

# Disgust Sensitivity, Obesity Stigma, and Gender: Contamination Psychology Predicts Weight Bias for Women, Not Men

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Recent research has established a link between disgust sensitivity and stigmatizing reactions to various groups, including obese individuals. However, previous research has overlooked disgust's multiple evolved functions. Here, we investigated whether the link between disgust sensitivity and obesity stigma is specific to pathogen disgust, or whether sexual disgust and moral disgust—two separate functional domains—also relate to negative attitudes toward obese individuals. Additionally, we investigated whether sex differences exist in the manner disgust sensitivity predicts obesity stigma, whether the sexes differ across the subtypes of obesity bias independent of disgust sensitivity, and last, the association between participants' BMI and different subtypes of obesity stigma. In study 1 ( $N = 92$ ), we established that obesity elicits pathogen, sexual, and moral disgust. In study 2, we investigated the relationship between these types of disgust sensitivity and obesity stigma. Participants ( $N = 387$ ) reported their level of disgust toward various pathogen, sexual, and moral acts and their attitudes toward obese individuals. For women, but not men, increased pathogen disgust sensitivity predicted more negative attitudes toward obese individuals. Men reported more negative general attitudes toward obese individuals whereas women reported greater fear of becoming obese. The sexes also differed in how their own BMI related to the subtypes of obesity stigma. These findings indicate that pathogen disgust sensitivity plays a role in obesity stigma, specifically for women. Defining the scope of disgust's activation in response to obesity and its relationship with other variables can help identify possible mechanisms for understanding and ultimately alleviating prejudice and discrimination.

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## INTRODUCTION

Researchers interested in the processes regulating negative attitudes toward stigmatized groups have recognized the importance of disgust. Across a growing number of studies, individual differences in disgust sensitivity have been shown to predict negative attitudes toward out-group members (1–4), the physically handicapped (5), colostomy patients (6), homosexuals (7), and obese individuals (8,9). Given the widespread prejudice and discrimination faced by obese individuals because of their weight (10,11), it is important to understand the multiple mediators of obesity stigma, which may include disgust sensitivity.

Disgust sensitivity is a term used to describe individual differences in reactivity toward elicitors of disgust. This construct has been used in hundreds of studies in clinical, social, and personality psychology, including studies concerning prejudice and intergroup relations (2,4) and myriad psychopathologies (ref. 12; for more on how this term has been used, see ref. 13). To better understand and potentially correct antiobesity

attitudes, it is important to examine how one's sensitivity to disgust, an emotion already linked to bigotry and its harmful sequelae (14), relates to obesity bias.

Many researchers have suggested that the emotion disgust evolved to perform the function of disease avoidance (15–17). Over human evolutionary history, disease-causing organisms exerted large selection pressures leading to the evolution of physiological and psychological mechanisms (e.g., disgust) designed to combat their negative consequences (18). Importantly, the disgust response hinges on the ability to detect pathogens. Given the higher costs associated with incorrectly categorizing a contaminated object as uncontaminated vs. incorrectly categorizing an uncontaminated object as contaminated, our disease avoidance and disgust psychology should be biased in registering a potential threat under circumstances of uncertainty (19). Thus, obesity might trigger disgust for multiple reasons, not all of which relate to objective pathogen threat. It could be that the excessive storage of body fat served as a direct cue of pathogen presence often enough

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during human evolution to have selected for a psychological adaptation that motivates the avoidance of obese individuals. However, given that widespread obesity appeared relatively recently (20), it seems unlikely that humans possess bona fide psychological adaptations that specifically evolved to deal with this condition. Rather, it is more likely that responses to obesity are by-products of systems that evolved to monitor for cues associated with disease. That is, obesity appears to share some of the same bodily features (e.g., skin swellings, fluid build-up) present in infectious conditions that would have been present in ancestral environments (e.g., lymphedema filariasis, which is caused by a parasitic worm; ref. 21). Hence, the connection between disgust sensitivity and obesity bias may result from evolved psychological mechanisms for disease-avoidance “hitch-hiking” on perceptions of modern individuals, including the obese. These evolved dispositions could then influence the spread of negative attitudes toward the obese within social circles (e.g., ref. 22).

Behavioral and neuroscientific investigations indicate that disgust sensitivity and obesity stigma are indeed linked (9,23,24). Although Park *et al.* (8) suggest this link is related to pathogen avoidance, disgust serves other functions, which might contribute to the development of biased attitudes. This raises a number of questions we address here.

One question we address is whether sensitivities to disgust distinct from pathogens predict attitudes toward obese individuals. Disgust is a heterogeneous emotion, elicited in response to a variety of acts and items. Multiple models of disgust have been proposed, each with a distinct way of categorizing the many disgust elicitors (15,16). A growing body of evidence suggests that disgust functions in three separate domains motivating the avoidance of (i) substances associated with disease (pathogen disgust), (ii) sexual partners and behaviors imposing net fitness costs (sexual disgust), and (iii) individuals imposing large fitness costs in social interactions (moral disgust; see refs. 15,25–27). Earlier models of disgust took into consideration disease-related substances, sexual acts, and sociomoral transactions (16), but during the development of instruments designed to assay disgust sensitivity, researchers measured only sensitivity to pathogen disgust, often with substantial measurement problems (15,28). Thus, the field has lacked an instrument capable of measuring individual differences across all three functional domains.

In an attempt to remedy this situation, Tybur *et al.* (15) developed the Three Domain Disgust Scale (TDDS), a measure of sensitivity to pathogen, sexual, and moral disgust. Whereas previous research on obesity bias has assessed Perceived Vulnerability to Disease (PVD) (8), a measure that does not ask about disgust sensitivity directly, or has focused only on pathogen disgust (9), for instance via the Disgust Scale Revised (28), the present study examined the relationship between sensitivity to multiple disgust domains and obesity stigma. For comparison with previous research, we also examined the association between PVD and obesity stigma.

Antiobese attitudes are themselves heterogeneous, raising the question of whether sensitivity to the different disgust

domains, pathogen, sexual, and moral disgust, similarly predict the diverse types of judgments assayed by obesity bias measures (e.g., dislike of obese people, fear of becoming overweight oneself, evaluation of the attractiveness of obese individuals; refs. 29,30). Although Park *et al.* (8) found that the “dislike” subscale of the Anti-Fat Attitudes Scale (AFA) (29) was related to the “germ aversions” subscale of the PVD Scale (31), it remains unknown whether pathogen, sexual, and moral disgust have a more textured relationship with the known factors comprising obesity attitudes. For instance, given that one component of obesity stigma relates to sexual attraction/repulsion, it is possible that sexual disgust sensitivity, but not pathogen or moral disgust sensitivity, predicts attitudes within this specific domain. On the other hand, another component of obesity stigma involves blame and attributions of willpower, which may relate to moral disgust sensitivity.

An additional question yet to be explored is whether there are meaningful sex differences in how the different types of disgust predict negative attitudes toward obese individuals. Research on obesity stigma has focused more often on the attitudes of females than males (32,33). When both sexes are studied, evidence for sex differences in attitudes toward obese individuals is mixed (29,30,34–37), with several studies showing greater weight bias by men (e.g., refs. 29,30,37) and fewer studies showing greater weight bias by women (e.g., refs. 35,36). The Park *et al.* (8) study investigating the relationship between weight bias and disease concepts included only 13 men out of 60 participants, raising the question of whether their results are generalizable to both sexes and whether they hold across the subtypes of obesity attitudes (e.g., general negativity, fear of becoming fat, social distance).

### The current investigation

Here, we report on two separate studies. The first served as a pilot study and examined how pathogen, sexual, and moral disgust are associated with obesity. Establishing that obesity elicits disgust provided the background for exploring more fine-grained relationships between disgust sensitivity and obesity stigma. Thus, study 2 investigated how the various domains of disgust sensitivity relate to obesity attitudes, the extent to which the sexes differ in their reactions to obesity in general, and whether sensitivity to different disgust domains predicts obesity attitudes for each sex. Using two separate, multidimensional measures of attitudes toward obese individuals, we made the following general predictions.

First, in line with previous research showing a relationship between disease concepts and attitudes toward obese individuals (8), we predicted that sensitivity to pathogen disgust would predict obesity stigma. However, we predicted this relationship would be qualified by an interaction with gender. Due to their greater reproductive demands (38), women face greater costs associated with infection, perhaps leading to a stronger bias in interpreting ambiguous cues and abnormalities such as obesity as greater pathogen threats. That is, all else equal, a woman has more to lose by selecting a mate who shows signs of disease than does a man; an infected woman runs a greater risk

of compromising the health of any developing offspring than does an infected man (38). Thus, in women, greater sensitivity to pathogen disgust should coincide with more negative attitudes toward obese individuals. Given that prior work on the relationship between pathogen concepts and obesity attitudes used the PVD Scale (8), a scale that does not directly assay disgust, we compared the predictive power of the PVD Scale and the TDDS, which does directly measure sensitivities to pathogen disgust (15), on obesity stigma.

