.5 kg m^{-2})	WBIS-M	Weight labels, weight status	Assigning a weight label of 'overweight' led to higher WBI, regardless of objective weight status.
Farhangi *et al.* (2017; Iran; cross-sectional)	*N* = 170; community health centre	100% women; Iranian; 31.3 years; 81.2% overweight, 17.1% obesity	WSSQ	GHQ-12, SF-12	Lower mental and physical HRQOL.
Hain *et al.* (2015; Germany; cross-sectional)	*N* = 94; clinical endocrinology patients	66% women; German nationality; mean age not reported (range 21–68 years); 45.4 ± 7.6 kg m^{-2}	WSSQ (German)	BMI, BDI, FDS-20, GHQ-12, IWQOL, SF-12, WEB-SG	Greater depression, shame, guilt and dissociative symptoms and lower HRQOL. Not correlated with BMI but higher among those with BMIs >50.
Hilbert, Braehler *et al.* (2014; German; cross-sectional)	*N* = 1,158; nationally representative	46% women; German nationality; 53.6 years; 80.4% overweight, 19.6% obesity	WBIS (German)	BMI, CSES, EQ-5D, Health Care Utilization Questionnaire, GAD-2, PHQ-2, VAS	Poorer self-evaluation and health status and higher BMI, depression and anxiety. Greater health care utilization when mediated by self-evaluation. BMI predicted higher WBI. Women had higher WBI and anxiety than men.
Hilbert, Baldofski *et al.* (2014; Germany; cross-sectional)	*N* = 1,092; nationally representative	47% women; German nationality; 53.9 years; 28.3 ± 3.7 kg m^{-2}	WBIS (German)	BDI-PC, SSS-8, weight status	Greater depressive symptoms, weight status and severity of somatic symptoms (e.g. stomach aches). Higher WBI in adults with obesity than overweight.
Hilbert *et al.* (2015; Germany; cross-sectional)	*N* = 1,158; nationally representative	46% women; German nationality; 53.6 years; 80.4% overweight 19.6% obesity	WBIS (German)	BMI, BDI-PC, EORTC-QLQ-C30, SCS, SSS-8	Higher BMI and depressive and somatic symptoms. Lower self-compassion and QOL.
Himmelstein *et al.* (2017; USA; cross-sectional)	*N* = 956; national online subsample – experienced weight bias	50% women; 64.7% White, 16.4% Hispanic, 13% Black; 44.1 years; 26.7 ± 5.7 kg m^{-2}	WBIS-M, 10-item version	BMI, items developed to assess coping with weight stigma	Higher BMI. Greater coping via avoidance (e.g. of physical activity) disordered eating, eating more and negative emotions.
Hübner *et al.* (2015; Germany; cross-sectional)	*N* = 179; clinical – prebariatric surgery	67.6% women; race not reported (German); 46.6 years; 48.7 ± 7.3 kg m^{-2}	WBIS, 10-item version (German)	IPAQ-SF	Less physical activity. Mediated the relationship between general self-efficacy and moderate to vigorous physical activity.

(*Continues*)

Table 1 (Continued)

Author (year, country, study design)	Sample size and type	Sample characteristics (gender, race, mean age, mean BMI ± SD)	Measure of WBI	Measure(s) of mental and/or physical health	Main associations between WBI and health
Hübner *et al.* (2016; Germany; cross-sectional)	*N* = 78; clinical – prebariatric surgery	55% women; race not reported (German); 41.7 years; 48.9 ± 7.9 kg m^{-2}	WBIS and WSSQ (German)	BMI, GAD-7, IWQOL-Lite (total score and Self-Esteem subscale), MBSRQ, PHQ-9	Greater appearance orientation, depression and anxiety and lower self-esteem and QOL. Neither associated with BMI. Larger effect size with WBIS versus WSSQ. Scales correlated with each other.
Innamorati *et al.* (2017; Italy; cross-sectional)	*N* = 386; clinical – inpatient and outpatient obesity treatment	85% women (inpatient), 66% women (outpatient); Italian nationality; 42.8 and 50.3 years; 29.8 ± 4.9 and 44.8 ± 8.3 kg m^{-2}	WBIS, 9-item version (Italian)	BES, BUT, CES-D, MMPI-2 LSE	Greater binge eating, depression and body image-related concerns, avoidance, compulsive self-monitoring and depersonalization. Lower self-esteem.
Jung *et al.* (2017; Germany; cross-sectional)	*N* = 878; nationally representative	44% women; German nationality; 56.4 years; 34.31 ± 4.0 kg m^{-2}	WBIS (German)	MBSRQ-AS, weight discrepancy	Greater discrepancy between current and desired weight. Greater dissatisfaction with appearance.
Koball *et al.* (2018; USA; cross-sectional)	*N* = 242; community –medical visits not related to weight	56% women; 98.7% White; 65.7 years; 31.1 ± 9.5 kg m^{-2}	WBIS-M	BMI, GL-TEQ, MOS-GA	Higher BMI. WBI associated with trying to lose weight, reporting their doctor discussed weight and weight loss. Less likely to adhere to weight loss recommendations from doctor. No association with physical activity.
Latner *et al.* (2013; USA; cross-sectional)	*N* = 120; clinical – weight loss treatment	67.5% women; 30% White, 20% Asian, 39% mixed ethnicity; 48.3 years; 35.1 ± 7.7 kg m^{-2}	WBIS	SF-12	Poorer mental and physical HRQOL.
Latner *et al.* (2014; USA; cross-sectional)	*N* = 81; online community	100% women; 97.5% White, 2.5%Asian; 41.1 years; 43.4 ± 15.4 kg m^{-2}	WBIS	BMI, SF-36	Not associated with BMI. Poorer mental and physical HRQOL. BMI moderated the effect of WBI on physical HRQOL.
Lee and Dedrick (2016; USA; cross-sectional)	*N* = 243; undergraduate students	100% women, 71% White, 23% Hispanic, 14% Black; 22.6 years; 28.6 kg m^{-2} (range 18.7–60.7)	WBIS	BMI and self-perceived weight status	Acceptable fit of WBIS with one-factor solution when one item excluded. Good psychometric properties with BMI-based and self-perceived weight status.

