

Impact of weight stigma on physiological and psychological health outcomes for overweight and obese adults: A systematic review

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Abstract

Aim: To summarize the associations between weight stigma and physiological and psychological health for individuals who are overweight or obese.

Background: Weight stigma can be defined as individuals experiencing verbal or physical abuse secondary to being overweight or obese. Weight stigma has negative consequences for both physiological and psychological health.

Design: A quantitative systematic review.

Data sources: PubMed, PsycINFO, CINAHL and MEDLINE from 1 January 2008 - 30 July 2016.

Review methods: A systematic review was conducted using the Cochrane Collaboration guidelines, the PRISMA statement guidelines and the quality assessment from the National Heart, Lung and Blood Institute. Inclusion criteria consisted of quantitative studies that examined the associations between weight stigma and physiological and psychological health outcomes in adults who were overweight or obese. Exclusion criteria consisted of qualitative studies, literature reviews, expert opinions, editorials and reports on weight stigma without health outcomes or with behavioural outcomes and intervention studies that reduced weight stigma. A quality appraisal of the selected studies was conducted.

Results: A total of 33 studies met the eligibility criteria. Weight stigma was positively associated with obesity, diabetes risk, cortisol level, oxidative stress level, C-reactive protein level, eating disturbances, depression, anxiety, body image dissatisfaction and negatively associated with self-esteem among overweight and obese adults.

Conclusion: Weight stigma is associated with adverse physiological and psychological outcomes. This conclusion highlights the need to increase public and professional awareness about the issue of weight stigma and the importance of the further development of assessment and prevention strategies of weight stigma.

KEYWORDS

adult, nursing, obesity, overweight, primary care, systematic review, weight stigma

1 | INTRODUCTION

Many people believe that weight control is an issue of personal will-power and those who hold this opinion may stigmatize individuals for being overweight (Salsman, 2012). However, teasing and stigmatizing others because of their weight does not motivate them to lose weight. Instead, the effect from the teasing or stigmatizing contributes to many adverse health consequences, including future weight gain (Puhl & Suh, 2015a). Weight stigma can be present in educational, work and healthcare settings as well as the media and can be perpetrated by family and friends (Levy & Pilver, 2012). Approximately 154.7 million individuals aged 20 years and older are overweight (body mass index [BMI] >25 kg/m²) or obese (BMI >30 kg/m²) in the United States (Go et al., 2014). Twenty percent of individuals who are overweight or obese experience weight stigma in the United States and may experience stigmatization repeatedly over their lifetimes (Levy & Pilver, 2012). It is imperative to change the public's view that teasing or stigmatizing individuals who are overweight or obese does not encourage them to lose weight and can create health problems. Before improving public knowledge, healthcare providers need to understand the negative impact of weight stigma on the health of individuals because the role of a healthcare provider is not only in delivering treatments, but also to be an informed educator and a passionate advocate. Healthcare providers serve the public through hospitals, clinics, communities and school healthcare systems. Therefore, healthcare providers have many opportunities to increase public awareness about weight stigma by educating patients and their families and friends. The goal of this review was to systematically review studies focused on weight stigma and physical and psychological health outcomes. It is hoped that the results of this review can provide healthcare providers with useful information for understanding the associations between weight stigma and obesity on health and also identify gaps for further research in the field of weight stigmatization.

2 | BACKGROUND

Several formats of weight stigma have been observed and measured, such as the experience of a weight stigma situation (Myers & Rosen, 1999), implicit weight bias (Rudolph & Hilbert, 2014), explicit weight bias (Puhl, Schwartz, & Brownell, 2005) and internalized weight stigma (Durso & Latner, 2008).

However, little is known about the associations between the different measures of weight stigma and physical and psychological health outcomes for obese people. The definitions of different measures of weight stigma are summarized as follows. The experience of a weight stigma situation can be defined as an overweight or obese individual's perception of negative attitudes (e.g. stigma, discrimination, prejudice, stereotypes) or inappropriate behaviours (e.g. teasing, bullying, verbal and physical attacks and being treated unfairly) directed towards him or her because of his or her weight (Myers & Rosen, 1999; Puhl & Heuer, 2009). The experience of weight stigma

Why is this review needed?

- Weight stigmatization is a stressful experience and a source of stress for individuals who are overweight or obese.
- Evidence showed that weight stigma cannot motivate individuals to lose weight and increases the risk for adverse health conditions.
- A new review to summarize the evidence of weight stigma was needed to increase public awareness about this issue.

What are the key findings?

- The most common measure for weight stigma was frequency of experiencing weight stigma, followed by internalized weight stigma, implicit weight bias and explicit weight bias.
- The greater the weight stigma, the worse the physiological health status of overweight and obese adults, regardless of the measures of weight stigma.
- The greater the weight stigma, the greater the eating disturbances, depressive symptoms, anxiety and body image dissatisfaction and the lower the self-esteem of overweight and obese adults, regardless of the measures of weight stigma.

How should the findings be used to influence policy/practice/research/education?