Second, whereas sensitivity to pathogen disgust should predict the various subscales of obesity stigma measures that relate to social distance and social interaction, subscales that measure attraction are predicted to activate sexual disgust. That is, we predicted that greater disgust sensitivity toward sexual behaviors in general should be associated with more negative attitudes regarding the attraction of obese individuals. In addition, obesity stigma subscales related to willpower and attributions of responsibility were predicted to correlate with moral disgust, as obese individuals are often labeled as having the negative moral attributes of laziness and lack of discipline (10,11,39).

Third, regarding sex differences, despite recent findings that men can also struggle with body image issues (40,41), some research has shown that women are more concerned with body image and show greater negative attitudes than men even toward average-weight targets (39). We therefore predicted that, independent of disgust sensitivities, men would hold more weight biased attitudes than women in general, but women would show greater fear of becoming obese themselves.

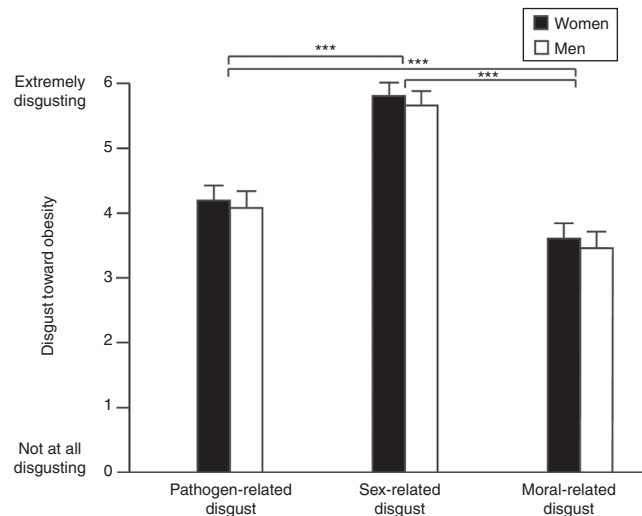
Last, previous research has demonstrated mixed results on the relationship between participants' own BMI ( $\text{kg}/\text{m}^2$ ) and attitudes toward obese individuals. Some studies have shown no relationship (37,42) whereas others have suggested that heavier body weight may be associated with less negative attitudes (43). Therefore, the present study also explored the relationship between participant body weight and attitudes regarding obesity.

## STUDY 1

### Methods

**Participants.** Ninety two undergraduate students (43 males; 49 females) participated in exchange for course credit (age range: 18–23, mean: 18.92; s.d.: 1.31). Underweight ( $\text{BMI} < 18.5$ ):  $N = 8$  (8.7%); normal weight ( $18.5 \leq \text{BMI} < 25$ ):  $N = 66$  (71.7%); overweight ( $25 \leq \text{BMI} < 30$ ):  $N = 15$  (16.3%); obese ( $\text{BMI} \geq 30$ ):  $N = 3$  (3.3%). Ethnic composition of sample: white: 57%; hispanic: 23%; Asian/Pacific Islander: 10%; black: 7%; other or unspecified: 3%.

**Materials and procedures.** Subjects completed a short questionnaire in which they answered on a 7-point Likert scale: “How morally disgusting do you find obesity, that is, how wrong is it for someone to be obese?” (scale anchors: 0 = not morally disgusting at all; 6 = extremely morally disgusting); “How sexually disgusting do you find obese individuals, that is, how disgusting would it be to have sex with someone who was obese?” (scale



**Figure 1** Ratings of obesity on questions measuring pathogen, sexual, and moral disgust ( $M \pm s.e.$ ;  $N = 92$ ). \*\*\* $P \leq 0.001$ .

anchors: 0 = not sexually disgusting at all; 6 = extremely sexually disgusting); “In terms of disease and overall grossness, how disgusting do you find obese individuals?” (scale anchors: 0 = not disgusting at all; 6 = extremely disgusting). Subjects confirmed that they interpreted this last question as relating to disease and contagion during debriefing.

**Data analyses.** We analyzed whether the means from each question significantly differed from zero to determine whether obesity elicits disgust in the domains of disease, sexuality, and, separately, morality. We also compared the means across disgust domains.

### Results

As **Figure 1** shows, participants rated obesity as disgusting, (i.e., they indicated responses significantly greater than zero) on the questions measuring pathogen disgust ( $t_{91} = 24.74$ ,  $P < 0.001$ ), sexual disgust ( $t_{91} = 39.30$ ,  $P < 0.001$ ), and moral disgust ( $t_{91} = 20.31$ ,  $P < 0.001$ ). Comparing across domains, ANOVA indicated that there were indeed differences across domains ( $F_{2,90} = 86.66$ ,  $P < 0.001$ ), with the strongest disgust response seen in the sexual domain (see **Figure 1**). Overall, obesity elicited significantly more sexual disgust ( $M = 5.75$ ; s.d. = 1.40) than pathogen disgust ( $M = 4.15$ ; s.d. = 1.61;  $t_{91} = 10.89$ ,  $P < 0.001$ ), significantly more sexual disgust than moral disgust ( $M = 3.54$ ; s.d. = 1.67;  $t_{91} = 12.74$ ,  $P < 0.001$ ), and significantly more pathogen disgust than moral disgust ( $t_{91} = 4.40$ ,  $P < 0.001$ ). There were no sex differences ( $P > 0.63$ ).

### Discussion

Study 1 confirms that individuals do indeed find obesity to be disgusting. The question remains, however, whether the *disgust* toward obese individuals found in study 1 relates to overall bias against obese individuals. In study 2, we address this issue and investigate the relationship between disgust sensitivity and obesity bias.

**Table 1** Correlations (*r*) between the AFA and UMB scales

	UMB Composite Scale	UMB Attraction Subscale	UMB Equal Rights Subscale	UMB Negative Judgment Subscale	UMB Social Distance Subscale
AFA Composite	0.56	0.58	0.17	0.42	0.53
AFA Dislike Subscale	0.59	0.5	0.24	0.41	0.61
AFA Fear of Becoming Fat Subscale	0.16	0.27	−0.06**	0.16	0.14*
AFA Blame Attribution Subscale	0.44	0.5	0.17	0.32	0.32

AFA, Anti-Fat Attitudes Scale; UMB, Universal Measure of Bias-FAT.  
All  $P \leq 0.001$  except where indicated; \* $P \leq 0.01$ ; \*\* $P > 0.05$ ;  $N = 387$ .

## STUDY 2

### Methods

**Participants.** 411 undergraduate students (136 males; 275 females) participated in exchange for course credit (age range: 18–70; mean (s.d.) = 21.15 (4.73); BMI range: 17–44; mean (s.d.) = 23.17 (4.36)). Underweight (BMI < 18.5):  $N = 29$  (7.5%); normal weight ( $18.5 \leq \text{BMI} < 25$ ):  $N = 250$  (64.6%); overweight ( $25 \leq \text{BMI} < 30$ ):  $N = 71$  (18.3%); obese (BMI  $\geq 30$ ):  $N = 37$  (9.6%). Ethnic composition of sample: Asian/Pacific Islander: 76%; white: 15%; Hispanic: 2%; black: 1%; Native American: 1%; other or unspecified: 5%.

**Materials and procedures.** Participants were brought into the laboratory and completed a survey that included the AFA (29), the Universal Measure of Bias-FAT (UMB; ref. 30), the TDDS (15), and the PVD Scale (31). Additional tasks unrelated to the present study were included to prevent expectancy biases.

The AFA Scale consists of 13 statements regarding obese individuals rated on a 9-point scale ranging from strongly disagree to strongly agree (29). Seven questions relate to the dislike of and discrimination against obese individuals (e.g., “If I were an employer looking to hire, I might avoid hiring a fat person”); three questions relate to feelings about one’s own weight gain (e.g., “I feel disgusted with myself when I gain weight”); and three questions relate to attributions of responsibility to individuals who are obese (e.g., “Some people are fat because they have no willpower”). The scale has good internal consistency and convergence with other measures of prejudice and blame (29). Following previous research (8), an overall AFA score was computed by averaging responses to all 13 questions. For the AFA Scale (Cronbach’s  $\alpha = 0.84$ ), the dislike, personal weight gain, and attributions of responsibility subscales had Cronbach’s  $\alpha$  of 0.84, 0.89, and 0.76, respectively.