(*Continues*)

Table 1 (Continued)

Author (year, country, study design)	Sample size and type	Sample characteristics (gender, race, mean age, mean BMI ± SD)	Measure of WBI	Measure(s) of mental and/or physical health	Main associations between WBI and health
Lent *et al.* (2014; USA; longitudinal, observational)	*N* = 170; clinical – bariatric surgery	82% women; 89.5% White, 7.0% Black, 2.0% Hispanic; 45.7 years; 47.8 ± 8.3 kg m^{-2}	WBIS	BDI-II, % weight loss	Greater depressive symptoms. Predicted lower % weight loss 12 months post-operatively.
Lillis *et al.* (2010; USA; cross-sectional)	*N* = 169; community – online and prior weight loss treatment	68% women; 69% White, 12% Black, 8% Asian; 47 years; 31.7 ± 6.6 kg $m-^{2}$	WSSQ	BMI, BSI, GHQ, ORWELL, TFEQ	Initial validation of the WSSQ. Good psychometric properties with two subscales (Fear of Enacted Stigma and Self-Devaluation). Higher BMI. Greater psychopathology, disinhibited eating and hunger. Poorer HRQOL.
Lillis *et al.* (2011; USA; cross-sectional)	*N* = 87; clinical – weight loss treatment	89% women; 91% White, 3% Black, 5% Hispanic; 50 years; 33.1 ± 7.3 kg m^{-2}	WSSQ	ORWELL	Poorer HRQOL. Mediated the relationship between BMI and HRQOL.
Lillis *et al.* (2017; USA; open label trial)	*N* = 188; clinical – online weight loss treatment	76% women; 88% White; 55 years; 35.7 ± 12.1 kg m^{-2}	WSSQ	BMI, EI, PROMIS Depression and Anxiety-Short Forms, % weight loss, treatment engagement	Greater anxiety, depression, disinhibited eating and dietary restraint. Fear of enacted stigma, but not self-devaluation, associated with higher BMI and less weight loss after 3 months. Participants high in weight self-devaluation viewed less online lessons.
Lin and Lee (2017; China; cross-sectional)	*N* = 156; undergraduate students	46% women; 100% Asian; 22.2 years; 27.4 ± 3.2 kg m^{-2}	WSSQ (Chinese)	BMI, MBSRQ	Higher BMI. Poorer appearance evaluation and body satisfaction.
Magallares *et al.* (2017; Spain; cross-sectional)	*N* = 170; clinical – weight loss treatment	35% women; race not reported (Spanish); 47.0 years; 42.8 ± 8.3 kg m^{-2}	WSSQ (Spanish)	BMI, HADS	Higher BMI. Greater depression and anxiety.
Meadows *et al.* (2017; UK; longitudinal)	*N*s = 658 and 614; undergraduate students and online community	90% and 59.8% women; 76% and 58.6% White, 14% and 19.1% Asian, 3% and 5.2% Black; 18.7 and 35.1 years; 22.0 ± 3.9 and 27.9 ± 8.7 kg m^{-2}	WSSQ	Yes/No item assessing food addiction; YFAS	More likely to have self-perceived food addiction in student but not community sample.
Mensinger and Meadows (2017; USA; RCT)	*N* = 80; clinical – weight loss/neutral treatments	100% women; 94% White; 39.6 years; 38.0 ± 3.9 kg m^{-2}	WBIS	Red Lotus QOL Questionnaire (physical activity enjoyment and engagement)	Reductions associated with increased physical activity enjoyment and mediated effects of intervention on physical activity engagement. Only participants with low WBI showed increased physical activity.

(*Continues*)

Table 1 (Continued)

Author (year, country, study design)	Sample size and type	Sample characteristics (gender, race, mean age, mean BMI ± SD)	Measure of WBI	Measure(s) of mental and/or physical health	Main associations between WBI and health
Mensinger *et al.* (2016; USA; RCT)	*N* = 80; clinical – weight loss/neutral treatments	100% women; 94% White; 39.6 years; 38.0 ± 3.9 kg m^{-2}	WBIS	EDE-Q, IES	Only participants with low WBI showed improvements in disordered and intuitive eating. Small reductions in WBI.
O'Brien *et al.* (2016; Australia; cross-sectional)	*N* = 634; undergraduate students	73% women; 60% White, 37% Asian/Pacific Islander; 19.7 years; 22.4 ± 4.1 kg m^{-2}	WBIS	BMI, DASS-21, LOCES-B, TFEQ-R18	Higher BMI. Greater psychological distress, emotional eating and uncontrolled eating. Mediated the relationship between weight stigma experiences and disordered eating.
Palmeira *et al.* (2016; Portugal; cross-sectional)	*N* = 282; community	100% women; race not reported (Portuguese); 44.2 years; 31.4 ± 4.5 kg m^{-2}	AAQW-R, WSSQ (Portuguese)	BES, BMI, ORWELL	Higher BMI. Greater binge eating. Poorer obesity-related HRQOL.
Palmeira *et al.* (2017b; Portugal; cross-sectional)	*N* = 125; clinical – nutrition counselling	100% women; race not reported (Portuguese); 41.1 years; 34.4 ± 5.5 kg m^{-2}	WSSQ (Portuguese)	BES, BMI, FSCRS	Greater binge eating and worse self-image. Not associated with BMI.
Pearl and Dovidio (2015; USA; cross-sectional)	*N* = 237; online community – experienced weight bias	44% women; 85.7% White, 4.6% Black, 4.6% Hispanic; 34.2 years; 33.3 ± 7.6 kg m^{-2}	WBIS-M	BMI, EDI-BD, scale created for exercise motivation/enjoyment	Higher BMI. Lower exercise motivation. Greater body dissatisfaction. No association with exercise intentions.
Pearl and Puhl (2014; USA; cross-sectional)	*N* = 148; online community	50% women; 79.1% White; 35.6 years; 27.9 ± 7.3 kg m^{-2}	WBIS-M	BMI, self-perceived weight status, BSQ, DASS-21, EDDS, EDI- DFT, RSE	Higher BMI and BMI-based and self-perceived weight status. Greater body dissatisfaction, DFT, depression, anxiety and binge eating frequency. Lower self-esteem. Gender moderated effects of WBI on drive for thinness.
Pearl and Puhl (2016; USA; experimental)	*N* = 260; online community	48% women; 83.4% White, 7.3% Black, 4.6% Hispanic; 34.6 years; 33.6 ± 6.0 kg m^{-2}	WBIS	EDI-BD, PANAS-X, RSE	Increased negative emotion. Reduced self-esteem and positive emotion. Increased body dissatisfaction in men only.
Pearl *et al.* (2017; USA; cross-sectional)	*N* = 159; clinical – weight loss treatment	88% women; 67.3% Black, 22.6% White, 5.7% Hispanic; 43.8 years; 41.1 ± 5.9 kg m^{-2}	WBIS	BMI, metabolic syndrome (triglycerides, HDL cholesterol, blood glucose, blood pressure, waist circumference), PHQ-9	Greater depression and odds of meeting criteria for metabolic syndrome. Not associated with age, gender or BMI.

(*Continues*)

Table 1 (Continued)