- These findings could raise the awareness of researchers, clinicians and the public regarding the negative effects that weight stigma may have on individuals who are overweight or obese.
- Healthcare providers should routinely assess for weight stigma among individuals in their practice who are overweight or obese by initiating a conversation that gives individuals permission to share their stories with the provider.
- Future research is needed on the long-term impact of weight stigma on physical and psychological health as well as to further develop assessment tools and prevention strategies to prevent weight stigma.

can be quantified by using a self-report frequency measure, such as the Stigmatizing Situations Inventory (Myers & Rosen, 1999).

The relationships between weight stigma experiences, implicit weight bias and explicit weight bias are related (Myers & Rosen, 1999; Puhl et al., 2005; Rudolph & Hilbert, 2014). Implicit bias can be defined as attitudes or stereotypes that affect an individual's understanding and actions in an unconscious manner (Dovidio,

Kawakami, & Gaertner, 2002; Rudolph & Hilbert, 2014). Implicit weight bias represents the weight bias evaluations that people are unwilling to report and it can be measured using performance-based measures, such as the Implicit Associations Test (Greenwald, McGhee, & Schwartz, 1998; Schwartz, Vartanian, Nosek, & Brownell, 2006).

Explicit bias can be defined as intentional and conscious (Puhl et al., 2005; Wilson, Lindsey, & Schooler, 2000). Explicit weight bias is a consciously stereotypical attitude, often represented by discrimination and prejudice, against the overweight and obese (Puhl et al., 2005; Wilson et al., 2000). Explicit weight bias can be obtained using self-report measures, such as the Obese Persons Trait Survey, but results may be affected by social desirability concerns (Puhl et al., 2005; Schwartz et al., 2006).

Internalized weight stigma is different from body image and is a measure of an individual's belief in stereotypes relating to negative self-evaluations (Durso & Latner, 2008). Internalized weight stigma also is a type of self-stigma among overweight and obese individuals and it can be ascertained using self-report measures, such as the Weight Bias Internalization Scale (Durso & Latner, 2008).

The influence of weight stigma on the physical health of individuals who are overweight or obese has been previously reviewed as follows. Papadopoulos and Brennan (2015) found that relationships were noted between weight stigma, BMI and difficulty losing weight in adults. In addition, weight stigma was related to poor medication adherence and weight and health-related quality of life (Papadopoulos & Brennan, 2015). Several reviews also documented that adults and children experiencing weight stigma exercised less were less motivated to exercise, had lower self-efficacy and tended to overeat (Papadopoulos & Brennan, 2015; Vartanian & Smyth, 2013). The effects of weight stigma on psychological health have also been reviewed. Across reviews, weight stigma has been associated with anxiety, depression, low self-esteem, substance abuse, binge eating disorders, bulimia nervosa and anorexia nervosa (Papadopoulos & Brennan, 2015; Puhl & Suh, 2015a,b).

These reviews provided information about the problem of weight stigma in individuals who are overweight or obese but lacked a clear focus on the associations between different measures of weight stigma and its physical and psychological effects. Therefore, the purpose of this review was to summarize the current literature with a quality appraisal of studies selected for associations between different measures of weight stigma and measures of physical and psychological health in overweight and obese adults.

3 | THE REVIEW

3.1 | Aims

The aims of this systematic literature review were (1) to identify the types of measures for weight stigma in overweight and obese adults; (2) to summarize associations between different measures of weight stigma and physiological health outcomes in overweight and obese adults; and (3) to summarize associations between different

measures of weight stigma and psychological health outcomes in overweight and obese adults. The research questions are as follows: (1) what types of measures of weight stigma are being used for adults with overweight and obesity in the current literature? (2) What is the association between different measures of weight stigma and physiological and psychological health outcomes in adults with overweight and obesity in the current literature?

3.2 | Design

The suggestions from the Cochrane Handbook (version 5.1.0) (Higgins & Green, 2011) were followed to define the review questions and to develop criteria for including studies and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses: the PRISMA statement guidelines (Moher, Liberati, Tetzlaff, & Altman, 2009) were used to present the search processes. We modified a Summary of Findings table from the Cochrane Effective Practice and Organisation of Care worksheets to present the summary of our findings in Table 1 (Cochrane Effective Practice and Organisation of Care 2017b).

3.3 | Search methods

PubMed, MEDLINE, PsycINFO and CINAHL were searched to identify studies published in English from 1 January 2008 to 30 July 2016. The following search terms were used: social stigma, discrimination, social discrimination, prejudice, bias, weight, body weight, overweight, obesity, weight stigma, stigma and stigmatization (Table S1). Reference lists of the studies were also searched to ensure a complete collection of study results. Inclusion criteria consisted of quantitative studies that examined the associations between weight stigma and physiological and psychological health outcomes for adults (18 years and older) who were overweight (BMI >25 kg/m²) or obese (BMI >30 kg/m²). No upper age limit was stipulated in this review because weight stigma can happen in all age groups. Qualitative research, literature reviews, expert opinions, editorials, reports on weight stigma without health outcomes or with behaviour outcomes such as exercise avoidance and intervention studies for reducing weight stigma were excluded because the focus of those articles does not include examining the relationships between weight stigma and physiological and psychological health outcomes.

Before the full-text review, two researchers worked independently and undertook duplicate screening of title-abstract records. Based on the inclusion and exclusion criteria, titles and abstracts were screened to identify studies of likely relevance and the screening excluded articles with improper topics and abstracts. Full-text articles were then screened by the two independent reviewers.

