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ORIGINAL CONTRIBUTION

Interphysician weight bias: A cross-sectional observational survey study to guide implicit bias training in the medical workplace

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Abstract

Objectives: Implicit bias contributes to both health care disparities and professional limitations, and it exists among physicians. Prior literature has described physician weight bias (WB) toward patients, but little research has investigated interphysician WB. This study describes the prevalence of interphysician implicit WB and investigates the relationships between implicit, explicit, and professional biases. The authors hypothesized that the majority of physicians possess interphysician implicit WB and that the degree of implicit bias has a direct relationship with explicit and professional WB.

Methods: In this cross-sectional study, a survey was used to measure interphysician implicit, explicit, and professional WB. It included adaptations of two previously validated measures (the Implicit Association Test and the Crandall Anti-fat Attitudes Questionnaire) and an investigator developed and tested Professional Weight Bias Scale. The survey was distributed electronically via medical society message boards, email lists, and social media groups.

Results: A total of 620 physicians and medical students participated. Fifty-eight percent were female, ages ranged from 22 to 83 years (mean = 44 years), and body mass index (BMI) ranged from 16 to 59 (mean = 26). Descriptive analyses revealed that 87% had some degree of implicit interphysician antifat bias, with 31% and 34% categorized as moderate and severe, respectively. Correlation and multiple regression analyses revealed that male sex, increased age, and decreased BMI were related to increased implicit bias, controlling for all other factors. Furthermore, implicit, explicit, and professional bias all had significant, direct relationships with each other.

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Conclusions: Our findings highlight the prevalence of interphysician implicit WB; the strong correlations between implicit, explicit, and professional WB; and the potential disparities faced by physicians with obesity. These results may be used to guide implicit bias training for a more inclusive medical workplace.

KEYWORDS
disparities, diversity, explicit bias, implicit bias, obesity

INTRODUCTION

Background

Similar to the general population, implicit and explicit bias exists among physicians. Destructive biases contribute to health care disparities when directed toward patients and to professional disparities when directed toward colleagues. Adequate literature has been published on patient perceptions of physicians with obesity as well as physician perceptions of patients with obesity. Patients with obesity have reported disrespect and poor-quality physician interactions relative to average-weight patients.[1–3] Physicians have been shown to possess strong weight bias (WB) rates that are comparable to the general population[4,5] and demonstrated across multiple specialties.[6,7] However, little prior work has addressed physician-to-physician or "interphysician" WB. One study utilized mock radiology residency application reviews to evaluate appearance-based candidate discrimination.[8] Facial unattractiveness and obesity strongly predicted negative candidate ratings from faculty participants, suggesting that these non–merit-based measures influence the selection of interview candidates.

Disparities have also been identified for professionals with obesity in the general population.[9] One study found that very heavy women earned $18,902/year less than their average-weight peers and that a 25-lb weight gain correlated with a salary decrease of up to $15,572/year.[10] Only Michigan has a state statute in place prohibiting weight-based workplace discrimination.[11]

Objectives

We aim to describe the prevalence of interphysician WB, including implicit, explicit, and professional WB (IWB, EWB, and PWB, respectively). We define IWB as the unconscious stereotypes that participants may hold against physicians with obesity, EWB as the perceptible outward views and practices that participants may direct toward physicians with obesity, and PWB as a decreased willingness to collaborate with physicians with obesity. These three WB types may impose unjust limitations on career opportunities and other aspects of professional life for the targets of the bias.

To our knowledge, our study is the first assessment of interphysician WB. Our goals are to raise awareness of this underrecognized implicit bias held by physicians; to uncover personal characteristics that contribute to inter-physician WB; and to find the correlation between interphysician IWB, EWB, and PWB. The hope is that this study may evoke productive discussion, self-reflection, mutual understanding, and problem-solving related to this historically stigmatized and important social issue.[12]

Our specific research questions are: RQ1—What is the degree of IWB, EWB, and PWB existing among physicians? RQ2—How do participants' sex, age, and body mass index (BMI) contribute to their degree of IWB, EWB, and PWB? RQ3—Does IWB among physicians relate to EWB and PWB toward physicians? Our hypotheses, respectively, are that physicians will show high frequencies of antifat IWB, EWB, and PWB; participant sex, age, and BMI will be significant factors related to degree of antifat biases; and increased IWB will be related to increased EWB and PWB after controlling for participant sex, age, and BMI.

METHODS

Human subjects

This study was approved by our institutional review boards. Study procedures were disclosed to participants prior to gaining voluntary informed consent.

Study setting and population

We utilized a cross-sectional design, the study setting was virtual, and no research incentives were offered. Inclusion criteria were practicing physicians and physicians-in-training (including fellows, residents, and medical students) in North America. Excluded were subjects who did not consent; did not identify as physicians or physicians-in-training; or were not currently residing in North America. To avoid duplicate data, individuals who indicated they had completed the survey previously were not included in analysis.