Author (year, country, study design)	Sample size and type	Sample characteristics (gender, race, mean age, mean BMI ± SD)	Measure of WBI	Measure(s) of mental and/or physical health	Main associations between WBI and health
Pearl *et al.* (2015; USA; cross-sectional)	*N* = 177; online community	100% women; 80.8% White; 35.5 years; 32.8 ± 6.9 kg m^{-2}	WBIS-M	BMI, GL-TEQ, SEES	Higher BMI. Lower exercise self-efficacy, motivation and behaviour. Did not moderate the relationship between experiences of weight stigma and exercise. Mediated the relationship between experiences and exercise.
Pearl *et al.* (2014a; USA; cross-sectional)	*N* = 245; clinical – BED and weight loss treatment	70% women; 80.8% White; 48.0 years; 39.5 ± 5.9 kg m^{-2}	WBIS	EDE, RSE	Greater overvaluation of weight/shape. Lower self-esteem. Overvaluation of weight/shape mediated relationship between self-esteem and WBI.
Pearl *et al.* (2014b; USA; cross-sectional)	*N* = 255; clinical – BED and weight loss treatment	74% women; 80.8% White; 47.9 years; 39.3 ± 6.0 kg m^{-2}	WBIS	BDI-II, BMI, EDE, SF-36	Depressive symptoms mediated the relationship between WBI and mental and physical HRQOL. Not associated with BMI or BED symptom severity.
Puhl, Himmelstein *et al.* (2018; USA; cross-sectional)	*N* = 3,504; national online panel and weight advocacy group members	56% women; 69.6% White, 12.4% Hispanic, 10.7% Black; 44.0 years; 28.1 ± 7.3 kg m^{-2}	WBIS-M, 10-item version	BMI, current attempts to lose/maintain weight, one item on dieting behaviour, self-perceived weight status	Higher BMI and self-perceived weight status. More dieting and attempts to lose weight. Approximately 40% of US adults internalized weight bias, and 20% to a high degree.
Puhl, Quinn *et al.* (2017; USA; cross-sectional)	*N* = 549; national online panel of adults who had lost weight in past year	59% women; 66.7% White, 11.3% Black, 15.1% Hispanic; 42.2 years; 27.8 ± 5.5 kg m^{-2}	WBIS-M, 10-item version	GL-TEQ, one item on eating breakfast, PSS-4, two items on dietary monitoring, self-perceived weight status, weight maintainer versus regainer, WHO-QOL Scale-Brief	Lower physical activity, dietary monitoring and physical HRQOL. Greater perceived stress. No association with eating breakfast. Higher self-perceived weight status. More likely to regain versus maintain weight.
Puia *et al.* (2017; Romania; cross-sectional)	*N* = 99; clinical – gastroenterology outpatient centre	71% women; race not reported (Romanian); 48.0 ± 14.7 years; 40.9 ± 6.9 kg m^{-2}	WSSQ (Romanian)	Age of obesity onset; BMI; desire for bariatric surgery	Higher BMI and younger age of onset. No relationship to desire for bariatric surgery.
Raves *et al.* (2016; USA; cross-sectional)	*N* = 300; clinical – post-bariatric surgery	96% men; race not reported (majority White); 53.7 years; 30.5 ± 6.5 kg m^{-2}	WBIS, 8-item version	BMI, DEBS, FFQ-DA, % BMI change (self-reported), PSA	Worse self-reported dietary adherence and greater disordered eating. Not associated with BMI or % BMI change.

(*Continues*)

Table 1 (Continued)

Author (year, country, study design)	Sample size and type	Sample characteristics (gender, race, mean age, mean BMI ± SD)	Measure of WBI	Measure(s) of mental and/or physical health	Main associations between WBI and health
Schvey and White (2015; USA; cross-sectional)	*N* = 197; online community, lean adults	89% women; 77.2% White, 13.7% Asian, 4.1% other; 31.6 years; 22.3 ± 1.9 kg m^{-2}	WBIS	BDI-II, BMI, EDE-Q, QEWP-R	Higher BMI. Greater depression, dietary restraint, eating/shape/weight concern, binge eating and purging.
Schvey *et al.* (2013; USA; cross-sectional)	*N* = 656; online community	85.7% women; 78.4% White, 7.9% Black, 6.9% Hispanic; 37.6 years; 34.3 ± 7.7 kg m^{-2}	WBIS	BDI-II, BMI, EDE-Q, QEWP-R	Higher BMI. Younger age of overweight onset. Greater depression, weight cycling, dietary restraint and weight/shape/eating concern. Greater odds of having binge eating and purging.
Schvey *et al.* (2017; USA; cross-sectional)	*N* = 389; online community with gym memberships	75% women; 53% White, 25% Black, 11% Hispanic; 33.0 years; 35.6 ± 7.7 kg m^{-2}	WBIS-M	BDI-II, BMI, current weight loss behaviours, Coping with Weight Stigma Questionnaire, SF-36, Stigma at the Gym Questionnaire	Higher BMI. Greater stigma at the gym and eating to cope with stigma. Poorer QOL. Not associated with depression or with healthy or unhealthy weight loss behaviours.
Sevincer *et al.* (2017; Turkey; cross-sectional)	*N* = 120; clinical – bariatric surgery	80% women; race not reported (Turkish); 37.7 ± 12.4 years; 46.1 ± 6.1 kg m^{-2}	WSSQ (Turkish)	Alcohol consumption, BAI, BDI, BMI, DEBQ, EDE-Q, IWQOL-Lite, RSE	Higher BMI. Not associated with alcohol consumption. Greater anxiety, depression, binge eating and eating/weight/shape concerns. Poorer self-esteem and quality of life.
Sienko *et al.* (2016; USA; cross-sectional)	*N* = 172; undergraduate students	100% women; 70.3% White; 21.1 years; 29.7 kg m^{-2} (no SD provided)	WBIS	BMI, EDE-Q, PHQ-9	Greater eating restraint, eating/weight/shape concerns and depression. Mediated the relationship between depressive symptoms and disordered eating. Not associated with BMI.
Vartanian *et al.* (2016; Australia; ecological momentary assessment)	*N* = 46; community	52% women; 45.7% White, 47.8% Asian; 28.4 years; 30.5 kg m^{-2} (range 22.3–42.6)	WBIS-M	BMI, resting heart rate, single items on physical activity, dieting, and motivation to lose weight	Higher resting heart rate. Lower motivation to exercise, diet and lose weight following experiences of weight stigma. Not associated with BMI.

(*Continues*)

Table 1 (Continued)

Author (year, country, study design)	Sample size and type	Sample characteristics (gender, race, mean age, mean BMI ± SD)	Measure of WBI	Measure(s) of mental and/or physical health	Main associations between WBI and health
Wang *et al.* (2017; USA; cross-sectional)	*N* = 237; clinical – BED and weight loss treatment	70% women; 77% White, 14% Black; 47.9 years; 39.5 ± 5.9 kg m^{-2}	WBIS	EDE, Ruminative Responses Scale, SCID for DSM-IV-TR	Greater rumination and overvaluation of shape and weight.
Webb and Hardin (2016; USA; cross-sectional)	*N* = 333; undergraduate students	100% women, 63% White, 20.2% Black, 5.9% multi-racial/ethnic; 19.4 years; 23.5 ± 4.9 kg m^{-2}	WBIS-M	BI-AAQ, BISS, BMI, IES-2	Higher BMI. Lower self-compassion, body-related cognitive flexibility and intuitive eating. Greater shame.
Weineland *et al.* (2013; Sweden; cross-sectional)	*N* = 178; clinical – post-bariatric surgery	90% women, race not reported (Swedish); 41.5 years; 27.5 ± 3.2 kg m^{-2}	Self-Stigma subscale of AAQ-W (Swedish)	BMI, BSQ, DASS, EDE-Q, EOQ	Higher BMI. Greater depression, anxiety, eating restraint, eating/shape/weight concerns and emotional overeating.

The term Hispanic is used for brevity and may also include persons of Latino/a and Mexican-American descent. When mean BMI was not reported in selected studies, weight statuses of participants were provided if available.