3.4 | Search outcome

The search of the present review yielded 877 studies with 296 duplicate studies; 581 studies remained after duplicates were

TABLE 1 Brief of included studies

Author/s (year)	Location	Study design	N	Weight stigma measure used/manipulated weight stigma
Ashmore et al. (2008)	US	Cross-sectional	93	Stigmatizing Situations Inventory
Friedman et al. (2008)	US	Cross-sectional	94	Stigmatizing Situations Inventory
Carels et al. (2009)	US	1-Group pretest/posttest	42	Obese Persons Trait Survey Implicit Associations Test
Farrow and Tarrant (2009)	UK	Cross-sectional	197	Experience of Weight-based Discrimination Scale
Hatzenbuehler et al. (2009)	US	Cross-sectional with secondary database analysis	31,558	Perceived Weight Discrimination Scale
Latner et al. (2009)	US	1-Group pretest/posttest	185	Stigmatizing Situations Inventory
Carels et al. (2010)	US	2-Group pretest/posttest	49	Implicit Associations Test Weight Bias Internalization Scale Obese Persons Trait Survey
Wott and Carels (2010)	US	2-Group pretest/posttest	49	Stigmatizing Situations Inventory
Savoy (2010)	US	Cross-sectional	123	Weight-based Stigmatization Experience Scale
Carels et al. (2011)	US	1-Group pretest/posttest	53	Implicit Association Test
Tsenkova et al. (2011)	US	Cross-sectional with secondary database analysis	938	Perceived Weight Discrimination Scale
Robinson (2011)	US	Cross-sectional	955	Perception of Teasing Scale Gatehouse Bullying Scale
Durso, Latner, and Hayashi (2012)	US	Cross-sectional	381	Weight Bias Internalization Scale
Durso, Latner, White, et al. (2012)	US	Cross-sectional	100	Weight Bias Internalization Scale
Durso (2012)	US	2-Group pretest/posttest	75	Weight Bias Internalization Scale
Fettich and Chen (2012)	US	Cross-sectional	234	Stigmatizing Situations Inventory
Levy and Pilver (2012)	US	Cross-sectional with secondary database analysis	20,649	Experiences of Discrimination Scale
Savoy et al. (2012)	US	Cross-sectional	CP:99 SP:100	Stigmatizing Situations Inventory
Carels et al. (2013)	US	Cross-sectional	62	Obese Persons Trait Survey Weight Bias Internalization Scale
Sutin and Terracciano (2013)	US	Longitudinal with secondary database analysis	6,157	Experience of Everyday Discrimination Scale
Burmeister and Carels (2014)	US	Cross-sectional	116	Weight Bias Internalization Scale
Hilbert et al. (2014)	Germany	Cross-sectional	1,158	Weight Bias Internalization Scale
Himmelstein et al. (2014)	US	2-Group pretest/posttest	110	Experimentally manipulated weight stigma in a clothes shopping scenario
Hunger and Major (2014)	US	Cross-sectional	SO:171 ST:194	Modified version of Perceived Racial Discrimination Modified version of Other Forms of Stigma Concerns
Jackson et al. (2014)	US	Longitudinal with secondary database analysis	2,944	Perceived Discrimination Questionnaire
Lee et al. (2014)	US Australia	Cross-sectional	USP:215 AP:264	Modified versions of the Attitudes to Mental Illness Questionnaire and the General Social Survey
Pearl et al. (2014a)	US	Cross-sectional	245	Weight Bias Internalization Scale
Pearl et al. (2014b)	US	Cross-sectional	255	Weight Bias Internalization Scale
Sutin et al. (2014)	US	Cross-sectional with secondary database analysis	7,394	Single-item measures from Perceived Discrimination Scale
Rudolph and Hilbert (2014)	Germany	Cross-sectional	78	Self-Discrimination Implicit Association Test
Schvey et al. (2014)	US	2-Group pretest/posttest	123	10-minute weight stigmatizing video

(Continues)

TABLE 1 (Continued)

Author/s (year)	Location	Study design	N	Weight stigma measure used/manipulated weight stigma
Tomiyama et al. (2014)	US	Cross-sectional survey with repeat measure of salivary cortisol	47	Stigmatizing Situations Inventory Modified version of the Stigma Consciousness Scale
Wu and Liu (2015)	Taiwan	Cross-sectional	141	Stigmatizing Situations Inventory

Year = published year; N = number of participants; US = United States of America; UK = United Kingdom; CP = clinical participants; SP = student participants; SO = study one; ST = study two; USP = United States participants; AP = Australia participants.

removed. After screening titles and abstracts, 219 studies were excluded and 362 studies remained. The full texts of the remaining 362 studies were reviewed, after which 329 were excluded, leaving 33 studies in the final analysis. Figure 1 displays the PRISMA flow-chart showing the search procedure for identification of the databases, screening studies, assessing for eligibility and the final studies that met the selection criteria.