Survey construction

The electronic platform Qualtrics was used to construct and distribute the survey. Four survey sections were presented to all participants in this order (see Data Supplement S1, available as supporting information in the online version of this paper, which is available at http://onlinelibrary.wiley.com/doi/10.1111/acem.14269/full):

1. Description of the study and provision of voluntary informed consent.
2. Measurement of IWB.
3. Measurement of EWB and PWB.
4. Measurement of nonidentifying participant demographics.

IWB was measured first to avoid a potential priming effect (participants might have exhibited increased IWB had they completed the measure directly after being asked about EWB and/or PWB). Participants were not able to skip items in the IWB section because this measurement was administered as a game. However, participants could decline to answer any individual question presented in all other sections. We looked to existing research on characteristics that have historically been found to predict IWB and IWB, as well as research on bias among physicians specifically,[13] to inform our inclusion of sex, age, and BMI as predictors and covariates.

The three scales and demographic questions were sent to a pilot group of 20 members of the nonprofit medical education alliance ALL NYC EM, which consists of emergency physician medical educators, residency leadership members, and resident education fellows. Feedback on clarity and usability was incorporated into the final survey prior to national-scale distribution. Specifically, explanations of cis female and cis male were added to the gender identity question in the demographics section, and technical errors with the Qualtrics hyperlink were corrected. Additional comments were made that the survey was interesting, but no other recommendations were made by the pilot group.

Implicit Weight Bias

Using previously validated analytical procedures,[14,15] IWB was measured using an investigator-adapted version of the Project Implicit Weight Bias Implicit Association Test (IAT).[16,17] The IAT assesses the degree to which target images are mentally associated with "good" (positive) and "bad" (negative) categories. Users sort silhouette images and descriptive words using their keyboards, and response times are used to make inferences about implicit bias. In Project Implicit's IAT, users first sort average-weight silhouettes and positive descriptors into the same category and obese silhouettes and negative descriptors into a second category. The task then proceeds to alternate the trials, ultimately asking users to pair average-weight silhouettes with bad words and obese silhouettes with good words.

Users are expected to sort stimuli faster when the rules presented are compatible with their associations. A standardized difference score (D-score) is calculated for each user from their response time data. The D-score represents conditions in which participants sorted words and images faster (compatible vs. incompatible). A D-score of 0 indicates no difference in sorting time between conditions, while a positive D-score indicates that a participant was faster in the compatible block (average-weight images paired with good words, obese images paired with bad words) and a negative D-score indicated that a participant was faster in the incompatible block. The original IAT has been shown to be both reliable and externally valid,[18] although test–retest reliability of this measure has at times been low (hence the care we took in this study not to allow users to take the survey multiple times).

In our study, the Project Implicit WB IAT was adapted to apply to physicians. The silhouette images of obese and average-weight individuals[17] were adjusted by adding physician features such as stethoscopes, long white coats, and clipboards (see Figure 1). The original positive and negative descriptors were replaced with words historically used to describe physicians, selected using original words and antonyms from Stern's medical professionalism framework[19] (see Table 1).

Our adapted IAT was integrated into Qualtrics survey using Iatgen,[20] a publicly available online service which has been thoroughly tested for reliable adaptation of the IAT into Qualtrics. Reliability analysis of our IAT data indicated above adequate reliability ($\alpha = 0.84$), and significant IWB was detected among the analytic sample (t-test = 29.68, $p < 0.01$, 95% confidence interval [CI] = 0.44 to 0.50). Preliminary evidence of this measure's predictive validity was indicated by significant correlations between participants' IAT D-scores and their EWB and PWB scores (discussed under "Preliminary Results").

Explicit Weight Bias

To measure EWB, we adapted the previously validated Crandall Anti-fat Attitudes Questionnaire[21] (CAAQ) to focus on interphysician views and practices. The original CAAQ utilized participant agreement levels with 13 statements capturing dislike of people with obesity, fear of becoming obese, and thoughts regarding lack of willpower in individuals with obesity. In our adaptation, we changed every instance of the word "people" to "physicians" and utilized a Likert scale from 1 ("strongly disagree") to 7 ("strongly agree"). Appendix S2 outlines the original and adapted CAAQ statements.

This adaptation displayed above adequate reliability ($\alpha = 0.86$) and preliminary evidence of predictive validity via significant relations with other key study variables (discussed below). Participants' mean scores on the overall measure were used in analyses.