AAQ, Acceptance and Action Questionnaire; AAQW-R, Acceptance and Action Questionnaire for Weight-Related Difficulties- Revised; AE, appearance evaluation; AS, appearance scale; BD, body dissatisfaction; BDI, Beck Depression Inventory; BED, binge eating disorder; BES, Binge Eating Scale; BI, body image; BISS, Body Image Shame Scale; BMI, body mass index; BSI, Brief Symptoms Inventory; BSQ, Body Shape Questionnaire; BUT, Body Uneasiness Test; CES-D, Center for Epidemiological Studies Depression Scale; CSES, Core Self-Evaluation Scale; DASS, Depression Anxiety Stress Scales; DEBS, Disordered Eating after Bariatric Surgery; DEBQ, Dutch Eating Behaviour Questionnaire; DERS, Difficulty in Emotion Regulation Scale; DFT, drive for thinness; EAH, eating in the absence of hunger; EES, Emotional Eating Scale; EDDS, Eating Disorder Diagnostic Scale; EDE, Eating Disorder Examination; EDI, Eating Disorder Inventory; EI, Eating Inventory; EORTC-QLQ-C30, European Organization for Research and Treatment of Cancer – Quality of Life Questionnaire; EOQ, Emotional Overeating Questionnaire; EQ-5D, EuroQol 5 Dimension; ESES, Eating Self-Efficacy Scale; FDS, Dissociative Experiences Scale (German); FFQ-DA, Food Frequency Questionnaire – Dietary Adherence; FNAES, Fear of Negative Appearance Evaluation Scale; FSCRS, Forms of Self-Criticizing/Attacking & Self-Reassuring Scale; GAD, generalized anxiety disorder; GHQ, General Health Questionnaire; GL-TEQ, Godin Leisure-Time Exercise Questionnaire; HADS, Hospital Anxiety and Depression Scale; HDL, high-density lipoprotein; HRQOL, health-related quality of life; LOCES-B, Loss of Control of Eating Scale - Brief; IES, Intuitive Eating Scale; IPAQ-SF, International Physical Activity Questionnaire – Short-Form; IWQOL, Impact of Weight on Quality of Life; M, modified; MARS, Medication Adherence Report Scale; MBSRQ, Multidimensional Body Self Relations Questionnaire; MMPI-2-LSE, Minnesota Multiphasic Personality Inventory-2 Low Self-Esteem Content Scale; MOS-GA, Medical Outcomes Survey – General Adherence; OBCS, Objectified Body Consciousness Scale; ORWELL, Obesity-Related Well-Being Scale; PANAS-X, Positive Affect Negative Affect Schedule – Expanded version; PC, primary care; PHQ, Patient Health Questionnaire; PROMIS, Patient Reported Outcomes Measurement Information System; PSA, Patient Dietary Success- Self-Assessed; PSS, Perceived Stress Scale; Q, questionnaire; QEWP-R, Questionnaire for Eating and Weight Patterns – Revised; Q-LES-Q, Quality of Life Enjoyment and Life Satisfaction Questionnaire; RCFIM, Radimer Cornell Food Insecurity Measure; RCT, randomized controlled trial; RSE, Rosenberg Self-Esteem Scale; SCID, Structured Clinical Interview for Diagnostic and Statistical Manual; SCS, Self-Compassion Scale; SD, standard deviation; SEES, Self-Efficacy to Exercise Scale; SF, Short Form Health Survey; SRHI, Self-Report Habit Index; SSS, Somatic Symptom Score; T1 and T2, time 1 and time 2; TFEQ, Three-Factor Eating Questionnaire; VAS, Visual Analogue Scale; WBIS, Weight Bias Internalization Scale; WEB-SG, Weight and Body-Related Shame and Guilt; WHO-QOL, World Health Organization Quality of Life Scale; W-R, for Weight-Related Difficulties - Revised; WSQ, Weight Stigma Questionnaire; WSSQ, Weight Self-Stigma Questionnaire; YFAS, Yale Food Addiction Scale.

overweight or obesity demonstrated that self-directed stigma following a hypothetical weight-stigmatizing situation led to lower self-esteem, regardless of BMI (32).

Some research has examined the mediating role of self-esteem in the relationship between WBI and other health indices. For example, a national German study of 1,158 adults found that core self-evaluation fully mediated the relationship between WBI and depression and anxiety (both large effects) (61). These meditational analyses suggest that self-esteem may be a mechanism by which WBI could impair other health outcomes.

Body image

To date, 27 studies have examined the relationship between body image and WBI (7,19,22,25,32,37,39,40,46,49,51,53,54,56–60,62,65–69,71–74). Across studies, body dissatisfaction and body image concerns were consistently and significantly correlated with WBI, indicating that higher levels of WBI were associated with worse body image and increased body dissatisfaction. Of the studies that provided correlations (n = 18), 16 reported strong correlations (r values = 0.51–0.80), and only two studies reported a correlation below r = 0.30 (62,67).

Similar to correlational findings for WBI and depression, the current literature showed that links between WBI and poor body image were present, and strong, for individuals of diverse body sizes. Furthermore, the consistency and strength of these associations were present in clinical samples of adults seeking treatment for weight loss (54,58,59), binge eating disorder (BED) (51,69) or bariatric surgery (37,67), as well as community samples (7,40,46,66). Importantly, the relationship between WBI and body image remained significant even after controlling for variables such as BMI (7,40,46,66), depression(46,51,66) and other psychological measures (51). Studies examining the effects of gender (n = 4) did not find significant differences in correlations between WBI and body image (40,46,54,69), despite higher levels of WBI in women versus men. As an example, in a community sample of adults with overweight and obesity (N = 148), WBI was a significant predictor of body image, and gender did not moderate these results (40).

Disordered eating

Disordered eating has emerged as a common focus of recent literature in the context of WBI. Collectively, 31 studies have examined links between WBI and different aspects of disordered eating, including binge eating (n = 18), other eating disorder pathology or non-normative eating behaviours (n = 22) and symptoms of food addiction (n = 3). Consistently, this literature showed significant and positive associations between WBI and symptoms of eating disorder pathology.

Binge eating. Moderate to strong correlations were consistently reported between WBI and binge eating symptoms (r values = 0.43–0.62) (7,19,38,40,46,48,49,51,56–59,65,69,70,73,75). Only one study reported a correlation of less than r = 0.30 (67). These associations were documented in both community and clinical samples (19,56–59,66,67,70,75). Significant correlations were also reported for links between WBI and frequency of binge eating in the past 3 or 6 months, as well as objective and subjective binge eating episodes (r values = 0.25–0.53) (7,40,46). Two studies of treatment-seeking samples of individuals with obesity and BED did not find significant associations between WBI and BED symptom severity (48,51), although this may be a result of more frequent binge eating in BED samples compared with community or other types of clinical samples.

Importantly, associations between WBI and binge eating remained significant after controlling for BMI and other weight and eating-related psychosocial and behavioural variables (7,40,56,66). While most literature to date has examined these links among individuals with higher body weight, research with non-overweight adults has similarly documented strong associations. For example, in a study of 197 lean adults, Schvey and White (49) found that participants with higher WBIS scores had over two times greater odds of meeting binge eating criteria. These findings persisted after controlling for depression and BMI. Although few studies have assessed gender differences, some work has demonstrated associations between WBI and binge eating in both men and women (46).