3.5 | Quality appraisal

The quality of all included articles was assessed by the two independent researchers. The studies included in this review were either observational and cross-sectional studies or pre-post studies with no control group. Therefore, we used two quality assessment tools from the National Heart, Lung and Blood Institute for Observational Cohort and Cross-Sectional Studies (National Heart, Lung and Blood Institute 2014a) and for Before-After (Pre-Post) Studies with No Control Group (National Heart, Lung and Blood Institute 2014b) to present the assessment of risk of bias because the Cochrane Handbook assessment of risk of bias guideline is more suitable for use in interventional studies with a control group and in interrupted time series studies (Cochrane Effective Practice and Organisation of Care 2017a). Quality appraisal of each article included study questions, study population, study participants representation, sample size, exposure measures for the observational studies, intervention, outcome measures, blinding of outcome assessors, loss of follow-up rate and statistical analysis. Overall quality rating (i.e. good, fair or poor) was based on the critical appraisal of the risk of potential for selection bias, information bias, measurement bias or confounding. Any disagreement was resolved by consensus. Tables S2 and S3 show the results of the quality appraisal.

3.6 | Data extraction

The following information was first extracted to organize the data and prepare for analysis: publication year, location of study, study design, sample and sample size, participants' ages, BMI, measures of weight stigma and instruments, measures of health outcomes, response rate for cross-sectional survey studies, attrition rate for intervention and longitudinal studies and study results. Second, descriptive statistics were used to obtain the sum, mean, standard deviation, range, percentage of study and sample characteristics for

the included studies. All data were analysed using Statistical Package for Social Sciences (SPSS) 3.0 software (SPSS 2014). Third, study results related to different measures of weight stigma were extracted in more detail to summarize the associations between the experiences of weight stigma, internalized weight stigma, implicit weight bias and explicit weight bias and health outcomes in the included studies. The process of data abstraction and synthesis was completed independently by two reviewers and any disagreement was resolved by consensus.

4 | RESULTS

4.1 | Characteristics and quality of included studies

Table 1 presents a brief of included studies, Table 2 presents a summary of findings and Table S4 presents the details of the 33 studies. Overall, the quality ratings for all 33 studies were fair to good (Tables S2 and S3). They included a total of 75,599 participants and individual sample sizes ranged from 42 to 31,558. The majority of participants across the studies were Caucasian (mean = 69.6% SD 26.9%). The mean age of participants across the studies was 44.6 years (SD 12.7), and the mean BMI of participants was 33.6 kg/m² (SD 7.6). The majority of the studies were conducted in the United States (84.8%, 28 studies) and used a cross-sectional design (69.7%, 23 studies) and a convenience sample (60.6%, 20 studies). Six studies in this review used secondary databases. Only two studies reported power analysis for sample size justification (Robinson, 2011; Wu & Liu, 2015), which makes it difficult to determine whether the sample size was sufficiently large enough for the majority of the studies.

Twenty studies in this review reported sample sizes of <200, which may have affected the results. The mean response rate for cross-sectional design studies was 93.3% (SD 11.6%) and the mean attrition rate for intervention studies was 11.3% (SD 11.2%). Two intervention studies in this review reported that participants lost to follow-up exceeded 20% (Carels et al., 2009; Durso, 2012). None of the studies in this review reported outcome assessors blinded to the participants' exposures or interventions, which may have altered the results.

Most of the psychological health outcomes were self-reported by the participants. Four studies in this review used doctoral-level diagnostic interviews for binge eating disorder but did not report whether the interviewers were blinded to the participants' exposures