Professional Weight Bias

PWB was defined in detail as reduced willingness to collaborate with, seek advice from, and foster mutually beneficial professional relationships with physician colleagues with obesity. Participant PWB was measured using an investigator-developed PWB scale. We asked users to rate on a Likert scale from 1 ("strongly disagree") to 7 ("strongly agree") their agreement with seven items purported to capture views on physicians with obesity regarding collaboration, hiring, promotion, leadership opportunities, and other classic measures of professional success determined by group consensus (see

FIGURE 1 Silhouette images of obese and average weight physicians used in the implicit association test portion of the survey. Obese images are investigator adaptations of non-copyrighted images from the original Project Implicit WB IAT. Average weight images are used with permission (designed by Vexels.com). WB IAT, weight bias implicit association test

TABLE 1 Positive and negative words historically used to describe physicians in the medical workplace (these were used in the implicit association test portion of the survey)

Positive word items	Negative word items
Dedicated	Abusive
Efficient	Careless
Empathetic	Corrupt
Ethical	Failure
Honorable	Harmful
Professional	Lazy
Respectful	Negligent
Smart	Rude

Table 2). After pilot testing (as described previously), it was determined that no revisions were necessary.

Our PWB scale displayed above adequate reliability ($\alpha = 0.92$), and exploratory factor analysis (described below) suggested that the scale captured a single factor. This measure displayed preliminary evidence of predictive validity as evidenced by significant relations with other key study variables (discussed below). Scores were averaged across items, and participants' mean scores on the overall measure were used in analyses.

TABLE 2 Items incorporated into the investigator-developed professional WB scale

Professional WB scale
I prefer making referrals to normal-weight physicians over fat physicians.
I prefer collaborating with normal-weight physicians over fat physicians.
I prefer to seek advice from normal-weight physicians over fat physicians.
If I were making decisions about salaries, I would probably give a normal-weight physician a higher salary than a fat physician if all other qualities were equal.
If I were making decisions about job promotions, I would probably give a normal-weight physician a promotion over a fat physician if all other qualities were equal.
Having a normal body weight, as opposed to being fat, should be required for any physician in order to be hired for any healthcare job.
Having a normal body weight, as opposed to being fat, should be required for any physician to be in a position of power in their career.

Abbreviation: WB, weight bias.

Participant demographics

Participants reported birth year, race/ethnicity, sex, gender, height, weight, state/region of residence, highest level of education completed, level of medical training, medical specialty, annual household income, and whether or not they were currently practicing as a physician or physician-in-training.

Study protocol

Data were collected between May 20 and December 31, 2019. Recruitment occurred online via email and message board invitations

on physician listservs and social media groups. On average, two contacts were attempted per message board, email listserv, or social media group. Due to the nature of medical society message boards and listservs, we anticipated limitations in our ability to calculate the number of successful contacts made from our attempts (further discussed under "Limitations").

Data analysis

Exploratory factor analysis (EFA) was performed to investigate the factor structure of the PWB scale, as this was a new instrument developed and applied for the first time in this study. Given our sample size of 620 participants, multiple metrics traditionally used to assess power in factor analyses in human subject research gave us confidence that we were adequately powered for these analyses. Specifically, sample sizes over 300 provide adequate power for factor analyses[22]; samples of 10 subjects per variable are recommended to be included in factor analyses,[23] and a ratio of 20 subjects per extracted factor is recommended.[24] Our sample size exceeds all of these criteria. EFA is widely considered the most appropriate approach in early stages of measure development when an underlying theory of factor structure has not been established,[25–27] as was the case in our study. Specifically, we employed principal components analysis (PCA) to explore the number of underlying factors suggested by the data. We did not specify a set number of factors to extract—rather, we extracted factors based on eigenvalues > 1. This approach is consistent with the fact that this study is the first time this newly developed PWB scale has been used. We used direct oblimin rotation in our PCA, which is an oblique rotation that assumes extracted factors will be correlated. Results of this analysis suggested a single factor accounting for 67% of the variance in the data, with individual item factor loadings ranging from 0.74 to 0.86. We ran an alternate PCA in which we extracted two factors using direct oblimin rotation, and the results of this PCA still strongly suggested one primary factor accounting for the majority of variance in the data, with factor loadings all above 0.74. As such, we are confident that the most accurate structure for this scale is a single factor.

A stepwise regression approach was used whereby predictor variables were added into the models in stages to inform the amounts of variance accounted for by each predictor. Stepwise model building is not without controversy but is widely used in psychological, behavioral, and educational research.[28] It was chosen for this study over standard direct modeling due to its efficiency and usefulness in choosing a small number of explanatory variables from a larger number of possible predictors.[29]

Descriptive analyses on all variables were performed to confirm normality of distributions. To address RQ1, the sample D-score mean and 95% CI on the IAT were examined to determine whether patterns of bias could be reliably detected based on data collected and to determine the direction in which any existing bias operated. The D-score mean can be interpreted as the average level of either pro- or antifat bias displayed by participants in their response times during the IAT tasks, and the 95% CI can be interpreted as the range of values around the observed mean that one can be 95% confident contains the true mean of the population. The t-test value and associated significance were also examined to confirm that participants' IAT D-scores differed significantly from 0, with a significant value indicating that the sample mean is significantly different from zero or, in this case, that IWB exists. Additionally, D-score frequencies were examined to determine the percentage of the analytic sample that had some degree of IWB. Ranges and mean scores on the EWB and PWB scales were also examined to provide insights into the extent and direction of participants' EWB and PWB as measured by these tools.