Other eating pathology. Studies examining links between WBI and eating disorder pathology (such as dietary restraint, drive for thinness, emotional eating, purging or other maladaptive eating behaviours) have been examined using a variety of validated measures (7,21,22,34,37,40,46,49,51,55,57,60,63,66–68,73,75–77) or survey items created by researchers to assess eating behaviours specifically in response to experiences of weight stigma (50,78). Across these measures, studies have demonstrated significant correlations between WBI and dietary restraint (r values = 0.21–0.50), eating concerns (r values = 0.37–0.64), drive for thinness (r = 0.47) and measures assessing disinhibition, uncontrolled eating and emotional eating (r values = 0.46–0.65). Moderate to strong correlations (r values = 0.29–0.77) were documented for associations between WBI and global or total scores for measures of disordered eating (37,46,49,51,57,60,63,67,77). As with binge eating, measures of eating pathology were associated with WBI in both clinical and community samples and across body weight statuses. In addition, WBI has been found to predict eating pathology

(including purging behaviours) above and beyond measures of depression and self-esteem (51,66).

Several noteworthy findings have emerged in this literature that provide initial insights on the relationship between WBI and eating disorder psychopathology. Two studies found that WBI mediated the relationship between the experience of being stigmatized due to one's weight and disordered eating. In a community sample of 228 adults with overweight and obesity, Durso *et al.* (73) tested the impact of WBIS scores on the relationship between perceived weight discrimination and eating pathology (including binge eating, emotional eating, bulimic symptoms and drive for thinness) and found that WBI mediated this relationship even after controlling for BMI. O'Brien *et al.* (55) found similar results in a sample of 634 undergraduate students, where the relationship between weight stigma experiences and emotional and uncontrolled eating was mediated by WBI. Specifically, participants who reported having experienced weight stigma had greater WBI, which was associated with more psychological distress, which was in turn associated with more maladaptive eating behaviours. These findings align with recent evidence from a nationally representative US sample, which found that individuals with higher WBI were more likely to report coping with experiences of weight stigma by eating (78).

Food addiction. Three studies to date have examined WBI in the context of symptoms of food addiction (34,57,76). These studies have demonstrated significant correlations between WBI and greater food addiction symptoms, as measured by the Yale Food Addiction Scale. For example, a recent German study of 240 pre-bariatric patients found that WBI was associated with higher levels of food addiction and eating disorder pathology with medium-to-large effects (p values < 0.01) (76).

Other psychological disorders and distress

Eleven studies have examined the relationship between WBI and other indices of psychological distress, including emotion regulation (75,76) (such as rumination (65)), perceived stress (79), negative affect,(32) dissociative experiences (53), somatic symptoms (47,52), maladaptive coping with experiences of weight stigma (78) and general psychological distress (63,80). Collectively, this research found that WBI was consistently and significantly associated with increased psychological distress. Moderate correlations were observed between WBI and brooding rumination, emotion dysregulation, dissociative experiences and perceived stress. Weaker correlations were observed for somatic symptoms, although Hilbert *et al.* (52) showed that WBI independently contributed to somatoform symptoms over and above BMI in a community sample (N = 1,092). Experimental research has also demonstrated a significant effect of WBI on affect, leading to greater negative affect ($F = 7.92$, $p < 0.01$) and less positive affect ($F = 4.11$, $p < 0.05$) than the experience of weight stigma from others in an online sample of adults with overweight and obesity (N = 260), regardless of BMI (32). These findings suggest that WBI may be a stronger predictor of psychological distress than experiences of weight stigma alone.

Health-related quality of life

Fifteen studies have examined and demonstrated significant correlations between WBI and both general and weight-specific HRQOL (38,45,47,48,50,53,61–63,67,79–83). Some of the measures used included subscales that distinctly assess mental versus physical QOL (e.g. Short Form [SF]-12, SF-36, Impact of Weight on Quality of Life [IWQOL]), while others only included one composite score (e.g. Obesity-Related Well Being Scale [ORWELL]).

Mental health-related quality of life. Six studies have examined associations between WBI and mental HRQOL using the Mental Component Summary Score of the SF-12 or SF-36 (48,50,53,80–82). Across these studies, WBI was significantly and negatively associated with mental domains of quality of life, and these findings remained consistent for both the WBIS and WSSQ. An additional study found that both the WSSQ and WBIS were associated with poorer mental HRQOL using the self-esteem subscale of the IWQOL (62).

Six studies have examined and demonstrated significant correlations between WBI and weight-specific QOL using the IWQOL and ORWELL (r values = -0.28 to -0.69) (38,53,62,63,67,83). While these associations have been observed for both the WSSQ and WBIS, Hübner *et al.* (62) who compared these measures in a sample of 78 pre-bariatric patients found stronger associations with the IWQOL when WBI was measured using the WBIS ($\beta = 0.57$, $R^2 = 0.33$, $p < 0.001$) compared with the WSSQ ($\beta = 0.45$, $R^2 = 0.20$, $p < 0.001$).

Several studies have reported mediational analyses examining the relationship between self-stigma and weight-related QOL. For example, in a sample of 87 treatment-seeking adults with overweight and obesity, Lillis *et al.* (83) found that self-stigma mediated the relationship between BMI and obesity-related quality of life. Pearl *et al.* (48) found that, among patients with obesity and BED (N = 255), depression mediated the relationship between WBI and HRQOL, as measured by the SF-36. Taken together, the existing literature suggests that WBI may be detrimental for mental HRQOL. Of note, all studies were cross-sectional, thus limiting conclusions about directionality and causality.

Physical health-related quality of life. Seven studies consistently showed significant associations between WBIS

scores and physical HRQOL (47,48,50,61,79,81,82). For example, Latner *et al.* (81) found that, among 120 treatment-seeking adults with overweight/obesity, WBIS scores predicted the physical component score (PCS) of the SF-36, even after controlling for BMI, age, exercise, medical conditions and medication use. In another study by Latner *et al.* (82), WBIS scores moderated the relationship between BMI and PCS scores in women with obesity ($N = 81$), such that women with higher BMIs only had worse physical HRQOL when they also had higher (but not lower) WBIS scores. Notably, this study did not show any effects of perceived weight discrimination on physical HRQOL, highlighting the unique contribution of WBI. More work is needed to clarify additional mechanisms in the relationship between WBI and self-perceived health.

The relationship between physical HRQOL and WBI as measured by the WSSQ is less clear. Farhangi *et al.* (80) found a significant association between the WSSQ total score and the PCS of the SF-36 but did not find an association between the self-devaluation subscale and this scale. Hain *et al.* (53). also did not find a significant correlation between the WSSQ total score and the SF-36 PCS. However, Sevincer *et al.* (67) reported a significant correlation between the WSSQ total score and the physical function subscale of the IWQOL. Hain *et al.* (53) and other researchers have also found significant associations between the WSSQ and weight-specific QOL scales, such as the IWQOL total score and the ORWELL (38,53,63,83). Both of these scales combine mental and physical HRQOL into one score, so we cannot determine their relative associations.