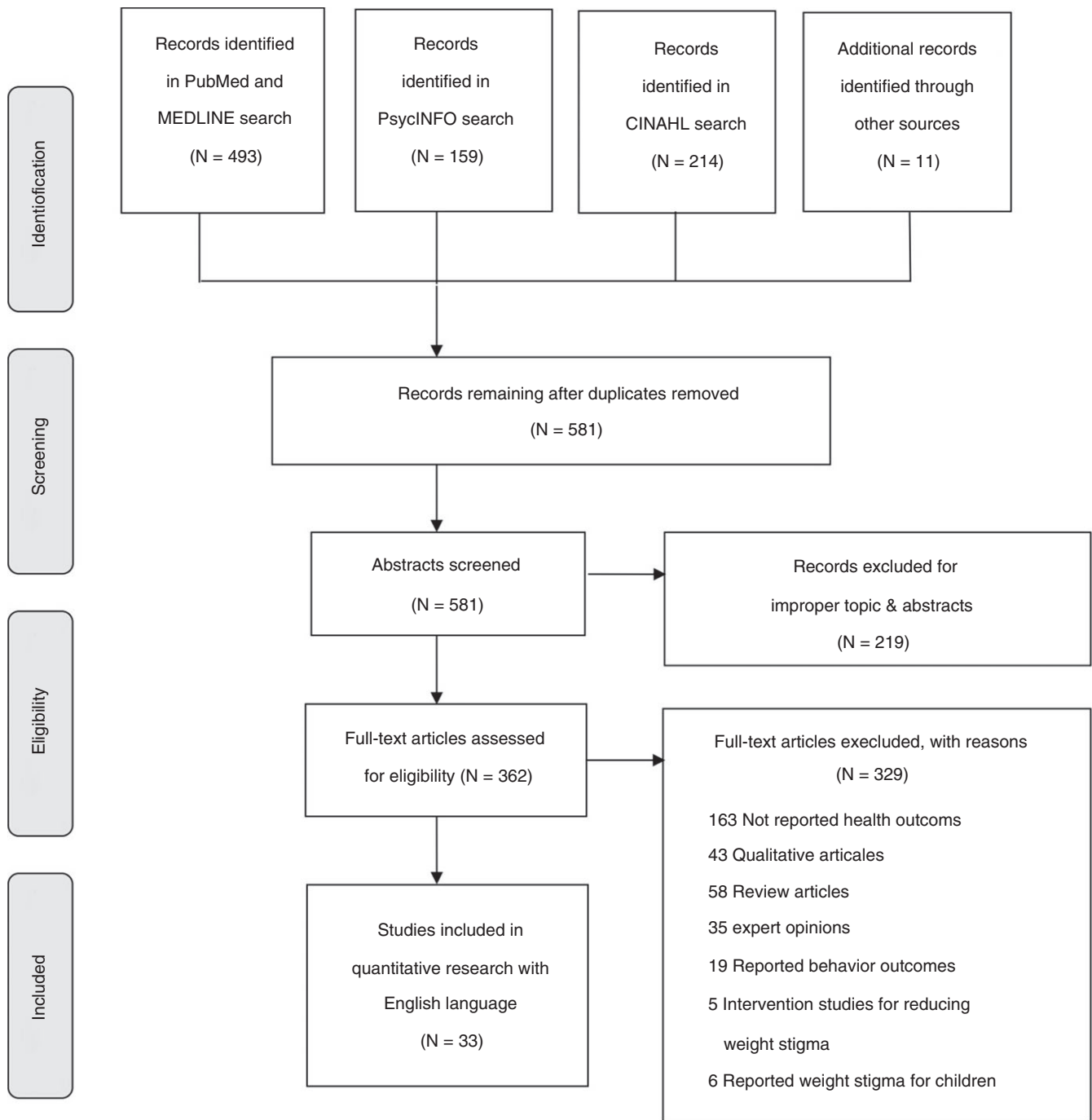


FIGURE 1 Flowchart of the inclusion procedure in a PRISMA diagram

(Durso, Latner, White, et al., 2012; Friedman, Ashmore, & Applegate, 2008; Pearl, White, & Grilo, 2014a,b). Finally, 18 of 25 longitudinal and cross-sectional studies measured and adjusted statistically for the impact of confounding variables on the relationship between weight stigma and health outcomes. Seven of eight intervention studies reported the pre-to-post health outcomes changes. In summary, the main limitations of the included studies consisted of small convenience samples without sample size justification, self-reported psychological health outcomes and lack of confounding variables in the studies.

4.2 | Measures of weight stigma

Six studies (18.2%) in this review observed weight stigma by more than one measure. The most common measure for weight stigma was experiences of weight stigma (54.5%, 18 studies). The most common tool for measuring the experiences of weight stigma was the Stigmatizing Situations Inventory (43.6%, 8 studies). The second most common measure of weight stigma was internalized weight stigma, measured by the Weight Bias Internalization Scale (27.3%, 9 studies). The third most common measure for weight stigma was

TABLE 2 Summary of findings

Associations between weight stigma and psychological and physiological health for overweight or obese adults			
People: Individual adults who are overweight or obese			
Settings: Primarily the United States of America			
Intervention: none			
Comparison: none			
Outcomes	Impacts	Number of studies ^b	Overall quality rating ^a
Weight change	Some researchers reported the higher the weight stigma, the lower percentage of weight loss. Others reported no statistically significant association between weight stigma and weight change	7	Fair
Obesity and diabetes risk	Higher weight stigma associated with higher HbA1c levels, which may increase the risk for developing type 2 diabetes mellitus. Higher weight stigma also increased the risk to be obese or remain obese	3	Good
Biomarkers	The greater the weight stigma, the higher the cortisol, oxidative stress and C-reactive protein levels, meaning that weight stigma is linked to hypothalamic-pituitary-adrenal axis reactivity and systemic inflammation and may contribute to adverse health outcomes like cardiovascular disease and diabetes	4	Fair
Eating disturbances	Higher weight stigma was significantly associated with higher eating disturbances like binge eating and emotional eating and result in weight gain	14	Fair
Depressive symptoms	The higher the weight stigma, the greater the depressive symptoms	17	Fair
Anxiety	The more frequently weight stigma was experienced, the higher the anxiety levels reported	7	Fair
Self-esteem.	Higher weight stigma was significantly associated with lower self-esteem	7	Fair
Body image	Higher weight stigma was significantly associated with higher body image dissatisfaction	9	Fair
Other psychological distress	Higher weight stigma was significantly associated with higher psychological distress such as social isolation, suspiciousness, hostility and nicotine, alcohol and drug dependence	10	Fair

^aNational Heart, Lung, and Blood Institute quality assessment guideline.

Good = Low risk of bias of included studies. The outcome results reported in the studies can truly be attributed to the intervention or exposure being evaluated, and not to biases, measurement errors, or other confounding factors that may result from flaws in the design or conduct of the studies.

Fair = Some risk of bias of included studies. The outcome results reported in the studies were attributed to the intervention or exposure being evaluated but the studies may contain some risk of bias.