The UMB-FAT Scale is a 20-item measure that assays attitudes toward obese individuals on a 7-point Likert scale (30). In general, the UMB was designed to compare the strength of bias against various groups and has been validated as a measure of antiobesity attitudes and shown to possess good internal consistency. In addition to a composite score, this instrument has four factors corresponding to: negative judgments (e.g., “Fat people are sloppy”), social distance (e.g., “I would not want to have a fat person as a roommate”), attraction (e.g., “Fat people are a turnoff”), and equal rights (e.g., “Special effort should be taken to make sure that fat people have the same rights and

privileges as other people”). Importantly, the UMB Scale, unlike the AFA Scale includes a measure of sexual attraction allowing us to test the link between sexual disgust and these particular negative attitudes toward obese individuals. The 20-item UMB Scale yielded an overall  $\alpha$  of 0.87. The  $\alpha$  for the subscales were as follows: negative judgment ( $\alpha = 0.74$ ), distance ( $\alpha = 0.72$ ), attraction ( $\alpha = 0.84$ ), and equal rights ( $\alpha = 0.83$ ).

We included both measures of antiobesity attitudes to maximize the breadth of our examination of the relationship between disgust sensitivity and the varied facets of antiobesity attitudes. The AFA and UMB scales are composed of different factors and together provide greater detail on the source of negative judgments toward obese individuals. We provide the correlations between the AFA and UMB composite scores and subscales in [Table 1](#).

The TDDS measures individual differences in sensitivity to pathogen disgust, sexual disgust, and moral disgust (15). The scale consists of 21 items, 7 in each domain, rated on a 7-point Likert-like scale ranging from not disgusting at all to extremely disgusting. Examples of pathogen disgust: “Stepping on dog poop” and “Standing close to a person who has body odor”; sexual disgust: “Hearing two strangers having sex” and “Bringing someone you just met back to your room to have sex”; moral disgust: “Stealing from a neighbor” and “Forging someone’s signature on a legal document”. The TDDS is currently the only validated instrument that measures sexual disgust and allows for an examination of how the different types of disgust relate to different constructs. For the TDDS, the items formed a pathogen disgust factor ( $\alpha = 0.77$ ), a sexual disgust factor ( $\alpha = 0.84$ ), and a moral disgust factor ( $\alpha = 0.87$ ).

The PVD Scale (31) was used to measure perceived disease susceptibility. It measures responses to 15 statements on a 7-point Likert-like scale with anchors ranging from strongly disagree to strongly agree. The PVD Scale contains two subscales, one measuring perceived infectability (e.g., “In general, I am very susceptible to colds, flu and other infectious diseases”) and the other measuring germ aversion (e.g., “I prefer to wash my hands pretty soon after shaking someone’s hand”). The PVD-15 item scale had an  $\alpha$  of 0.82 with  $\alpha$  of 0.71 and 0.87 for the germ aversion and perceived infectability subscales, respectively.

Participants also reported their height and weight, which were used to calculate BMI ( $\text{kg}/\text{m}^2$ ) following Kraemer *et al.* (44), and their level of religiosity by answering the single

**Table 2** Results of regression analyses on the AFA composite scale and subscales

	AFA		Dislike Subscale		Fear of Becoming Fat Subscale		Blame Attribution Subscale	
	Composite Scale				Fear of Becoming Fat Subscale		Blame Attribution Subscale	
	$\beta$	s.e.	$\beta$	s.e.	$\beta$	s.e.	$\beta$	s.e.
Model 1								
Age	−0.15**	0.01	−0.06	0.01	−0.15**	0.03	−0.13**	0.02
Gender	0.06	0.15	−0.14**	0.16	0.40***	0.27	−0.11*	0.21
BMI	0.03	0.02	−0.11*	0.02	0.16***	0.03	0.05	0.02
Model 2								
Age	−0.12*	0.02	−0.06	0.02	−0.12*	0.03	−0.10*	0.02
Gender	0.09	0.16	−0.10†	0.18	0.40***	0.29	−0.11†	0.24
BMI	0.03	0.02	−0.12*	0.02	0.17***	0.03	0.06	0.02
Pathogen disgust	0.20***	0.01	0.11*	0.01	0.18***	0.02	0.16**	0.01
Sexual disgust	−0.11†	0.01	−0.12†	0.01	−0.05	0.02	−0.05	0.01
Moral disgust	−0.07	0.01	−0.04	0.01	−0.05	0.01	−0.07	0.01
Model 3								
Age	−0.13*	0.02	−0.06	0.02	−0.12*	0.03	−0.11*	0.02
Gender	0.09	0.17	−0.10†	0.19	0.41***	0.31	−0.12*	0.25
BMI	0.23*	0.03	0.08	0.03	0.35***	0.05	0.07	0.04
Pathogen Disgust	0.05	0.02	−0.01	0.02	0.1	0.03	0.05	0.03
Sexual Disgust	0.01	0.02	0.01	0.02	−0.01	0.03	0.04	0.02
Moral Disgust	0.03	0.01	0.02	0.01	0.05	0.02	−0.02	0.02
BMI × Gender	−0.23*	0.15	−0.23*	0.16	−0.22*	0.27	−0.01	0.22
Pathogen Disgust × Gender	0.16†	0.16	0.13	0.17	0.09	0.28	0.13	0.22
Sexual Disgust × Gender	−0.14	0.18	−0.014	0.2	−0.05	0.32	−0.11	0.26
Moral Disgust × Gender	−0.12	0.15	−0.07	0.16	−0.13	0.27	−0.07	0.21

AFA, Anti-Fat Attitudes Scale.

\*\*\* $P \leq 0.001$ ; \*\* $P \leq 0.01$ ; \* $P \leq 0.05$ ; † $P \leq 0.10$ . All regression models were significant ( $P$ 's ranged from  $<0.001$ – $0.025$ ).  $R^2$ : AFA Composite Scale: Model 1: 0.02; Model 2: 0.06, Model 3: 0.09; Dislike Subscale: Model 1: 0.03; Model 2: 0.05, Model 3: 0.07; Fear of Becoming Fat Subscale: Model 1: 0.18; Model 2: 0.20, Model 3: 0.22; Blame Attribution Subscale: Model 1: 0.03; Model 2: 0.06, Model 3: 0.07.

question, “How religious do you consider yourself to be?” on a scale of 1 (not religious at all) to 7 (extremely religious).

**Data analyses.** All analyses report the two-tailed  $P$  value. Twenty-four participants did not complete all instruments and were therefore not included in analyses. There were no systematic differences in age, gender, or BMI observed between these 24 subjects and the remaining 387 subjects (125 men and 262 women).

Following Green (45), we conducted identical multiple regression analyses on each obesity stigma composite scale and their subscale components. To determine the extent to which the different domains of disgust predict attitudes relating to obesity, and whether similar disgust domains underpin such attitudes in males and females, the following independent variables were entered into analyses: gender, sensitivities to pathogen, sexual, and moral disgust, interactions between each disgust domain and gender, BMI and the interaction between BMI and gender. Given the age range of our sample, we also included age as a covariate. Variables were entered in blocks, which generate different regression models for each

block of variables (46). Gender was dummy coded and continuous variables were centered to allow for interpretability of simple effects (e.g., of pathogen disgust) within male and female participants (see ref. 47). All analyses were carried out in SPSS 17.0.

## Results

**Disgust sensitivity and obesity stigma.** For the composite AFA Scale, regression analyses revealed a marginally significant interaction between pathogen disgust and gender on the composite AFA score ( $\beta = 0.16$ ,  $t = 1.72$ ,  $P = 0.08$ , Table 2, model 3). Closer inspection of how each disgust domain predicted antiobesity attitudes for men and women separately revealed that for women, but not men, greater pathogen disgust sensitivity significantly predicted greater antiobesity attitudes (Table 3). This held for the composite AFA score ( $\beta = 0.25$ ,  $t = 3.80$ ,  $P < 0.001$ ) as well as each of the three subscales (dislike subscale:  $\beta = 0.15$ ,  $t = 2.28$ ,  $P = 0.023$ ; Fear of Becoming Fat Subscale:  $\beta = 0.20$ ,  $t = 3.36$ ,  $P = 0.001$ ; blame attribution subscale:  $\beta = 0.21$ ,  $t = 3.18$ ,  $P = 0.002$ ). In contrast, sensitivity to pathogen disgust did not predict AFA scores for

**Table 3 Comparison of regression coefficients (and s.e.s) for the AFA scale and subscales for men and women**

	Composite Scale		Dislike Subscale		Fear of Becoming Fat Subscale		Blame Attribution Subscale	
	Men	Women	Men	Women	Men	Women	Men	Women
BMI	0.23* (0.03)	−0.06 (0.02)	0.08 (0.03)	−0.20** (0.02)	0.35*** (0.05)	0.09 (0.04)	0.07 (0.04)	0.06 (0.03)
Pathogen Disgust	0.05 (0.02)	0.25*** (0.01)	−0.01 (0.02)	0.15* (0.01)	0.10 (0.03)	0.20*** (0.02)	0.05 (0.02)	0.21** (0.02)
Sexual Disgust	0.01 (0.01)	−0.002	0.01 (0.02)	−0.002	−0.01 (0.03)	−0.09 (0.02)	0.04 (0.02)	−0.11 (0.02)
Moral Disgust	0.03 (0.01)	−0.13 (0.01)	0.02 (0.01)	−0.07 (0.01)	0.05 (0.02)	−0.11 (0.02)	−0.02 (0.02)	−0.11 (0.01)

AFA, Anti-Fat Attitudes Scale.