Physical health outcomes in adults

In comparison with studies of mental health outcomes, less research has assessed the relationship between WBI and physical health, and findings are less consistent. Studies on physical health have mostly focused on the relationship between WBI and weight (including BMI, weight loss and weight regain) or weight-related health behaviours (e.g. dietary adherence and physical activity). Studies examining other health outcomes (e.g. cardiometabolic risk and treatment adherence) are also reviewed below.

Body weight

Body mass index. Forty-two cross-sectional studies examined the relationship between WBI and BMI or categorical weight status (i.e. normal weight, overweight and obesity). Among samples that only included persons with overweight/obesity, 16 studies found significant associations between WBI and BMI or weight status (10,19,37,38,46,47,50,52,53,61,63,64,66,67,72,74,79,84,85), and 17 found no significant associations (7,21,36,44,45,48,51,54,56–58,60–62,70,76,77,82). In studies that found significant associations, r values ranged from 0.12 to 0.40. One study found no significant linear relationship between BMI and WSSQ scores ($r = 0.14$, $p = 0.18$) but did find that patients with BMIs $\geq$ 50 kg m^{-2} had significantly higher scores than those with BMIs of 35–49.9 kg m^{-2} ($p = 0.017$) (53). Among the nine studies that also included participants with lower body weights (i.e. BMIs $<$ 25 kg m^{-2}), all found significant associations between BMI and WBI (10,37,39,40,49,55,72,78,79,86). Thus, although the literature does not show a consistent, linear relationship between body weight and WBI among persons who have higher body weight, higher weight appears to be associated with higher WBI when a broad range of body weights are represented.

Three of these studies also found significant associations between WBI and higher self-perceived weight status, independent of objective weight status as measured by BMI (10,40,79). In two of these studies (10,40), self-perceived weight status was more strongly associated with WBI than was objective weight status. Lee and Dedrick (87) showed that the WBIS retained its psychometric properties regardless of whether it was administered to participants with a self-perceived versus objective weight status of overweight/obesity, and scores were higher when weight status was defined by self-perceptions. Furthermore, in an experimental study of undergraduate women with BMIs of 21.5–27.5 kg m^{-2}, women who were "labelled" as overweight as part of the study manipulation had higher WBIS scores than those labelled as normal weight, regardless of their objective weight category (31). Taken together, these findings suggest that researchers can expand their criteria when defining "overweight," since WBI may affect individuals who do not meet objective weight classifications.

Weight loss. Six studies have assessed the relationship between WBI and weight loss following behavioural ($n = 4$) (19–21,57) or surgical ($n = 2$) (33,77) treatments. None of the behavioural weight loss studies found associations between WBI (assessed with the WBIS and Self-Devaluation subscale of the WSSQ) and weight loss following short-term (7–14 weeks) treatment. Among the two studies assessing effects of WBI on weight loss via bariatric surgery, Raves *et al.* (77). found no association between WBI and percent weight change after surgery, while Lent *et al.* (33) found that higher baseline WBIS scores predicted less percent weight loss at 12 months after controlling for demographics, baseline BMI, depression and surgery type ($P = 0.04$). Of note, Raves *et al.* (77) did not standardize the time since surgery, and pre and post weight were assessed via self-report.

Aside from measuring weight loss, three studies have assessed self-reported weight loss attempts and motivation. Vartanian *et al.* (36). found that, following acute instances of weight-stigmatizing experiences, WBI was associated with less motivation to lose weight among adults with overweight/obesity ($p = 0.04$). Puhl *et al.* (10) found that, among over 3,500 adults, those who reported trying to lose weight in the past year had higher WBIS-M scores ($\beta = 0.08$, $p < 0.001$). Koball *et al.* (86) also found that, among 242 patients seeking non-weight-related medical care, those with higher WBI were more likely to report trying to lose weight ($p < 0.001$). Thus, this initial evidence suggests that WBI may be associated with greater efforts to lose weight but perhaps not immediately following instances of weight-based stigmatization.

Weight regain versus maintenance. Two studies have assessed WBI in relation to weight cycling, defined as losing and regaining 20 lb or more (46,66). Results showed that WBIS scores correlated with greater frequency of weight cycling (r values = 0.19 to 0.20), although one study only, found this association among women but not men (46). Additionally, in a self-report study of 549 adults who reported losing at least 10% of their body weight in the past year, Puhl *et al.* (79) found that adults who had regained at least 5% of their weight had higher WBIS-M scores than those who maintained their weight loss (4.6 versus 3.5, $p < 0.001$). Logistic regression analyses showed that higher WBIS-M scores were associated with lower odds of maintaining lost weight (odds ratio = 0.72, $p < 0.001$), even after controlling for engagement in maintenance behaviours, stress, BMI and demographics. Thus, while evidence examining the relationship between WBI and initial weight loss are mixed, these two studies show consistent negative effects of WBI on weight loss maintenance.

Eating behaviours related to weight management. Ten studies have assessed the relationship between WBI and eating behaviours and experiences pertinent to weight management, including: reported hunger(63); the ability to respond to hunger and satiety cues (i.e. intuitive eating) (22,39); self-monitoring behaviours (79); eating to cope with stigma (78); self-efficacy to avoid overeating(57); adherence to the postsurgical diet following bariatric surgery (77); and efforts to eat healthfully and diet (10,36,50).

Findings regarding the relationship between WBI and dieting are mixed. For example, Puhl *et al.* (10) found that, among adults who had lost at least 10% of their body weight in the past year, those with high levels of WBI were more likely to report dieting in the past year than those with low levels of WBI (71.7% versus 94.9%, $p < 0.001$). Dieting in the past year remained a significant predictor of WBI in linear regression analyses that controlled for variables such as BMI, experiences of weight stigma and demographics. In contrast, Vartanian *et al.* (36) found that higher WBIS scores were associated with lower motivation to diet in response to acute reports of weight stigmatization ($p = 0.03$). The vague use of the term 'dieting' may explain these mixed findings, as people may attempt to diet in both healthy (e.g. reducing portion sizes) and unhealthy (e.g. skipping meals) ways. Additionally, as illustrated by Himmelstein *et al.* (78), some people respond to instances of weight stigma with urges to eat more food (thus the opposite of dieting). Schvey *et al.* (50) reported an association between WBIS scores and maladaptive coping strategies in response to weight stigma ($r = 0.59$, $p < 0.01$), which included both eating more food and using extreme dieting behaviours to lose weight quickly. Of note, Schvey *et al.* (50) did not find an association between WBIS scores and more general reported engagement in healthy or unhealthy weight loss behaviours.

Aside from dieting, four studies have documented a consistent, negative relationship between WBI and other weight management-related eating behaviours. In a study of 300 adults who had undergone bariatric surgery (77), small but significant associations were found between WBI and worse adherence to the postoperative diet, as assessed by patients' self-evaluation (i.e. how well they thought they were adhering to the diet; $r = -0.19$) and by an adapted version of the Food Frequency Questionnaire ($r = -0.18$, p values < 0.01). Another study of 549 adults who had recently lost weight found an association between WBIS-M scores and reported frequency of dietary monitoring ($r = -0.14$, $p < 0.05$), which is a strong predictor of successful weight management. Additionally, Burmeister *et al.* (57) found a strong, negative correlation ($r = .46$, $p < 0.01$) between WBIS scores and self-efficacy to control urges to overeat among 57 adults with overweight/obesity seeking behavioural weight loss treatment. Finally, Mensinger *et al.* (22) found that WBI moderated the effects of lifestyle intervention on improvements in intuitive (or adaptive) eating behaviours. Participants high in WBI did not show improvements in intuitive eating, while those low in WBI did. Together, these findings suggest that, while the evidence of an association between WBI and dieting is mixed, WBI appears to have negative associations with eating-related behaviours and psychological factors that promote successful weight management.