Poor = High risk of bias of included studies such as potential for selection bias, information bias, measurement bias, or confounding (the mixture of exposures that one cannot tease out from each other). The outcome results reported in the studies cannot be attributed to the intervention or exposure being evaluated.

^bTwenty of the 33 studies reported more than one type of health outcomes.

implicit weight bias (12.1%, 4 studies), measured by the Implicit Associations Test (3 studies) and Self-Discrimination Implicit Association Test (1 study). The fourth most common measure for weight stigma was explicit weight bias, measured by the Obese Persons Trait Survey (9.1%, 3 studies).

4.3 | Associations between weight stigma and physiological health outcomes

4.3.1 | Weight change

More weight stigma experienced was correlated with a greater percentage of weight loss ($r = .23, p < .005$) (Latner, Wilson, Jackson, & Stunkard, 2009); however, Wott and Carels (2010) found no significant association. Jackson, Beeken, and Wardle (2014) compared participants who did not report experiences of weight discrimination to those who did and found that those who reported having experienced weight stigma gained a mean of 1.66 kg ($SD\ 0.42, p < .001$) over 4 years. Greater implicit weight bias was significantly associated with a lower percentage of weight loss ($r = -.33, p = .04$) (Carels et al., 2011), but no statistically significant associations were found between implicit weight bias and weight change in the other two studies (Carels et al., 2009, 2010).

Obese participants who lost at least 2.5% of their baseline weight reported less explicit weight bias (Carels et al., 2009); however, another study reported no statistically significant association between explicit weight bias and weight change (Carels et al., 2010). Participants with low levels of internalized weight stigma lost twice as much weight as participants with higher levels of internalized weight stigma (Durso, 2012). In contrast, Carels et al. (2010) reported no significant difference between internalized weight stigma and weight change.

4.3.2 | Obesity and diabetes risk

The experiences of weight stigma moderated the effects of waist-to-hip ratio on glycated haemoglobin (HbA1c) after controlling for selected socio-demographic, health and psychosocial variables (Tsenkova, Carr, Schoeller, & Ryff, 2011). Participants who experienced a higher frequency of weight stigma had higher HbA1c levels and a higher risk for developing type 2 diabetes mellitus (Tsenkova et al., 2011). Controlling for baseline BMI, participants who experienced weight stigma were more likely to be obese than those who did not (Jackson et al., 2014; Sutin & Terracciano, 2013) and were also more likely to remain obese at 4-year follow-up ($OR = 3.20, 95\% CI = 2.06-4.97$) (Sutin & Terracciano, 2013).

4.3.3 | Cortisol, oxidative stress and C-reactive protein levels

Two of these studies examined weight stigma using weight stigma scenarios and weight stigma videos, respectively (Himmelstein, Incollingo, & Tomiyama, 2014; Schvey, Puhl, & Brownell, 2014). The two

studies found that participants who experienced the weight stigmatizing conditions sustained salivary cortisol elevation, controlling for baseline cortisol (Himmelstein, Incollingo, & Tomiyama, 2014; Schvey et al., 2014). F_2 -isoprostane levels represent oxidative stress levels, a pathogenic mechanism of stress response causing physical damage, such as disrupting the activity of antioxidant enzymes (Tomiyama et al., 2014). Researchers found that the greater the weight stigma, the higher the morning serum cortisol and F_2 -isoprostane levels (Tomiyama et al., 2014). Finally, one study that examined the association between experience of everyday discrimination because of weight and the level of C-reactive protein in overweight participants found that having experienced weight discrimination was associated with higher levels of C-reactive protein among participants with a BMI of 25–30 kg/m^2 (Sutin, Stephan, Luchetti, & Terracciano, 2014).

4.4 | Associations between weight stigma and psychological health outcomes

4.4.1 | Eating disturbances

The experience of weight stigma was significantly positively associated with either binge eating behaviours or emotional eating ($r = .21-.45, all\ p < .05$) (Ashmore, Friedman, Reichmann, & Musante, 2008; Farrow & Tarrant, 2009; Friedman et al., 2008; Savoy, 2010; Wott & Carels, 2010; Wu & Liu, 2015).

For implicit and explicit weight bias, Carels et al. (2010) reported a significant positive association between implicit weight bias and binge eating behaviours ($r = .36, p < .05$). In a later study, Carels et al. (2013) reported no significant associations between explicit weight bias and binge eating behaviours among adults; however, more negative self-ratings of explicit weight bias were associated with greater binge eating behaviours ($r = .55, p < .001$).

In terms of internalized weight stigma, four studies reported a significant positive association between internalized weight stigma and binge eating behaviours ($r = .43-.58, all\ p < .05$) (Burmeister & Carels, 2014; Carels et al., 2010, 2013; Pearl et al., 2014b). In addition, Durso, Latner, and Hayashi (2012) found that internalized weight stigma partially mediated the association between perceived discrimination and eating disturbances.

As it relates to the other measures of weight stigma, such as weight-based stigma towards a fictional character, perceived weight-related teasing and fat stereotypes, Lee, Hall, Lucke, Forlini, and Carter (2014) found no significant associations between weight-based stigma towards a fictional character and a diagnosis of food addiction among adults. No significant association between implicit self-discrimination and eating disorders has been reported among adults (Rudolph & Hilbert, 2014).