To provide insights into RQ1 and RQ2, bivariate correlations among the three types of bias and the three target demographic variables (sex, age, and BMI) were examined. To address RQ2 more rigorously, multiple regression models were performed that included sex, age, and BMI as simultaneous predictors of each type of bias in three separate models. To address RQ3, additional multiple regression models were run in which IWB was modeled as a focal predictor (along with sex, age, and BMI, now considered covariates) of EWB and PWB as outcomes, modeled separately. In all multiple regression models, both the significance and the magnitude of effects were examined using p-values and r-squared estimates, respectively, as were the relative strength of the effects of each predictor on each outcome by examining the standardized coefficients provided in each model. R-squared estimates of the RQ3 models were compared to their respective RQ2 models to ascertain the amount of variance in EWB and PWB explained by the addition of IWB as a predictor in addition to sex, age, and BMI.

RESULTS

Participants

Of 1,198 individuals who initially opened the survey, 620 participants completed it to a degree that provided usable data (defined as completing the IAT and continuing on to provide data on at least one other study variable; see Figure 2). Two subjects whose IAT results were inconclusive but who provided usable data on other measures were included in analyses, and these missing data were handled using procedures described below.

Descriptive data

Of the 620 participants who provided usable data, 618 (99%) provided response time data that could be used to calculate IWB scores via the IAT task, 604 (97%) provided EWB scores through the adapted CAAQ, 597 (96%) provided PWB scores through the investigator developed scale, 599 (97%) provided their age, and 590 (95%) provided height and weight to calculate BMI. Fifty-eight percent of participants were female, 38% were male, and 4% reported another identity. Ages ranged from 22 to 83 years (mean = 44 years). BMI ranged from 16 to 59 (mean = 26). A total of 73% were Caucasian, 8%

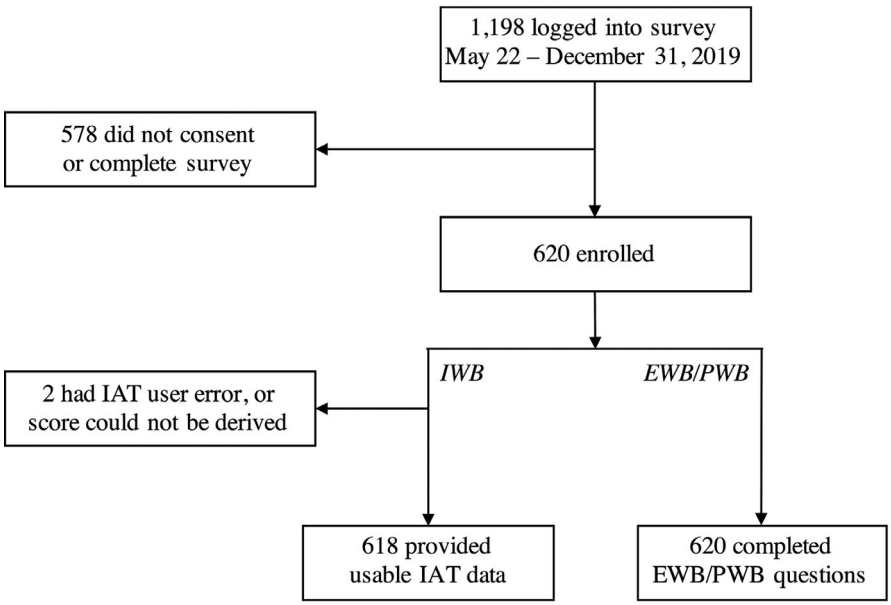

FIGURE 2 Enrollment flow diagram showing participants included and excluded at each stage of data collection. IAT, implicit association test; IWB, implicit weight bias; EWB, explicit weight bias; PWB, professional weight bias

Asian/Pacific Islander, 5% Hispanic/Latino(a), 3% African American, and 7% multiple ethnicities, with 4% missing these data. Specialty breakdown was 78% emergency medicine (EM), 4% pediatrics, 3% internal medicine, 2% family medicine, 1% psychiatry, and <1% surgery, with 6% reporting another specialty. Seventy-two percent were attending physicians, 13% were residents, and the remaining 2% were medical students or did not specify.