Physical activity

Ten studies tested associations between WBI and physical activity (23,36,50,56,74,78,79,84,86,88). Seven of these studies measured self-reporte engagement in physical activity (e.g. minutes of moderate-to-vigorous activity), and six included measures of exercise-related motivational factors

(e.g. self-efficacy). Physical activity measures included validated self-report questionnaires (56,79,84,86,88), single-item assessments (23,36,78) and self-report scales created specifically for the studies (50,74,79).

Studies did not consistently find a direct relationship between WBI and engagement in physical activity. Four studies found small, marginally or statistically significant effect sizes for the association between WBIS scores and reported engagement in physical activity, with r and β values ranging from −0.14 to −0.22 (56,79,84,88). One study found no association between WBIS-M scores and frequency of exercising at various intensities (86) and another found that WBIS-M scores were not associated with the frequency of going to the gym (50). However, three studies did show WBI to be a significant mediator or moderator of physical activity. For example, in a study of women with obesity receiving a lifestyle intervention, Mensinger and Meadows (23) found that those with high WBI did not show significant increases in physical activity, while those low in WBI did. They also found that WBIS scores mediated the effects of the intervention on increased physical activity. Pearl *et al.* (84) showed that WBI did not moderate the effects of experiencing weight stigma on physical activity for women with overweight/obesity, but it did mediate this relationship. Thus, while a direct relationship between WBI and physical activity remains unclear, WBI may determine how other experiences and interventions affect physical activity.

Associations between WBI and motivational factors related to physical activity – such as exercise self-efficacy, enjoyment, and avoidance – appear to be stronger and more consistent than associations between WBI and physical activity engagement (23,36,50,74,84). In a large, US national sample, adults with higher WBIS-M scores reported higher scores on a scale assessing avoidance of physical activity as a coping response to weight stigma (78). Schvey *et al.* (50) created a self-report measure containing three subscales related to exercising at the gym for people with obesity: stigma at the gym, self-consciousness at the gym, and negative attitudes toward the gym. Significant correlations were observed between all subscales and WBIS-M scores (r values ranging from 0.19 to 0.41), and correlations between WBI and two subscales assessing perceived barriers to exercise. Additionally, Vartanian *et al.* (36) found that higher WBI was associated with less motivation to exercise following experiences of weight stigma. Thus, studies consistently showed associations between WBI and reduced self-reported motivation to exercise.

Cardiometabolic risk

To date, only two studies have examined the relationship between WBI and cardiometabolic risk factors. In a community sample of 46 adults, Vartanian *et al.* (36) found a correlation between WBIS scores and resting heart rate ($r = 0.31$, $p < 0.05$). Pearl *et al.* (44) assessed WBI and criteria for metabolic syndrome in 159 treatment-seeking adults with obesity. Results showed that, when controlling for demographics, BMI and depressive symptoms, WBIS scores were marginally ($p = 0.052$) associated with increased odds of having metabolic syndrome. However, when WBIS scores were divided into tertiles, participants with high levels of WBI had three times greater odds of having metabolic syndrome than those with low levels of WBI. Additionally, WBIS scores were significantly and positively associated with triglycerides when controlling for all covariates, regardless of whether WBIS scores were analysed continuously or categorically. These findings require replication but suggest a link between WBI and poorer cardiometabolic health.

Other health behaviours and outcomes

Four studies assessed adherence to treatments related and unrelated to weight. One study of 70 patients with schizophrenia enrolled in a weight loss study found no relationship between WBIS scores and attitudes toward antipsychotic medication adherence (45), suggesting that WBI does not necessarily translate to reduced self-efficacy and motivation to engage in non-weight-related behaviours. With regard to weight loss, two studies found reduced treatment adherence among adults with higher levels of WBI, as measured by adherence to their doctor's weight loss recommendations (86) and number of sessions attended in an online weight loss program (21). Another study found no difference in WBI between participants who completed a weight loss program and those who dropped out (20).

Seven studies have examined the relationship between WBI and other outcomes related to weight and health. These studies reported the following findings: WBI was lower among white adults with (versus without) a family weight history of overweight/obesity (89); higher WBI was associated with a younger age of onset of overweight/obesity (66,85) and reports of food insecurity (90); and WBI was not significantly related to television use (56), health care utilization (61) or alcohol consumption (67).

Studies of weight bias internalization in youth

Two studies have validated the WBIS in adolescents: one in a sample of 57 US adolescents seeking bariatric surgery (43) and one among 191 German adolescents seeking treatment for overweight/obesity (41). Between the two studies, and controlling for BMI, WBIS scores correlated with: depressive symptoms; anxiety; psychiatric problems by both child and parent report; self-esteem; disordered eating symptoms, including frequency of objective binge eating episodes; body image concerns; general self-efficacy; and HRQOL (absolute r values = 0.28 to 0.81). However, in one study, WBIS scores were not associated with the presence of psychiatric diagnoses, psychiatric treatment or suicidal ideation as

determined by clinical interview (43). Semi-structured interviews by Ciupath-Plath *et al.* (41) confirmed the acceptability and accessibility of the scale. Thus, the WBIS appears to be valid for use in adolescents. Additionally, one study validated the WSSQ in a sample of 156 French-speaking, Canadian adolescents with overweight/obesity (42). This study found support for a two-factor solution and significant associations between the self-devaluation subscale and self-esteem, body image, disordered eating, depression and anxiety (absolute r values = 0.24 to 0.43), although not BMI.

Only one prospective study has assessed WBI in children (ages 7–11). Zuba and Warschburger (35) conducted a 2-year longitudinal study of over 1,000 German children, making minor changes to the WBIS item wording to be appropriate for children of all weight statuses. Results showed that children with overweight scored higher on the WBIS than non-overweight children, although at time 1, BMI correlated with the WBIS more strongly among non-overweight than overweight children. No gender differences were found for correlations between WBIS and BMI, restrained eating, emotional eating or conduct problems (r values = 0.10 to 0.46). Higher BMI at time 1 predicted higher WBIS scores 2 years later for non-overweight (but not overweight) boys and girls. Furthermore, WBIS scores at time 2 mediated the relationship between BMI at time 1 and emotional problems (in non-overweight children) and restrained eating (for both weight statuses) at time 2. Thus, findings from this single study suggest that adverse associations with WBI may begin during youth.