4.4.2 | Depressive symptoms

The more frequent the experience of weight stigma, the greater the depressive symptoms ($r = .31-.51, all\ p < .05$) (Ashmore et al., 2008; Fettich & Chen, 2012; Friedman et al., 2008; Hatzenbuehler, Keyes,

& Hasin, 2009; Savoy, Almeida, & Boxer, 2012; Wott & Carels, 2010). In addition, the experiences of weight stigma mediated the relationship between weight status and depressive disorders (Levy & Pilver, 2012) and between BMI and depressive symptoms (Hunger & Major, 2014). Related to implicit and explicit weight bias, one study reported that neither implicit nor explicit weight bias was significantly associated with depressive symptoms (Carels et al., 2010); however, another study reported that explicit weight bias was significantly associated ($r = .419, p = .001$) (Carels et al., 2013).

Internalized weight stigma was positively associated with depressive symptoms ($r = .43-.66$, all $p < .05$) (Burmeister & Carels, 2014; Carels et al., 2013; Durso, 2012; Durso, Latner, White, et al., 2012), but one study reported no significant association (Carels et al., 2010). In addition, Hilbert, Braehler, Haeuser, and Zenger (2014) found that self-evaluation mediated the relationship between internalized weight stigma and depressive symptoms. Pearl et al. (2014b) found that depressive symptoms mediated the relationship between internalized weight stigma and self-reported psychological and physiological health.

Perceived weight-related teasing, weight-related victimization and implicit self-discrimination were significantly positively associated with depressive symptoms among adults ($r = .28-.53$, all $p < .05$) (Robinson, 2011; Rudolph & Hilbert, 2014). Perceived weight-related teasing of adults mediated the effect of BMI on depressive symptoms (Hunger & Major, 2014).

4.4.3 | Anxiety

More frequent experience of weight stigma was associated with higher anxiety levels ($r = .33-.39$, all $p < .05$) (Ashmore et al., 2008; Friedman et al., 2008; Hatzenbuehler et al., 2009; Savoy et al., 2012). The experiences of weight stigma also mediated the association between weight status and anxiety among adults (Levy & Pilver, 2012).

Core self-evaluation mediated the relationship between internalized weight stigma and anxiety among adults (Hilbert et al., 2014). However, another study demonstrated no significant association between internalized weight stigma and anxiety among adults (Durso, 2012). No studies in this review examined associations between implicit or explicit weight bias and anxiety.

4.4.4 | Self-esteem

Higher frequency of experienced weight stigma was significantly related to lower self-esteem among adults ($b = -.23, p < .02$) (Friedman et al., 2008); however, another study reported no significant associations with self-esteem (Latner et al., 2009). Still another study indicated that the experiences of weight stigma mediated the relationship between BMI and self-esteem among adults (Hunger & Major, 2014).

Higher internalized weight stigma was significantly associated with lower self-esteem among adults ($r = -.41$ to $-.68$, all $p < .05$) (Durso, 2012; Durso, Latner, White, et al., 2012; Pearl et al., 2014a).

Overvaluation of shape and weight mediated the relationship between internalized weight stigma and self-esteem (Pearl et al., 2014a).

For the other measures of weight stigma, a higher implicit self-discrimination level was significantly associated with lower self-esteem among adults ($r = -.39, p < .001$) (Rudolph & Hilbert, 2014) and an individual's weight stigma concerns mediated the relationship between BMI and self-esteem among adults (Hunger & Major, 2014). No studies in this review reported associations between implicit or explicit weight bias and self-esteem.

4.4.5 | Body image

Higher frequency of experienced weight stigma was significantly associated with higher body image dissatisfaction among adults ($r = .25-.41, b = 0.40$, all $p < .05$) (Farrow & Tarrant, 2009; Friedman et al., 2008; Latner et al., 2009) and was significantly associated with concerns regarding body shape ($r = .44, p < .015$) (Savoy, 2010). Higher implicit weight bias was associated with higher investments in personal appearance ($r = .27, p < .05$), but explicit weight bias was not significantly associated with body image (Carels et al., 2010).

Higher internalized weight stigma was significantly associated with higher body image dissatisfaction ($r = .60, p < .01$) (Durso, 2012), lower appearance evaluation ratings ($r = -.63, p < .01$) (Carels et al., 2010) and lower body satisfaction ($r = -.51, p < .01$) (Burmeister & Carels, 2014). For the other measures of weight stigma, Robinson (2011) reported that greater perceived weight-related teasing was associated with higher body image dissatisfaction ($r = .42, p < .01$).

4.4.6 | Other psychological distress

The experiences of weight stigma were significantly positively associated with interpersonal sensitivity (Ashmore et al., 2008), social isolation and social phobia (Ashmore et al., 2008; Hatzenbuehler et al., 2009), suspiciousness (Ashmore et al., 2008), hostility (Ashmore et al., 2008), phobic anxiety (Friedman et al., 2008), perceived stress and dysthymia (Hatzenbuehler et al., 2009), nicotine, alcohol and drug dependence (Hatzenbuehler et al., 2009), manic or hypomanic episodes (Hatzenbuehler et al., 2009), panic and posttraumatic stress disorder (Hatzenbuehler et al., 2009), fear of fat and weight gain (Latner et al., 2009), antisocial behaviour (Savoy et al., 2012) and negative association with the 'in group' social consensus ($r = -.20, p < .01$) (Farrow & Tarrant, 2009). No studies in this review looked at associations between implicit or explicit weight bias and other types of psychological distress.