\*\*\* $P \leq 0.001$ ; \*\* $P \leq 0.01$ ; \* $P \leq 0.05$ .

men (all  $\beta < 0.10$ , all  $P > 0.25$ ). For women, sexual disgust also predicted attitudes regarding obesity, but in the opposite direction. The greater a woman's sexual disgust sensitivity, the less negative (more favorable) her attitudes toward obese individuals (AFA composite:  $\beta = -0.18$ ,  $t = 2.37$ ,  $P = 0.018$ ; dislike subscale:  $\beta = -0.19$ ,  $t = 2.41$ ,  $P = 0.016$ ). There was no relationship between moral disgust sensitivity and the AFA Scale for men or women.

Disgust sensitivities also predicted bias against obese individuals as measured by the UMB Scale (Table 4, model 2). For women but not men, greater sensitivity to pathogen disgust predicted composite UMB Scale scores ( $\beta = 0.18$ ,  $t = 2.86$ ,  $P = 0.005$ ) and three of the four subscales (attraction subscale:  $\beta = 0.28$ ,  $t = 4.32$ ,  $P < 0.001$ ; negative judgment subscale:  $\beta = 0.16$ ,  $t = 2.46$ ,  $P = 0.014$ ; social distance subscale:  $\beta = 0.16$ ,  $t = 2.49$ ,  $P = 0.013$ ; Table 5). There was not a significant relationship between pathogen disgust sensitivity and the equal rights subscale. For women only, there was also a significant relationship between sexual disgust and attitudes toward obese individuals, but in the opposite direction. The greater a woman's sensitivity to sexual disgust, the less bias exhibited toward obese individuals overall (composite:  $\beta = -0.21$ ,  $t = 2.78$ ,  $P = 0.006$ ), the greater the attraction ( $\beta = -0.33$ ,  $t = 4.34$ ,  $P < 0.001$ ), and the more inclined to socially interact with obese individuals ( $\beta = -0.21$ ,  $t = 2.71$ ,  $P = 0.007$ ). There was no relationship between moral disgust and any of the subscales for men or women.

**Pathogen disgust sensitivity, PVD, and obesity stigma.** As mentioned above, PVD is a measure conceptually analogous to the pathogen disgust subscale, yet does not directly assess disgust as the TDDS does. As predicted, these two measures were significantly correlated in the current sample,  $r = 0.38$ ,  $P < 0.001$ ,  $N = 387$ , although the pathogen disgust subscale was more strongly correlated with the PVD germ aversion subscale ( $r = 0.45$ ,  $P < 0.001$ ) than the PVD infectability subscale ( $r = 0.17$ ,  $P = 0.001$ ). We conducted additional regression analyses to determine whether the pathogen disgust subscale of the TDDS or the PVD subscales better predict the composite AFA score and, separately, the composite UMB score. Analyses included only women's data because only women showed a significant positive relationship between pathogen disgust and attitudes toward obese individuals. In regression analyses we entered into

the model sensitivities to pathogen, sexual, and moral disgust, scores on the PVD infectability and germ aversion subscales, age, and BMI.

For both AFA and UMB scales, we found that only sensitivity to pathogen disgust positively predicted weight bias (AFA:  $\beta = 0.20$ ,  $t = 2.90$ ,  $P = 0.004$ ; UMB:  $\beta = 0.16$ ,  $t = 2.29$ ,  $P = 0.023$ ). Neither PVD subscale was significant (AFA: infectability:  $\beta = -0.04$ ; germ aversion:  $\beta = 0.13$ ; UMB: infectability:  $\beta = -0.07$ ; germ aversion:  $\beta = 0.09$ ). As before, sexual disgust also negatively predicted both composite scores (AFA:  $\beta = -0.18$ ,  $t = 2.66$ ,  $P = 0.008$ ; UMB:  $\beta = -0.21$ ,  $t = 3.04$ ,  $P = 0.003$ ). Consistent with the regression analyses reported in Tables 2 and 4, age was a significant predictor (AFA:  $\beta = -0.15$ ,  $t = 2.32$ ,  $P = 0.021$ ; UMB:  $\beta = -0.15$ ,  $t = 2.31$ ,  $P = 0.022$ ) as was BMI, but only for the UMB Scale ( $\beta = -0.20$ ,  $t = 3.26$ ,  $P = 0.001$ ; see BMI results below).

We conducted similar analyses for men ( $N = 125$ ) and found, as before, that pathogen disgust did not predict antiobesity attitudes (AFA:  $\beta = 0.005$ ,  $t = 0.05$ ,  $P > 0.05$ ; UMB:  $\beta = 0.17$ ,  $t = 1.56$ ,  $P > 0.05$ ). Consistent with this finding, we also did not find a statistically significant relationship between the conceptually related germ aversion PVD subscale and composite scores on the AFA ( $\beta = 0.20$ ,  $t = 1.92$ ,  $P > 0.05$ ) or UMB ( $\beta = -0.01$ ,  $t = 0.08$ ,  $P > 0.05$ ). However, we did find a significant negative relationship for the infectability subscale, but only with the composite AFA ( $\beta = -0.20$ ,  $t = 2.14$ ,  $P = 0.035$ ), not the UMB Scale ( $\beta = -0.02$ ,  $t = 0.22$ ,  $P > 0.05$ ).

**Sex differences and obesity stigma.** For the AFA Scale, gender was a significant predictor of each subscale (fear of becoming fat:  $\beta = 0.41$ ,  $t = 7.56$ ,  $P < 0.001$ ; attributions of blame:  $\beta = -0.12$ ,  $t = 1.98$ ,  $P = 0.049$ ; and, marginally, dislike:  $\beta = -0.10$ ,  $t = 1.69$ ,  $P = 0.091$ ; see Table 2). However, the direction of the sex difference varied across subscales. Women ( $M = 6.47$ ; s.d. = 2.47) reported significantly greater fear of becoming fat than did men ( $M = 4.39$ ; s.d. = 2.43;  $t_{385} = 7.78$ ,  $P < 0.001$ ). In contrast, men ( $M = 6.15$ ; s.d. = 1.74) were significantly more likely to attribute obesity to a lack of willpower ( $M = 6.15$ ; s.d. = 1.74) and to report greater dislike of obese individuals ( $M = 2.96$ ; s.d. = 1.48) than did women (attribution of willpower:  $M = 5.65$ , s.d. = 2.01,  $t_{385} = 2.40$ ,  $P = 0.017$ ; dislike:  $M = 2.58$ , s.d. = 1.45,  $t_{385} = 2.36$ ,  $P = 0.019$ ).