Compared to 2019 U.S. Census data on all physicians in the national workforce,[30] our analytic sample included more female (58% vs. 38%), Caucasian (73% vs. 65%), and younger physicians (mean age = 44 years vs. 49 years). The sample was composed mostly of emergency physicians due to the use of EM society listservs, message boards, and social media groups in recruitment. Independent-samples t-tests comparing mean levels of bias between emergency physicians and nonemergency physicians revealed no significant differences for IWB (t = −0.11, p = 0.92), EWB (t = −0.97, p = 0.33), or PWB (t = −0.19, p = 0.08). The sample also included a minority of medical students. Again, independent-samples t-tests comparing mean levels of bias between medical students and practicing physicians revealed no significant differences for IWB (t = −0.28, p = 0.78), EWB (t = 0.28, p = 0.78), or PWB (t = −0.19, p = 0.85). Results of these tests gave us confidence in our approach to include both nonemergency physicians and medical student participants in our analytic sample.

Main results

Descriptive statistics on continuous study variables (IWB, EWB, IWB, age, and BMI) revealed estimates within expected ranges and with enough variability to proceed with formal analyses. Estimates of skewness and kurtosis for each variable revealed no severe departures from normality (skewness < 2, kurtosis < 7),[31] suggesting that no variable transformations needed to be performed prior to formal analysis. Our analyses addressed the three research questions as follows.

RQ1—What is the degree of IWB, EWB, and PWB existing among physicians?

The D-score sample mean on the adapted IAT fell above 0 (mean = 0.47, 95% CI = 0.44 to 0.50) and the t-test ascertaining whether D-scores significantly differed from 0 was significant (t-test = 29.68, p < 0.01). These indicate that participants responded more quickly, on average, to the IAT blocks with compatible words and images, thus displaying antifat bias. We can therefore be 95% confident that the true mean of the population we are generalizing to (all physicians) falls within a range that would be interpreted similarly because it did not span from negative to positive or include zero. Frequencies of D-score values indicated that 87% of participants had a D-score above 0 or, in other words, displayed IWB against physicians with obesity. Together, these metrics indicate that IWB was detected among this sample with use of the adapted IAT and that this bias was largely against physicians with obesity.

Score ranges and means observed on the EWB and PWB scales indicated significant variability on these measures, suggesting that bias did exist in both cases. Bivariate correlations revealed small to moderately sized significant relations among the three types of bias; specifically, IWB was positively correlated with EWB (r = 0.24, p < 0.01) as well as with PWB (r = 0.16, p < 0.01). Further, EWB and PWB were strongly correlated with each other (r = 0.73, p < 0.01). On formal analysis, 87% of participants demonstrated at least some antifat IWB. Based on previously described standard cutoffs for D-scores,[14,32] 34% of physicians demonstrated severe antifat IWB, and 31% demonstrated moderate antifat IWB (see Figure 3).

RQ2—How do participants' sex, age, and BMI contribute to their degree of IWB, EWB, and PWB?

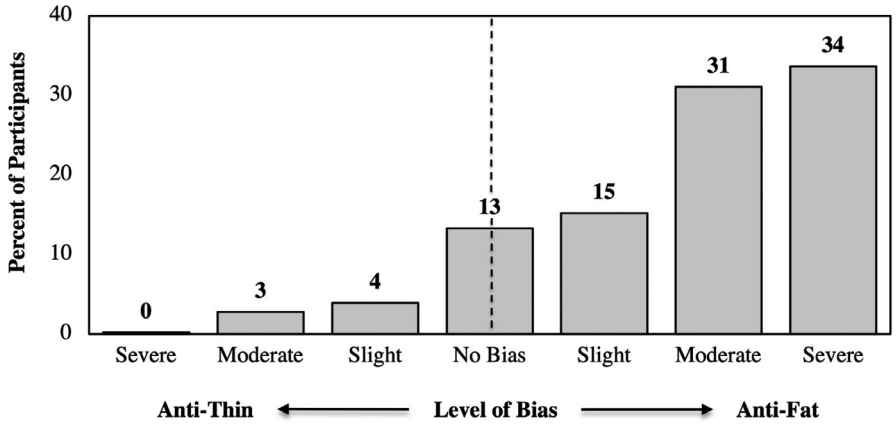

FIGURE 3 Histogram of participant D-scores for implicit weight bias. Black dashed line indicates the point at which no antifat or antithin bias was observed (standard difference score of 0)

Further examination of bivariate correlations revealed small, positive associations between sex and IWB (r = 0.14, p < 0.01; being male was associated with increased IWB) and between age and IWB (r = 0.15, p < 0.01). Additionally, these correlations revealed small negative associations between BMI and IWB (r = −0.11, p < 0.05), EWB (r = −0.10, p < 0.05), and PWB (r = −0.12, p < 0.01).