5 | DISCUSSION

Frequency of experiencing weight stigma, internalized weight stigma, implicit weight bias and explicit weight bias are four types of measures that were found in current literature for measuring weight stigma in overweight and obese adults. The majority of the studies

in our review focused on the impact of the frequency of experiencing weight stigma by using self-report frequency tools. However, whether the frequency of experienced weight stigma is equal to the level of stress a person perceives may require further discussion. The personal perception of weight stigma for individuals may lead to different stress levels and, therefore, may result in different health outcomes.

Overall, our review found that the greater the weight stigma, the worse the physiological health status of overweight and obese adults, regardless of the measures of weight stigma. Obesity and diabetes risk, cortisol, oxidative stress and C-reactive protein levels are all positively related to experiences of weight stigma, but the association between different measures of weight stigma and weight change demonstrated mixed results. We also found in this review that only a few studies reported physiological health outcomes. One reason might be the difficulty of separating the physiological impact of weight stigma from the physiological impact of being overweight or obese. That is, individuals who are overweight or obese have significantly greater physiological vulnerabilities than individuals who are normal weight (Tsenkova et al., 2011). For instance, higher frequency of experienced weight stigma may increase HbA1c by activating the hypothalamic–pituitary–adrenal axis (Tsenkova et al., 2011). However, it is difficult to determine by an observational study design whether the increase of HbA1c is due to weight stigma. One solution to this design problem is to use a manipulated weight stigma intervention. Two studies in our review employed weight stigma scenarios and videos and measured cortisol at baseline and 30-min postmanipulation (Himmelstein et al., 2014; Schvey et al., 2014). However, the long-term impact of weight stigma on cortisol levels remains unclear. Longitudinal studies with larger samples of overweight and obese adults are needed.

The current review found that the greater the weight stigma, the greater the eating disturbances, depressive symptoms, anxiety and body image dissatisfaction and the lower the self-esteem among overweight and obese adults, regardless of the measures of weight stigma. Weight stigma is a stressor to overweight and obese people. Overeating has been found to be a comfort-seeking behaviour and may help individuals who are overweight or obese to manage the stress caused by weight stigma (Tomiyama, 2014). In addition, when people who are overweight or obese are faced with negative judgments related to being overweight or obese, they may feel blamed or accused for failing to be healthy and thin. Therefore, they may feel dissatisfied with their body image and have a sense of shame, which, in turn, may increase depression and anxiety (Kemeny, Grunewald, & Dickerson, 2004; Tomiyama, 2014).

The negative influences from weight stigma are preventable. The first step of prevention is to alert the public to the importance of the weight stigma issue. It is imperative that researchers, clinicians and the public become aware of the adverse effects of weight stigma. For example, the Binge Eating Disorder Association has established Weight Stigma Awareness Week as an annual online event recurring in the last week of September to educate the public about weight stigma and to focus on children's perceptions of

weight bias (Binge Eating Disorder Association 2016). The for-pay television channel HBO created a short film called 'Stigma: The Human Cost of Obesity' to document the stigma and discrimination individuals have faced because of their weight (UConn Rudd Center 2017). These important actions comprise the first step in educating the public about weight stigma.

In addition, assessment tools for weight stigma should be developed for healthcare providers. The purpose of the tools would be to not only assess for weight stigma routinely but also to initiate discussion about weight stigma between healthcare providers and individuals who are overweight or obese, their family members and friends. It is important to include the family members and friends of individuals who are overweight or obese in the weight stigma conversation because these individuals may also experience weight stigma comments or treatment from their family members or friends (Wu & Liu, 2015). Such a conversation about weight stigma can provide an opportunity for providers to educate affected people about the adverse physiological and psychological conditions weight stigma may be having on their health.

6 | REVIEW LIMITATIONS

This review of the literature had several limitations. First, only four databases for English articles were searched and publications may have been missed. Second, we included both physiological and psychological health outcomes, but we excluded behavioural outcomes. Third, we excluded the articles that reported weight stigma related to children and adolescents, which may limit our understanding of weight stigma on the younger generation.

7 | CONCLUSION

This review provides important information on measures of weight stigma and its associations with health outcomes for overweight and obese individuals. Providing regular and accessible weight stigma education to the public and clinical healthcare providers is necessary. A more convenient and easy-to-use tool must be developed for screening individuals who are overweight or obese for weight stigma in clinical settings. In addition, longitudinal studies measuring personal perception of weight stigma are needed to further examine the long-term impact of weight stigma on physiological, psychological and behavioural aspects for adults, children and adolescents.

AUTHOR CONTRIBUTIONS

All authors have agreed on the final version and meet at least one of the following criteria (recommended by the ICMJE [<http://www.icmje.org/recommendations/>]):

1. substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data;

2. drafting the article or revising it critically for important intellectual content.

CONFLICTS OF INTEREST

No conflict of interest has been declared by the authors.

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