**Table 4 Results of regression analyses on the UMB composite scale and subscales**

	UMB Composite Scale		Attraction Subscale		Equal Rights Subscale		Negative Judgment Subscale		Social Distance Subscale	
	$\beta$	s.e.	$\beta$	s.e.	$\beta$	s.e.	$\beta$	s.e.	$\beta$	s.e.
<i>Model 1</i>										
Age	-0.13**	0.01	-0.10*	0.01	-0.03	0.01	-0.17***	0.01	-0.08†	0.01
Gender	-0.23***	0.09	-0.14**	0.13	-0.26***	0.15	-0.09†	0.12	-0.16**	0.11
BMI	-0.15**	0.01	-0.18***	0.01	-0.03	0.02	-0.05	0.01	-0.19***	0.01
<i>Model 2</i>										
Age	-0.12*	0.01	-0.09†	0.01	-0.03	0.02	-0.16**	0.01	-0.09†	0.01
Gender	-0.17**	0.1	-0.08	0.14	-0.21***	0.17	-0.08	0.14	-0.11*	0.13
BMI	-0.16**	0.01	-0.19***	0.01	-0.05	0.02	-0.04	0.01	-0.20***	0.01
Pathogen disgust	0.18***	0.01	0.23***	0.01	0.02	0.01	0.15**	0.01	0.14**	0.01
Sexual disgust	-0.18**	0.01	-0.20***	0.01	-0.11†	0.01	-0.07	0.01	-0.15*	0.01
Moral disgust	-0.03	0.01	-0.04	0.01	-0.05	0.01	-0.02	0.01	0.03	0.01
<i>Model 3</i>										
Age	-0.12*	0.01	-0.09	0.01	-0.03	0.02	-0.16**	0.01	-0.09	0.01
Gender	-0.17**	0.11	-0.1	0.15	-0.20***	0.18	-0.05	0.14	-0.11*	0.14
BMI	-0.05	0.02	0	0.02	-0.07	0.03	-0.05	0.02	-0.03	0.02
Pathogen disgust	0.15	0.01	0.11	0.02	0.12	0.02	0.13	0.01	0.07	0.01
Sexual disgust	-0.14	0.01	0.02	0.01	-0.18	0.02	-0.19	0.01	-0.05	0.01
Moral disgust	-0.01	0.01	-0.04	0.01	-0.1	0.01	0.08	0.01	0.06	0.01
BMI × gender	-0.13	0.1	-0.23*	0.13	0.01	0.16	0.01	0.13	-0.20*	0.12
Pathogen × gender	0.03	0.1	0.13	0.14	-0.12	0.16	0.03	0.13	0.07	0.13
Sexual × gender	-0.05	0.12	-0.25**	0.16	0.07	0.19	0.13	0.15	-0.11	0.14
Moral × Gender	-0.02	0.1	-0.01	0.13	0.06	0.16	-0.11	0.12	-0.05	0.12

UMB, Universal Measure of Bias.

\*\*\* $P \leq 0.001$ ; \*\* $P \leq 0.01$ ; \* $P \leq 0.05$ ; † $P \leq 0.10$ . All regression models were significant ( $P$  ranged from  $<0.001$  to  $0.003$ ).  $R^2$ : UMB Composite Scale: Model 1: 0.08; Model 2: 0.12, Model 3: 0.13; Attraction Subscale: Model 1: 0.06; Model 2: 0.12, Model 3: 0.15; Equal Rights Subscale: Model 1: 0.07; Model 2: 0.08, Model 3: 0.09; Negative Judgment Subscale: Model 1: 0.04; Model 2: 0.06, Model 3: 0.07; Social Distance Subscale: Model 1: 0.06; Model 2: 0.09, Model 3: 0.10.

**Table 5 Comparison of regression coefficients (and standard errors) for the UMB scale and subscales for men and women**

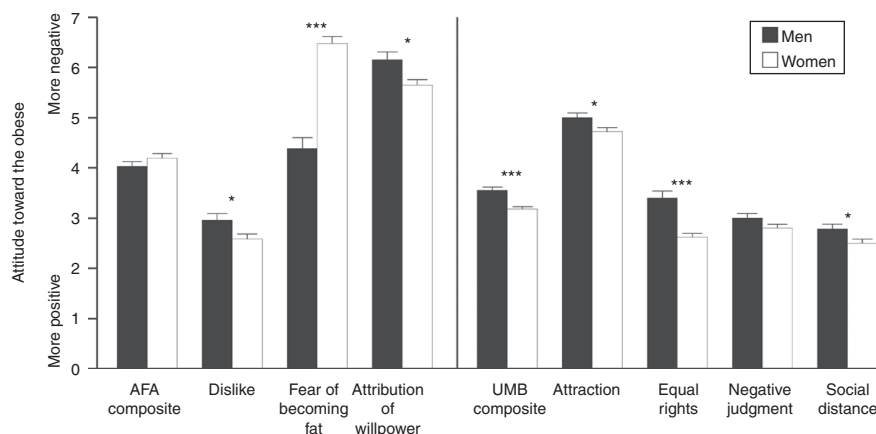
	UMB Composite Scale		Attraction Subscale		Equal Rights Subscale		Negative Judgment Subscale		Social Distance Subscale	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
BMI	-0.05 (0.08)	-0.21*** (0.06)	0.00 (0.11)	-0.27*** (0.07)	-0.07 (0.13)	-0.05 (0.09)	-0.05 (0.11)	-0.04 (0.07)	-0.03 (0.10)	-0.27*** (0.07)
Pathogen disgust	0.15 (0.09)	0.18** (0.06)	0.11 (0.12)	0.28*** (0.08)	0.12 (0.13)	-0.03 (0.10)	0.13 (0.11)	0.16* (0.08)	0.07 (0.11)	0.16* (0.07)
Sexual disgust	-0.14 (0.09)	-0.21** (0.07)	0.02 (0.12)	-0.33*** (0.09)	-0.18 (0.14)	-0.08 (0.11)	-0.19† (0.11)	-0.02 (0.09)	-0.05 (0.11)	-0.21** (0.08)
Moral disgust	-0.01 (0.08)	-0.04 (0.06)	-0.04 (0.11)	-0.04 (0.08)	-0.10 (0.12)	-0.02 (0.10)	0.08 (0.10)	-0.06 (0.08)	0.06 (0.10)	0.00 (0.07)

UMB, Universal Measure of Bias.

\*\*\* $P \leq 0.001$ ; \*\* $P \leq 0.01$ ; \* $P \leq 0.05$ ; † $P < 0.10$ .

For the UMB Scale, gender significantly predicted the composite score, ( $\beta = -0.17$ ,  $t = 2.91$ ,  $P = 0.004$ ) and two of the four subscales (equal rights:  $\beta = -0.20$ ,  $t = 3.44$ ,  $P = 0.001$ ; social distance:  $\beta = -0.11$ ,  $t = 1.93$ ,  $P = 0.05$ ; Table 4). Men reported significantly greater overall weight bias ( $M = 3.55$ ; s.d. = 0.83),

significantly greater bias regarding equality of rights ( $M = 3.41$ ; s.d. = 1.45) and significantly greater social distance ( $M = 2.79$ ; s.d. = 0.98) as compared to women (composite:  $M = 3.17$ ; s.d. = 0.90,  $t_{385} = 4.02$ ,  $P < 0.001$ ; equal rights subscale:  $M = 2.63$ ; s.d. = 1.34,  $t_{385} = 5.18$ ,  $P < 0.001$ ; social distance subscale:



**Figure 2** Comparison of means ( $\pm$ s.e.) between men and women on two measures of obesity stigma: the Anti-Fat Attitudes Scale (AFA) and its subscales which measure the dislike of obese individuals, the fear of becoming fat oneself, and attributions of responsibility toward obese individuals; and the Universal Measure of Bias-Fat scale (UMB-Fat) and its subscales which measure the attraction toward obese people, the need for equal rights for obese people, negative judgments of obese people, and social distance from obese people. \*\*\* $P \leq 0.001$ ; \*\* $P \leq 0.01$ ; \* $P \leq 0.05$

$M = 2.51$ ;  $s.d. = 1.15$ ,  $t_{385} = 2.39$ ,  $P = 0.017$ ). Though gender did not significantly predict the attraction and negative judgment subscales in the regression model, they follow the same pattern, and simple  $t$ -tests indicated a significant difference on the attraction subscale ( $P = 0.035$ ) and a marginally significant difference on the negative judgment subscale ( $P = 0.11$ ; see Figure 2).

**BMI and obesity stigma.** For the AFA composite score and two subscales, we found a significant interaction between BMI and gender (composite:  $\beta = -0.23$ ,  $t = 2.53$ ,  $P = 0.012$ ; Fear of Becoming Fat Subscale:  $\beta = -0.22$ ,  $t = 2.56$ ,  $P = 0.011$ ; dislike subscale:  $\beta = -0.23$ ,  $t = 2.45$ ,  $P = 0.015$ ). For men, but not women, the higher one's BMI, the more negative one's attitudes toward obese individuals overall (composite for men:  $\beta = 0.23$ ,  $t = 2.45$ ,  $P = 0.015$ ). This effect is mainly carried by the heightened male bias on the Fear of Becoming Fat Subscale. That is, for men but not women, the higher one's BMI, the greater the concern over becoming obese ( $\beta = 0.35$ ,  $t = 4.15$ ,  $P < 0.001$ ). In contrast, for women but not men, the greater one's BMI, the more favorable one's attitudes toward obese individuals as measured by the dislike subscale ( $\beta = -0.20$ ,  $t = 3.15$ ,  $P = 0.002$ ).