Multiple regression analyses (see Table 3) were performed in which sex, age, and BMI were modeled as simultaneous predictors of each type of bias, in three separate models. Diagnostic assessments were performed to ensure that all variables utilized in regression analyses were appropriate for linear regression modeling. Specifically, p-plots, scatterplots, and collinearity statistics were examined to confirm that data met assumptions for linearity, homoscedasticity, and multicollinearity for each regression model. No violations of these assumptions were detected.

In the model for IWB, being male and increased age were both significantly associated with increased IWB (B = 0.11, p < 0.01 for sex; B = 0.01, p < 0.01 for age), and increased BMI was significantly associated with decreased IWB (B = −0.01, p < 0.01). Comparisons of the standardized coefficients suggested that the relative strengths of these effects were similar across predictors (β = 0.13 for sex, β = 0.15 for age, β = −0.14 for BMI). The proportion of variance in IWB explained by the predictors, or the r-squared estimate, was small at 0.05 (5% variance explained).

TABLE 3 Correlations among study variables and demographic characteristics

	IWB	EWB	PWB	Age	BMI	Sex
IWB	1					
EWB	0.24**	1				
PWB	0.16**	0.73**	1			
Age	0.15**	−0.10*	−0.02	1		
BMI	−0.10*	−0.10*	0.11*	0.19**	1	
Sex	0.10*	0.10*	0.06	0.20	0.19**	1

Abbreviations: BMI, body mass index; EWB, explicit weight bias; IWB, implicit weight bias; PWB, professional weight bias.

*Correlation significant at p < 0.05.; **Correlation significant at p < 0.01.

In the model for EWB, being male was significantly associated with increased EWB (B = 0.23, p < 0.01), and increased BMI was associated with decreased EWB (B = −0.02, p < 0.05). Age was not significantly related to EWB. Comparisons of the standardized coefficients in this model suggested that sex had the strongest influence on the outcome, followed by BMI (β = 0.12 for sex, β = −0.10 for BMI). The r-squared estimate was small at 0.03 (3% variance explained).

In the model for PWB, being male was significantly associated with increased PWB (B = 0.17, p = 0.05), and increased BMI was associated with decreased EWB (B = −0.02, p < 0.05). Age was not significantly related to PWB in this model. Comparisons of the standardized coefficients suggested that BMI had the strongest influence on the outcome, followed by BMI (β = 0.13 for BMI, β = 0.08 for sex). The r-squared estimate was small at 0.02 (2% variance explained).

RQ3—Does IWB among physicians relate to EWB and PWB toward physicians?

Two final multiple regression models were executed in which IWB, sex, age, and BMI were modeled as simultaneous predictors of EWB and PWB, separately. In these models, IWB was considered the focal predictor and sex, age, and BMI were considered control variables. The model for EWB revealed a significant positive effect of IWB that was stronger than the included covariates (B = 0.594, p < 0.01, β = 0.25). The r-squared estimate for this model was 0.09 (9% variance explained). When comparing r-squared estimates with the previous model in which sex, age, and BMI predicted EWB, IWB explained an additional 6% of the variance in the outcome. The model for PWB revealed a significant positive effect of IWB that was stronger than the included covariates (B = 0.418, p < 0.01, β = 0.17). The r-squared estimate for this model was 0.05 (5% variance explained). When comparing r-squared estimates with the previous model in which sex, age, and BMI predicted PWB, IWB explained an additional 3% of the variance in the outcome.

DISCUSSION

RQ1—What is the degree of IWB, EWB, and PWB existing among physicians?

Our results showed that interphysician antifat IWB, EWB, and PWB do exist, which confirms our hypothesis for this research question. Of note is that the spread of IWB scores was markedly negatively skewed. Although we expected that the majority of physicians would exhibit some degree of antifat IWB, we did not expect the severe antifat IWB category to have the highest frequency and the moderate antifat IWB category to have the second-highest frequency.

Physicians are taught that obesity is a disease process that requires medical and/or surgical treatment. However, our participants' interphysician IWB scores were comparable to previously published large-scale assessments of IWB in the general population,[33] suggesting that this education and training makes no significant difference in IWB prevalence among physicians. The impact of medical education on the spectrum of biases is incompletely understood. Undergraduate and graduate medical training on obesity as a disease process may not be enough to correct the deeply ingrained cultural and societal patterns of WB. In fact, this training may actually increase WB among physicians, evidenced by a recent study that found that medical students' EWB increased during medical school.[34] We speculate that, particularly when it comes to interphysician WB, physicians may feel their colleagues have an obligation to set an example for their patients and the public by maintaining a healthy weight.

RQ2—How do participants' sex, age, and BMI contribute to their degree of IWB, EWB, and PWB?