Interventions to reduce weight bias internalization

Seven studies have tested the effects of psychological interventions, often combined with healthy eating or weight loss programs, on reductions in WBI. Five of these studies have tested interventions based on Acceptance and Commitment Therapy (ACT), which focused on topics such as self-compassion, mindfulness and "experiential avoidance" (i.e. the tendency for people to avoid uncomfortable feelings) (24,26–29). Only one study was a randomized controlled trial, which tested the effects of the 'kilogram-free' program (ACT combined with a healthy eating programme) compared with treatment as usual (TAU; medical and nutritional visits) in 73 women with overweight/obesity (29). Results showed that, after 12 sessions, participants in the KG-free intervention had significantly greater improvements in WBI, psychiatric symptoms, HRQOL, physical activity and disordered eating than participants who received TAU (d values ranged from 0.44 to 0.85). The intervention also conferred small but significant benefits for reduction in BMI compared with TAU (d = 0.09) but did not affect cardiometabolic risk factors such as waist circumference or cholesterol. Other smaller studies without control groups have found similar benefits for mental health, HRQOL and health behaviours up to 3 months following treatment (24,26–28).

One study has tested the effects of an intervention for WBI adapted from cognitive–behavioural therapy, without any weight loss or health behaviour intervention (30). Results showed significantly greater improvements in WBIS scores, stereotype endorsement and weight self-efficacy among participants who attended the 8-week intervention program, compared with those in the quasi-control group who did not receive any intervention (η_p^2 values = 0.36 to 0.39). There were no significant differences in weight change between the two groups, signifying that these improvements were attributable to the psychological intervention rather than changes in weight.

Additionally, Carels *et al.* (25) tested a weight loss intervention that included some content on WBI (using similar cognitive–behavioural strategies as those described earlier), in comparison with a standard behavioural weight loss programme. Results showed that WBI decreased in both groups, and no differences were found between groups for outcomes such as binge eating, body satisfaction and weight loss. Due to a number of differences between the two programs apart from the inclusion of a stigma intervention, it is difficult to decipher the effects of the stigma intervention specifically. Of note, only two studies have explored the effects on WBI of weight loss and healthy eating programmes, without specific interventions targeting WBI (19,22). These studies have generally found small but significant decreases in WBI (e.g. 0.5 points on the 7-point WBIS). The magnitude of these WBI reductions are smaller to those found in the aforementioned stigma intervention studies (e.g. 1 point on the WBIS (30)).

Discussion

This systematic review provides a synthesis of the evidence linking WBI to mental and physical health outcomes. Although largely an understudied topic, WBI has gained increasing empirical attention in the past decade and particularly in the past 1–2 years. Overall, evidence summarized in this review shows that WBI is consistently associated with negative mental health outcomes such as depression, anxiety, poor self-esteem and body image, disordered eating and impaired mental HRQOL. Studies assessing the association between WBI and physical health were fewer and less consistent in their findings. However, clear associations have been demonstrated between WBI and higher severity of obesity, reduced motivation/self-efficacy to engage in health-promoting behaviours (e.g. physical activity) and impaired dietary adherence.

A notable finding from the current review is the overwhelming use of two self-report scales – the WBIS and

WSSQ (and iterations, such as the WBIS-M) – to assess WBI. Although validated in a number of studies that included translated versions, the psychometric properties of the WBIS have been somewhat inconsistent, with some studies finding one or two factor solutions that included all 11 items or excluded one or two items. Additional consideration is also warranted to determine whether the items included in the WBIS and WSSQ truly capture the internalization of negative weight stereotypes and self-derogation due to weight. For example, the Fear of Enacted Stigma subscale of the WSSQ assesses *anticipated* stigma from others, which has been differentiated from *internalized* stigma in prior work (91). Only one study to date has compared the WBIS and WSSQ, and no clinical cut-offs for either scale have been established. Efforts to improve measurement of this important construct are needed. This may include the development of new measures that clearly assess key aspects of internalization, including (i) awareness of one's stigmatized identity, (ii) agreement with weight-based stereotypes, (iii) application of these stereotypes to oneself, and (iv) self-devaluation based on this stigmatized identity. Improvements in measurement will enhance the quality of future studies and more accurately assess the effects of WBI on health. Greater standardization of the measurement of WBI (as well as its related health outcomes) will also allow for better synthesis of key findings, such as through meta-analysis.

Strengths of prior research include assessment of WBI and health across the spectrum of body weight statuses and in both clinical and community samples. Significant findings in these studies highlight the broad impact of WBI, regardless of one's objective weight status or efforts to seek treatment for obesity. However, several considerable limitations of the current body of existing evidence that must be addressed in future research to advance our understanding of the effects of WBI on health.

First, the vast majority of studies to date have relied solely on self-reported measures of health. Subjective distress is an important outcome to assess, as it reflects the individual's psychological experience. Still, more objective measures of health should be included in future studies, such as: psychiatric diagnoses as assessed by clinician interview/rating; accelerometry data to track physical activity; cardiometabolic risk factors such as blood pressure, waist circumference, blood glucose, cholesterol, triglycerides and other biological markers of health; and obesity-related comorbidities as defined by diagnoses of diabetes, hypertension, sleep apnea, and so forth. Objective assessments would help to clarify discrepancies in self-reported health outcomes (e.g. eating more or less in response to WBI) and enhance confidence in study findings by reducing bias and corroborating self-report measures.

Another major limitation is the lack of gender and racial/ethnic diversity in the majority of studies. The predominant focus on white women (versus men or women of colour) limits the generalizability of prior findings. Because existing measures of WBI were developed primarily in white, female samples, these measures also may not adequately capture the experiences of other populations. Future research should include more diverse samples in both scale development and assessments of WBI as it relates to health, as well as in intervention studies to reduce WBI. Additionally, other forms of diversity (such as sexual orientation) have been neglected in this area of research and should be considered in future work. Further assessment and adaptation of WBI measures in children and adolescents are also needed to understand the developmental effects of WBI on health across the lifespan.

Finally, prior research assessing WBI and health has been predominantly cross-sectional in nature, with only one study experimentally testing the effects of WBI on mental health, a handful of observational studies assessing the effects of WBI over time, and only short-term (up to 3 month) assessment of the effects of interventions to reduce WBI. Experimental and prospective studies are needed to better understand whether WBI causes adverse mental and physical health outcomes or whether worse health outcomes contribute to WBI. For example, persons with depression and anxiety may be more self-critical and may anticipate negative judgments from others, which may lead to self-devaluation due to weight. Additionally, persons with more obesity-related health problems may have greater self-blame and stress, which could also contribute to WBI. A number of large-scale, prospective studies have included brief assessments of perceived weight discrimination (92,93); inclusion of a measure of WBI in such studies, especially beginning in childhood or adolescence, could help to provide much-needed longitudinal data on the effects of WBI on health over time. As the literature on WBI becomes better established with improved measurement, more rigorous research designs, and intervention studies, meta-analyses should be prioritized to improve estimates of effect sizes and to help resolve areas of discrepancy in the literature.

A promising advancement in this research area is the recent increase in efforts to develop and test psychological interventions to reduce WBI. To date, most of these studies have been small pilot studies with short-term follow-up and, for some, without control groups. However, the large effect sizes of these interventions on reducing WBI are encouraging. Future research should continue to test interventions, on a larger scale and with long-term follow-up. In addition to assessing effects on WBI, researchers should also include both self-report and objective measures of mental and physical health. Given the reported negative associations between WBI and various indices of health, it will be important to move beyond simply documenting such associations and focus research efforts on investigating strategies

for reducing WBI and, in turn, improving mental and physical health.

Conflict of interest statement

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