The UMB Scale revealed a significant relationship between BMI and attitudes relating to obesity for women only, and results are consistent with those found for the AFA Scale. For women but not men, the higher one's BMI, the less overall bias reported against obese individuals (UMB composite:  $\beta = -0.21$ ,  $t = 3.42$ ,  $P = 0.001$ ), and the less negative one's attitudes regarding the attractiveness of obese individuals (attraction subscale:  $\beta = -0.27$ ,  $t = 4.57$ ,  $P < 0.001$ ) and coming into social contact with obese individuals (social distance subscale:  $\beta = -0.27$ ,  $t = 4.40$ ,  $P < 0.001$ ). Consistent with these findings, women with a BMI  $\geq 25$  ( $N = 57$ ) reported less weight bias than women with a BMI  $< 25$  ( $N = 205$ ), but only on those subscales measuring social interaction (AFA dislike subscale:  $t_{260} = 2.43$ ,  $P = 0.016$ ; UMB attractiveness subscale: ( $t_{260} = 4.04$ ,  $P < 0.001$ ; UMB social closeness subscale:  $t_{260} = 3.06$ ,  $P = 0.002$ ).

**Age and obesity stigma.** As shown in Tables 2 and 4, we found significant effects for subject age on obesity stigma. In general, the older the subject, the less negative the attitudes reported toward the obese (AFA:  $\beta = -0.13$ ,  $t = 2.40$ ,  $P < 0.05$ ; UMB:  $\beta = -0.12$ ,  $t = 2.33$ ,  $P < 0.05$ ). Closer inspection found that this held for two of the three AFA subscales (fear of becoming fat:  $\beta = -0.12$ ,  $t = 2.53$ ,  $P < 0.05$ ; Blame:  $\beta = -0.11$ ,  $t = 2.05$ ,  $P < 0.05$ ), and for one of the four UMB subscales (negative judgment:  $\beta = -0.16$ ,  $t = 2.95$ ,  $P < 0.01$ ). Follow-up analyses that included the interaction between age and gender found no gender differences in how age predicted scores on the AFA and UMB scales.

## GENERAL DISCUSSION

The present study examined the relationship between three domains of disgust sensitivity and attitudes toward obese individuals. For women, greater pathogen disgust sensitivity predicted greater obesity stigma. We found no relationship between pathogen disgust sensitivity and obesity stigma for men. Thus, whereas previous research has shown a link between disease/pathogen disgust sensitivity and obesity bias (8,9), our results suggest this only operates in women. These findings are consistent with a theoretical framework that suggests the greater reproductive demands and costs of infection in women may increase their likelihood of perceiving ambiguous physical cues such as obesity as potential pathogen threats (38).

The high prevalence of obesity is a relatively recent phenomenon, facilitated by the modern food environment and novel sedentary lifestyles (20). As such, researchers have applied sociocultural models to explain the occurrence of obesity bias. Overweight body types deviate from the sociocultural thin ideal (48,49); media exposure is associated with obesity bias (50), and content analyses demonstrate obesity bias in many different forms of popular media (51). The current investigation adds a novel perspective to this body of research: that individual differences in disgust sensitivity can inform the factors influencing obesity bias. Given the evolutionary influences

on emotions—especially disgust—we use an evolutionary perspective to help explain obesity bias. However, the relative evolutionary novelty of obesity and associated bias begs a critical question: How can an evolved mechanism be invoked to explain a modern bias?

We offer three possible explanations for why an evolved psychological mechanism for pathogen avoidance might contribute to negative attitudes toward obese individuals. First, it may be the case that humans have evolved to perceive sufficient deviations from the prototypical body shape as indicative of infectious disease (8). Certain infectious diseases cause growths and swellings that may be perceptually similar to obesity (e.g., elephantiasis, which causes a swelling of certain body parts that may be perceptually similar to obesity; bacterial infections that cause fluid build-up and swelling; ref. 21). Thus, similar to extreme thinness, extreme obesity might violate what is considered to be a culturally acceptable physique.

Second, obese individuals may possess physical cues that were used to detect disease threats in the environment in which humans evolved. For example, recent research suggests that subtle aspects of skin tone and texture are critical cues for assessing health in people (52,53). These cues could serve as input for evolved psychological mechanisms for avoiding disease and influence obesity bias. Thus, even though obesity (as caused by agricultural developments) might not have been common in ancestral environments, particular features of modern obesity (e.g., skin and tissue swelling) would have signaled, when present, communicable bacterial, viral, or helminthic infection. Reactions to modern obesity can then be viewed as a nonfunctional output of pathogen-avoidance systems.

Finally, it is possible that obese individuals actually present a greater infection risk than “normal” weight individuals, and people learn to associate obesity with contagion. Falagas and Kompoti (54) review the literature on obesity and infectious disease, and they find that obese individuals have higher rates of respiratory infection, postsurgical bacterial infection, urinary infection, gastrointestinal infection, and skin infection. This is a “learning” perspective, but it is not an alternative to our theoretical perspective or our data. Evolved behavioral and psychological disease-avoidance strategies are highly reliant on learned associations between ecological stimuli and pathogen threat (e.g., learning which foods threaten pathogen transmission; learning which individuals acquire infections more often; for more on an evolutionary perspective of learning, see ref. 55).

In summary, evolved mechanisms for avoiding pathogens could be triggered by cues associated with obesity for multiple reasons. Additional research effort will be required to identify why pathogen-avoidance systems are triggered and how these evolved systems interact with culturally specific ideals of body image in the generation of obesity bias.

With respect to sexual and moral disgust sensitivities, neither disgust domain related to obesity stigma in the predicted direction. In fact, contrary to prediction, the more disgusted women were by sexual behaviors, the more neutral (less unfavorable) their attitudes toward obese individuals on the UMB

attraction subscale. One possible explanation for this pattern is that women who are highly sensitive to sexual disgust might be less open to most sexual behaviors in general. For this reason, they might not need to be specifically avoidant of obese partners since they might be generally avoidant of sex and sex partners of all sizes. Indeed, previous research has found that the more disgusted an individual is by sexual behaviors as measured by the sexual disgust subscale of the TDDS, the more avoidant he or she is of sex (56). Certainly additional investigations are needed to further investigate the extent to which one's sensitivity to sexual disgust relates to obesity bias.

Likewise, additional investigations are needed to determine the relationship between moral judgments and attitudes toward obesity. Though we did not find a significant relationship between moral disgust sensitivity and obesity bias, others have shown that priming individuals with concepts related to work ethic increases the association between obesity bias and unpleasant concepts (8) suggesting such a link might exist.

The absence of any positive relationship between sexual and moral disgust and obesity bias might be explained by the instruments used to measure these constructs or possibly by the effects of a third variable such as social desirability. With respect to the constructs measured, the UMB and AFA instruments do not include a factor that relates specifically to immorality. Though there is a factor that assays perceived laziness in the AFA, none of the items from the AFA or UMB line up perfectly with the morality-related behaviors represented by the TDDS, for example, stealing from a neighbor, or forging someone's signature—behaviors that might more strongly relate to morality. The inclusion of such items in follow-up studies would be informative and might also provide insight into the role sociocultural models play in generating obesity bias. For instance, sociocultural norms for preferences for thinness might lead to the moralization of obesity. This can be examined in future studies that include questions to better assess the moral component of obesity bias.

Likewise, the absence of a positive association between sexual and moral disgust and obesity bias might have also been due to the effects of social desirability or a related third variable. Though the TDDS showed discriminant validity with other measures and little evidence of social desirability (15), and past correlations between weight stigma and social desirability have typically been low or nonsignificant (30), future research should take care to rule out such effects.

Although the current research was motivated by current theoretical perspectives on the function of disgust—and the nature of disgust sensitivity—a substantial portion of the variance in obesity bias remains unexplained by this perspective. Other models may account for aspects of obesity bias unexplained by disgust sensitivity. For instance, sociocultural preferences for a thin body shape could account for women's higher mean obesity bias. Women, in contrast to men, have a more biased perception of what is considered to be the ideal body, preferring a more thin body type (57,58), and thus might be more likely to internalize the perceived cultural disapproval of obesity. Given that disgust reactions tend to enforce social

norms (59), this could also explain the link between disgust sensitivity and views regarding obesity.

Our findings regarding sexual disgust might also be explained using a sociocultural model. We found that the more sensitive an individual was to sexual disgust, the less the bias against the obese. Greater sexual disgust sensitivity might correspond with more restrictive and more conservative (i.e., more religious) views regarding sexuality (27). Indeed, in our study it was (correlation between sexual disgust sensitivity and religiosity:  $r = 0.23$ ,  $P < 0.001$ ,  $N = 387$ ;  $M = 3.64$ ;  $s.d. = 1.71$ ). Juxtaposed with the finding that religiosity is positively correlated with obesity, particularly in women (60), suggests that greater sexual restrictiveness might be found in populations where individuals are more overweight, which generates a cultural tolerance and hence reduced stigma.