We found that male sex, increased age, and decreased BMI were significantly related to increased IWB; that male sex, decreased age, and decreased BMI were significantly related to increased EWB; and that decreased BMI was significantly related to decreased PWB. This supports our hypothesis regarding IWB and EWB, but not regarding the novel, investigator-developed PWB measure, which was not based on a previously validated tool. Prior research regarding nonphysicians has directly correlated male sex[21,35] and younger age[36] with increased possession of EWB, but there has been inconsistent evidence relating to BMI,[37] possibly due to high-BMI lean body mass outliers and other confounders.

While our analyses suggest that sex, age, and BMI are important factors, our research provides limited insight into why IWB is stronger in these groups. One possible explanation is that physician biases reflect the biases of society as a whole, as previously discussed. Males in the general population have shown higher levels of IWB and EWB,[4] and it follows that male physicians may have higher levels of IWB and EWB than female physicians. Regarding increased IWB and EWB among lower-BMI physicians, a likely contributing factor is the lack of lived experience of obesity (physicians with obesity may have more empathy). A possible explanation for the increased IWB among older physicians may be the evolution of obesity education in undergraduate and graduate medical education to more recently include psychosocial aspects, including bias, as the prevalence of obesity increases in the United States. Also, given the growth in prevalence of obesity in the general population, the probability that younger physicians have had loved ones struggling with obesity may be higher and thus may bring about increased empathy.

RQ3—Does IWB among physicians relate to EWB and PWB toward physicians?

We found that increased IWB was significantly related to increased EWB and PWB and that EWB and PWB were significantly related to each other, after controlling for reported age, sex, and BMI. This supports our hypothesis for this research question. We infer from our analyses that interphysician IWB may translate to explicit thoughts, actions, and practices. Although interphysician IWB may not be easily sensed by the origin or target of the bias, it may translate to EWB and PWB (which is more directly experienced by the target).

The relationship between implicit and explicit bias measures has been inconsistent in prior literature.[38,39] One meta-analysis of 126 large studies found that IAT scores and explicit self-reports are systematically related to one another.[40] The question of correlation strength between physicians' IWB and EWB has also previously been posed in the literature.[4] Our findings do answer this question, specifically regarding interphysician WB. Implicit attitudes have previously been better predictors of detrimental views and practices than explicit reports, particularly regarding stigmatized topics and socially sensitive areas.[18,41] Obesity stigma is prevalent in the general population.[42] Physician obesity may be especially stigmatized because physicians may be expected to exemplify perfect health. We argue that IWB measurement is the most accurate bias measure because it does not require participant honesty or introspection, as is imperative for accurate EWB reports. We expect that EWB and PWB are universally underreported, and even so, we found significant direct correlation between all biases measured. This suggests that interphysician IWB may indeed translate to detrimental effects in the medical workplace.

Effect sizes and significance of relations

A notable pattern revealed throughout preliminary analyses and main results is that the sizes of effects detected, correlations and effect sizes concerning the effects of characteristics on bias, and the effects of bias on other types of bias were generally small. These small effect sizes, however, are in line with what has been observed in past literature[40,43,44] and have been explained in past studies by both the psychological factors of participants and the methodological aspects of how bias is measured.[45] For example, motivation and opportunity to control the expression of mental reactions is a psychological factor that can decrease the strength of association between implicit and explicit bias. Among groups where this motivation and opportunity is high, the association tends to be lower, whereas in groups where motivation and opportunity are low or in samples of the general population where a distinct group is not assessed, the association tends to be higher. As relates to this study, this could suggest that physicians are a group that may have higher motivation to control the expression of their bias, which conceptually would make sense (but, important to note, is pure conjecture at this point).

From a methodological perspective, it has also been demonstrated that correlations between implicit and explicit bias are

higher when participants complete measures of each type of bias using the same stimuli (for example, looking at the same sets of pictures in both assessments) and lower when measures present different stimuli of the same subject matter, as was the case in this study.[40,46,47] We also want to note that past meta-analytic work examining the predictive utility of the IAT on individuals' behavior has found that even small effect sizes can translate to societally consequential impacts,[48] and this is true among physicians as well. Reviews of bias research stress the importance of considering additional factors including context in interpretations of relations between bias and its antecedents and outcomes, but hold strong that bias, and especially implicit bias, cannot be discounted as an important factor contributing to social discrimination.[45] In the case of this study, we extrapolate from this foundational literature that the small effects detected here to not negate the potential for physician's biases to impact their behavior and professional practices.

Detrimental effects of interphysician WB

The possible detrimental effects of WB in the medical workplace are numerous. This is evidenced by three of our more profound item-level analyses: 17% of physicians agreed with the statement, "I really don't like fat physicians very much"; 15% agreed with, "Fat physicians make me somewhat uncomfortable"; and 14% agreed with, "If I were an employer looking to hire, I would avoid hiring a fat physician." Physicians with higher BMI may have unique backgrounds and perspectives for patients, and colleagues who decline to collaborate removes them from the referral pool in clinical practice. This may be detrimental to not only directly to physicians with obesity but also to their patients. For example, similar body habitus from patient to physician may improve their working relationship from the patient perspective by reducing feelings of shame or stigma.[49] Effects such as these may be felt not only at the level of the individual, but also on an institutional scale—they may impair cultivation of workplace cultures of equity and inclusivity.