Similarly, models looking at internalized weight bias might also explain our findings. Internalized weight bias has been shown to be positive correlated with the dislike AFA subscale (61), the same subscale that showed a positive correlation with pathogen disgust sensitivity for women. Thus one's internalized weight bias and attitudes about one's own body shape might mediate the relationship between pathogen disgust sensitivity and the dislike of obese individuals. Additional research can further explore these relationships.

Although evolutionary and cultural models are often pitted against one another, both models might contribute to understanding obesity bias. If, as proposed here, humans evolved to track the cues related to pathogens and that females are more sensitive to these cues, then this might interact with cultural values regarding body image ideals to influence both internalized and externalized obesity stigma. Also, evolved systems underlying disease avoidance might be evoked differently in different cultural settings.

This study also found systematic sex differences in obesity stigma and in BMI's association with stigma. Men reported more obesity stigma than did women on most subscales (except fear of becoming fat), including dislike, willpower, attraction, equal rights, and social distance. This was true even after controlling for disgust sensitivity and BMI. Some previous research indicates that women tend to hold more negative attitudes toward obesity than do men (62). Our data suggest otherwise and lend support to more recent findings that men, like women, stigmatize obese individuals (63). In addition, our data suggest that future studies should take into consideration specific subtypes of antiobesity attitudes that may show systematic sex differences.

The present results likewise indicate that BMI is associated with attitudes toward obese individuals, but in different ways for men and women. For men, BMI related only to attitudes regarding themselves, not others. This was found in the AFA Fear of Becoming Fat Subscale: the greater a man's BMI, the greater his fear of becoming fat. By contrast, a woman's BMI only related to attitudes toward others, not herself. With increasing BMI, women rated obese individuals as less unattractive (UMB attractiveness subscale), and they reported less aversion to being in close proximity with obese individuals

(UMB social distance subscale) and less overall dislike of obese people (AFA dislike subscale). But for women, unlike men, there was no relationship between BMI and the fear of becoming fat oneself. This gender difference may be due to women's higher fear of fat than men across BMI levels. Women's greater fear of fat is consistent with previous findings that women report higher levels of body dissatisfaction than men; in addition, many men at lower BMI levels wish to gain weight rather than lose weight (64). Similar to the present findings, as college students' BMI increased, body dissatisfaction increased among both men and women, but this increase was disproportionately steeper for women than for men (65).

Nevertheless, our findings are consistent with some previous research (43) and suggest the existence of in-group bias, at least among women: members of the stigmatized group may manifest less stigma toward fellow group members. Indeed, in our sample, overweight and obese women reported less dislike, more attraction, and more social interaction with obese individuals than nonoverweight women. This is consistent with sociocultural models showing that people tend to have weight gains similar to their friends (22); it is possible that female participants are aware of this pattern and fearful of the spread of obesity through social ties. However, in other studies, overweight and obese individuals have demonstrated levels of weight bias close to those of nonoverweight individuals (37,42), suggesting the internalization of obesity stigma (61) and minimal in-group bias. A host of factors (e.g., cultural mores and individual differences) likely dictate whether weight bias is expressed and/or internalized and is a rich area for future research.

Last, we found a negative relationship between age and obesity bias. In our sample, in addition to the standard 18–22 age range typically found in college populations, we had 53 subjects between the ages of 23–29, six subjects in their thirties, three in their forties, two in their fifties, and one who was 70 years old. The older the subject, the less negative the attitudes reported toward the obese and the less the fear of becoming fat oneself. As others have noted, the importance of body shape, weight, and appearance have been found to decrease with older age (66). Older females (65+), unlike younger females, tended to reject the “thinness ideal” promoted by popular media (67). Our results extend this literature on body image by demonstrating age effects for weight bias as well.

There are a few additional caveats to consider when interpreting the current research. First, this research was correlational in nature and therefore unable to directly assess a causal relationship between activations of disgust processes and attitudes toward obese individuals. Follow-up studies using experimental methods can further assess the causal relationship between the different domains of disgust and obesity stigma. Second, we examined antiobesity attitudes in college undergraduates, a limited cross-section of the population. As such, our findings might not generalize to groups characterized by different ages or ethnicities. Third, we calculated BMI based on self-reported height and weight. Nevertheless, we were able to replicate how BMI relates to two different measures of antiobesity

attitudes for men and women. Last, the obesity measures we used asked about obese people in general and did not separate targets by gender. Different domains of disgust, including sexual and moral disgust, might well indeed predict attitudes toward obese individuals when targets are specified by gender (or other demographic variables). This is a promising area for future research.

In closing, obese individuals are discriminated against in a variety of settings (11). Uncovering the factors that influence negative attitudes can help point the way to alleviating weight bias. Here we focused on evolutionary-derived hypotheses to shed light on how disgust might relate to obesity bias. Given that disgust is an emotion that has been linked to stigmatization and associated behaviors (68), it is crucial to identify how disgust relates to obesity so that we might learn how to inoculate against the initial development of disgust or reverse this reaction once formed. As mentioned above, we maintain that future studies incorporating both evolutionary and cultural factors promise to address a wider range of questions. Regardless of origin, evolutionary or cultural, understanding how disgust and perhaps other emotions regulate the development of antiobesity attitudes for men and women promises to identify ways to intervene along the multiple routes of stigmatization.

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#### DISCLOSURE

The authors declared no conflict of interest.