These consequences of interphysician WB are in addition to those which may be experienced by any member of society with obesity, including the previously discussed salary disparity,[10] depression, and suicidality.[50] Weight stigma has long been misunderstood. Both the general population and health professionals have previously argued that stigmatizing obesity may actually prompt weight loss by motivating healthier choices.[51] However, weight stigma has actually been associated consistently with both worse mental and worse physical health outcomes.[50]

LIMITATIONS

The most notable limitation is inability to calculate participant response rate precisely, as each of the utilized organizational listservs, message boards, and medical social media groups have members who do not receive or check associated message boards, have opted out of email communications from the organization, or do not check listserv emails received from these organizations. Medical society members also have a tendency toward dual membership in medical societies, thereby adding another factor limiting our ability to calculate response rate. The structure of the survey itself may also have contributed to the low response rate: the IAT requires the use of an external keyboard to measure IWB, excluding those who open the survey with a smartphone. We included statements in survey distributions that a keyboard was required to complete the survey; nonetheless, we anticipate that this is the primary reason that only about half of participants who initially opened the survey completed it. It is important to acknowledge that those participants who completed the survey are likely characteristically different than those who did not. In future studies, a structured method of directly contacting potential subjects and tracking email open rate would mitigate the issue of the untraceable response rate.

Also important to note is the fact that emergency and female physicians were overrepresented in our analytic sample and that our sample included medical students. While formal comparisons of group means on key study variables between emergency and nonemergency physicians, and between medical students and practicing physicians, revealed no significant differences between groups, it is likely that these groups do indeed differ in characteristics not considered in this study. Due to this, while the inclusion of these groups moves us in the direction of generalizing results to the overall population of U.S. physicians, the results reported here may not generalize as precisely to the groups underrepresented in our data.

Future directions

Much work remains to be done to raise awareness and correct the effects of interphysician WB. One step is to replicate and expand upon this study using a sample that more accurately reflects the composition of physicians in the U.S. workforce. Further analysis of participant factors omitted from this study may show additional significant effects. Comparative studies should be undertaken to determine weight bias levels in physicians relative to nonphysicians as well as in myriad other communities. Identifying community weight bias baselines would allow greater exploration of other factors (such as race and religion), which may contribute differently to weight bias. Interphysician weight bias educational interventions must be created, validated, implemented, monitored, and studied over time with funded research. In the meantime, we suggest that residency and medical school leadership incorporate more robust weight bias training into their curricula and that the ACGME consider requiring weight bias training of residency programs in their onboarding protocols for both residents and faculty.

CONCLUSIONS

Most participants (87%) possessed interphysician antifat implicit weight bias, with >65% falling into the severe or moderate category. Older, male, and nonobese physicians exhibited the most implicit weight bias. We also found direct, positive associations between

implicit weight bias and explicit weight bias: physicians with high implicit weight bias reported negative views and decreased intent to collaborate with obese colleagues, which may suggest that implicit weight bias translated into explicit actions. This relationship has been inconsistently demonstrated in previous literature, and it highlights the potential detrimental effects that interphysician implicit weight bias may cause. Our findings can be used to raise awareness of the high prevalence of weight bias, guide discussion, and facilitate bias training in the medical workplace to reduce the potential for professional disparities faced by physicians with obesity.

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CONFLICT OF INTEREST

The authors have no potential conflicts to disclose.

AUTHOR CONTRIBUTIONS

Mary E. McLean contributed to the study concept and design, acquisition of the data, interpretation of the data, drafting of the manuscript, and critical revision of the manuscript for important intellectual content. Leigh E. McLean contributed to the study concept and design, acquisition of the data, analysis and interpretation of the data, drafting of the manuscript, and critical revision of the manuscript for important intellectual content and statistical expertise. Annie C. McLean-Holden contributed to the drafting of the manuscript and critical revision of the manuscript for important intellectual content. Linelle F. Campbell contributed to the drafting of the manuscript and critical revision of the manuscript for important intellectual content. Adriana M. Horner contributed to the drafting of the manuscript and critical revision of the manuscript for important intellectual content. Miriam L. Kulkarni contributed to the study concept and design, drafting of the manuscript, and critical revision of the manuscript for important intellectual content. Laura D. Melville contributed to the study concept and design, drafting of the manuscript, and critical revision of the manuscript for important intellectual content. Elizabeth A. Fernandez contributed to the drafting of the manuscript and critical revision of the manuscript for important intellectual content.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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