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#### REFERENCES

- Faulkner J, Schaller M, Park JH, Duncan LA. Evolved disease-avoidance mechanisms and contemporary xenophobic attitudes. *Group Process Intergroup Relat* 2004; 7:333–353.
- Navarrete CD, Fessler DMT. Disease avoidance and ethnocentrism: the effects of disease vulnerability and disgust sensitivity on intergroup attitudes. *Evol Hum Behav* 2006; 27:270–282.
- Cottrell CA, Neuberg SL. Different emotional reactions to different groups: a sociofunctional threat-based approach to “prejudice”. *J Pers Soc Psychol* 2005;88:770–789.
- Hodson G, Costello K. Interpersonal disgust, ideological orientations, and dehumanization as predictors of intergroup attitudes. *Psychol Sci* 2007;18:691–698.
- Park JH, Faulkner J, Schaller M. Evolved disease-avoidance processes and contemporary anti-social behavior: prejudicial attitudes and avoidance of people with physical disabilities. *J Nonverbal Behav* 2003;27:65–87.
- Smith DM, Loewenstein G, Rozin P, Sherriff RL, Ubel PA. Sensitivity to disgust, stigma, and adjustment to life with a colostomy. *J Res Pers* 2007;41:787–803.
- Olatunji BO. Disgust, scrupulosity and conservative attitudes about sex: evidence for a mediational model of homophobia. *J Res Pers* 2008;42:1364–1369.
- Park JH, Schaller M, Crandall CS. Pathogen-avoidance mechanisms and the stigmatization of obese people. *Evol Hum Behav* 2007;28:410–414.
- Vartanian LR. Disgust and perceived control in attitudes toward obese people. *Int J Obes (Lond)* 2010;34:1302–1307.
- Puhl R, Brownell KD. Bias, discrimination, and obesity. *Obes Res* 2001;9:788–805.
- Puhl RM, Heuer CA. The stigma of obesity: a review and update. *Obesity (Silver Spring)* 2009;17:941–964.
- Olatunji BO, Sawchuck CN. Disgust: characteristic features, social manifestations, and clinical implications. *J Soc Clin Psychol* 2005;27:932–962.
- Haidt J, McCauley C, Rozin P. Individual differences in sensitivity to disgust: a scale sampling seven domains of disgust elicitors. *Pers Individ Dif* 1994;16:701–713.
- Taylor K. Disgust is a factor in extreme prejudice. *Br J Soc Psychol* 2007;46:597–617.
- Tybur JM, Lieberman D, Griskevicius V. Microbes, mating, and morality: individual differences in three functional domains of disgust. *J Pers Soc Psychol* 2009;97:103–122.
- Rozin P, Haidt J, McCauley C. Disgust. In: Lewis M, Haviland J (eds). *Handbook of Emotions*. Guilford Press: New York, 1993, pp 574–594.
- Curtis V, Aunger R, Rabie T. Evidence that disgust evolved to protect from risk of disease. *Proc Biol Sci* 2004;271 Suppl 4:S131–S133.
- Tooby J. Pathogens, polymorphism, and the evolution of sex. *J Theor Biol* 1982;97:557–576.
- Haselton MG, Nettle D. The paranoid optimist: an integrative evolutionary model of cognitive biases. *Pers Soc Psychol Rev* 2006;10:47–66.
- Brownell KD, Horgen KB. *Food Fight: The Inside Story of the Food Industry, America's Obesity Crisis, and What We Can Do About It*. McGraw-Hill: New York, 2004.
- Taylor MJ, Hoerauf A, Bockarie M. Lymphatic filariasis and onchocerciasis. *Lancet* 2010;376:1175–1185.
- Christakis NA, Fowler JH. The spread of obesity in a large social network over 32 years. *N Engl J Med* 2007;357:370–379.
- Krendl AC, Macrae CN, Kelley WM, Fugelsang JA, Heatherton TF. The good, the bad, and the ugly: an fMRI investigation of the functional anatomic correlates of stigma. *Soc Neurosci* 2006;1:5–15.
- Harvey T, Troop NA, Treasure JL, Murphy T. Fear, disgust, and abnormal eating attitudes: a preliminary study. *Int J Eat Disord* 2002;32:213–218.
- Schaich Borg J, Lieberman D, Kiehl KA. Infection, incest, and iniquity: investigating the neural correlates of disgust and morality. *J Cogn Neurosci* 2008;20:1529–1546.
- DeBruine LM, Jones BC, Tybur JM, Lieberman D, Griskevicius V. Women's preferences for masculinity in male faces are predicted by pathogen disgust, but not moral or sexual disgust. *Evol Hum Behav* 2010;31:69–74.
- Tybur JM, Merriman LA, Caldwell AE, McDonald MM, Navarrete CD. Extending the behavioral immune system to political psychology: Are political conservatism and disgust sensitivity really related? *Evolutionary Psychol* 2010;8:599–616.
- Olatunji BO, Cisler JM, Deacon BJ, Connolly K, Lohr JM. The Disgust Propensity and Sensitivity Scale-Revised: psychometric properties and specificity in relation to anxiety disorder symptoms. *J Anxiety Disord* 2007;21:918–930.
- Crandall CS. Prejudice against fat people: ideology and self-interest. *J Pers Soc Psychol* 1994;66:882–894.
- Latner JD, O'Brien KS, Durso LE, Brinkman LA, MacDonald T. Weighing obesity stigma: the relative strength of different forms of bias. *Int J Obes (Lond)* 2008;32:1145–1152.
- Duncan LA, Schaller M, Park JH. Perceived vulnerability to disease: Development and validation of a 15-item self-report instrument. *Pers Individ Dif* 2009;47:541–546.
- Miller CT, Rothblum ED, Felicio D, Brand PA. Compensating for stigma: obese and nonobese women's reactions to being visible. *Pers Soc Psychol Bull* 1995;21:1093–1106.
- Rucker CE, Cash TF. Body images, body-size perceptions, and eating behaviors among African-American and White college women. *Int J Eat Disord* 1992;12:291–299.
- Puhl RM, Latner JD. Stigma, obesity, and the health of the nation's children. *Psychol Bull* 2007;133:557–580.
- Schwartz MB, Chambliss HO, Brownell KD, Blair SN, Billington C. Weight bias among health professionals specializing in obesity. *Obes Res* 2003;11:1033–1039.
- Tiggemann M, Rothblum E. Gender differences in social consequences of perceived overweight in the United States and Australia. *Sex Roles* 1988;18:75–86.
- Latner JD, Stunkard AJ, Wilson GT. Stigmatized students: age, sex, and ethnicity effects in the stigmatization of obesity. *Obes Res* 2005;13:1226–1231.
- Trivers RL. Parental investment and sexual selection. In: Campbell MB (ed). *Sexual Selection and the Descent of Man*. Aldine: Chicago, 1972, pp 136–179.
- Hebl MR, Mannix LM. The weight of obesity in evaluating others: a mere proximity effect. *Pers Soc Psychol Bull* 2003;29:28–38.

40. Phillips N, de Man, AF. Weight status and body image satisfaction in adult men and women. *Am J Psychol* 2010;12:171–184.
41. Davis C, Karvinen K, McCreary DR. Personality correlates of a drive for muscularity in young men. *Pers Individ Dif* 2005;39:349–359.
42. Wang SS, Brownell KD, Wadden TA. The influence of the stigma of obesity on overweight individuals. *Int J Obes Relat Metab Disord* 2004;28:1333–1337.
43. Schwartz MB, Vartanian LR, Nosek BA, Brownell KD. The influence of one's own body weight on implicit and explicit anti-fat bias. *Obesity (Silver Spring)* 2006;14:440–447.
44. Kraemer HC, Berkowitz RI, Hammer LD. Methodological difficulties in studies of obesity I: measurement issues. *Ann Behav Med* 1990;12:112–118.
45. Green SB. How many subjects does it take to do a regression analysis. *Multivariate Behav Res* 1991;26:499–510.
46. Cohen J, Cohen P, West SG, Aiken LS. *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*. 3rd edn. Lawrence Erlbaum: Mahwah, NJ, 2003.
47. Aiken LS, West SG. *Multiple Regression: Testing and Interpreting Interactions*. Sage: Newbury Park, CA, 1991.
48. Heinberg LJ. Theories of body image disturbance: perceptual, developmental, and sociocultural models. In: Thompson JK (ed). *Body Image, Eating Disorders, and Obesity*. American Psychological Association: Washington, DC, 1996, pp 27–47.
49. Wiseman CV, Gray JJ, Mosimann JE *et al*. Cultural expectations of thinness in women: an update. *Int J Eat Disord* 1992;11:85–9.
50. Latner JD, Rosewall JK, Simmonds MB. Childhood obesity stigma: association with television, videogame, and magazine exposure. *Body Image* 2007;4:147–155.
51. Ata RN, Thompson JK. Weight bias in the media: a review of recent research. *Obes Facts* 2010;3:41–46.
52. Stephen ID, Law Smith MJ, Stirrat MR, Perrett DI. Facial Skin Coloration Affects Perceived Health of Human Faces. *Int J Primatol* 2009;30:845–857.
53. Fink B, Grammer K, Thornhill R. Human (*Homo sapiens*) facial attractiveness in relation to skin texture and color. *J Comp Psychol* 2001;115:92–99.
54. Falagas ME, Kompoti M. Obesity and infection. *Lancet Infect Dis* 2006;6:438–446.
55. Tooby J, Cosmides L. The psychological foundations of culture. In: Barkow JH, Cosmides L, Tooby J (eds). *The Adapted Mind*. Oxford University Press: New York, 1992, pp 19–136.
56. Kurzban R, Dukes A, Weeden J. Sex, drugs and moral goals: reproductive strategies and views about recreational drugs. *Proc Biol Sci* 2010;277:3501–3508.
57. Fallon AE, Rozin P. Sex differences in perceptions of desirable body shape. *J Abnorm Psychol* 1985;94:102–105.
58. Cafri G, Yamamiya Y, Brannick M, Thompson JK. The influence of sociocultural factors on body image: a meta-analytic review. *Clin Psychol: Sci Pract* 2005;12:421–433.
59. Nichols S. On the genealogy of norms: A case for the role of emotion in cultural evolution. *Philosophy of Science* 2002;69:234–255.
60. Cline KMC, Ferraro KF. Does religion increase the prevalence and the incidence of obesity in adulthood? *J Scientific Study of Religion* 2006;45:269–281.
61. Durso LE, Latner JD. Understanding self-directed stigma: development of the weight bias internalization scale. *Obesity (Silver Spring)* 2008;16 Suppl 2:S80–S86.
62. Hebl M, Heatherton TF. The stigma of obesity: the differences are Black and White. *Pers Soc Psychol Bull* 1997;24:417–426.
63. Hebl M, Turchin JM. The stigma of obesity: what about men? *Basic Appl Soc Psych* 2005;27:267–275.
64. McCabe MP, Ricciardelli LA. Body image dissatisfaction among males across the lifespan: a review of past literature. *J Psychosom Res* 2004;56:675–685.
65. Pingitore R, Spring B, Garfield D. Gender differences in body satisfaction. *Obes Res* 1997;5:402–409.
66. Tiggemann M. Body image across the adult life span: stability and change. *Body Image* 2004;1:29–41.
67. Clarke LH. Older women's perception of ideal body weights: the tensions between health and appearance motivations for weight loss. *Ageing & Society* 2002;22:751–773.
68. Kurzban R, Leary MR. Evolutionary origins of stigmatization: the functions of social exclusion. *Psychol Bull* 2001;127:187–208.