Spring 5-1-2023

The Effect of Weight Bias on the Prevalence of Cardiovascular Disease

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Senior Honors Project

Submitted in partial fulfillment of the graduation requirements of the Westover Honors College

Westover Honors College

May, 2023

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Abstract

The condition of obesity has been recognized by the American Medical Association (AMA) as a multi-faceted chronic disease. Previous studies have shown an associational relationship between recorded weight bias in healthcare providers, in society at large, and towards oneself and negative health outcomes. In addition, the increased rate of recorded obesity is often tied to the increased incidence of cardiovascular disease in the population. Therefore, it is imperative to discuss the causes of this relationship and an updated course of treatment. The purpose of this study is to evaluate how the attitudes and beliefs of healthcare providers towards people who are considered overweight and obese affects the management and treatment of cardiovascular disease in this same population. In addition, this study will explore the intersectionality of health disparities along both weight and racial lines. A survey was created and sent to Lynchburg area healthcare providers and health science graduate students to analyze their attitudes and beliefs towards obese persons. Variables studied include the following: level of weight bias (explicit); the racial composition of the provider's patient case load; if the physician treats patients with cardiovascular disease; the provider's medical specialty; the number of years spent practicing; healthcare provider's age and gender; and recency of weight bias training. The results of this survey were analyzed and discussed. No statistically significant differences were found between ATOP and BAOP scores for most independent variables. However, the BAOP score for respondents who see a patient population ≥ 50% Black was found to be statistically significant. This variable requires additional focused study before conclusions can be made.

Introduction

Weight bias is defined as negative weight-related attitudes and beliefs that are exhibited through stereotypes, discrimination, and prejudice towards individuals (Puhl et al. 2008). Weight bias regularly affects people who are overweight in a variety of harmful ways. People of size can experience weight bias through explicit, implicit, externalized, and internalized bias. With regard to issues of weight, explicit bias is defined as the consciously expressed weight biases that one knows they possess (Puhl et al. 2008). Conversely, implicit bias involves unconsciously held beliefs about the characteristics of a person or group of people (Puhl et al. 2008). Persons who project their negative weight-biases on others rather than themselves demonstrate externalized bias (Puhl et al. 2008). Moreover, people who are overweight/obese can experience internalized bias, which is defined as prejudices about weight that are targeted towards oneself because of societal discrimination (Puhl et al. 2008). Persons of larger size tend to experience these biases regularly, and they compound on each other to result in several negative stigmas. These are weight stigma, anticipated stigma, felt stigma, and self-stigma. Weight stigma is when a person recognizes they are being treated poorly because of weight (Cullin and White 2019). This kind of stigma often manifests itself in anticipated stigma (when one expects discrimination), felt stigma (when someone recognizes they are being devalued), and self-stigma (when a person targets themselves) (Cullin and White 2019). Current widespread weight bias and stigma are a consequence of the inappropriately glamorized skinny body type promoted by 20th century advertising agencies and healthcare's weight-focused push to promote a past ideal of good health. This pervasive weight bias and stigma, termed "fat panic", is regularly observed in contemporary media, public health policies, and campaigns that serve to glorify and romanticize skinniness (or thinness) and demonize fatness (Alberga et al. 2016). Weight bias may also lead to violence, as people (especially women) of larger size

are more likely to experience domestic and sexual abuse because of their weight (Farhat et al. 2014). This fat panic exacerbates the societal discrimination that people who are overweight/obese deal with on a regular basis.

One cannot discuss fat panic without further examining the role of healthcare professionals. According to a study of 2,400 women on weight bias, 69% said they experienced weight bias from their physicians and about 52% reported that they experienced externalized bias from physicians on more than one occasion (Puhl and Brownwell 2006). Moreover, physicians were reported to be the second most common source of general weight bias. The exposed role of physicians in perpetrating healthcare weight bias is not surprising when considering the publicly expressed view of leaders in the medical field. In a 2013 editorial, the president of the Institute of Medicine, Harvey Fineberg, listed gluttony and sloth as 'deadly sins' in order to posit that obesity should be solved, through mere personal resolve and self-control. According to Fineberg, if people just had more motivation and will-power, they could eat less and lose weight (Lucan and DiNicolantonio 2014). These sorts of statements in healthcare lead to internalized bias and self-stigma in people of a larger size, potentially leading to an unhealthy relationship with food in the form of eating disorders. Moreover, these attitudes guide people who are overweight/obese to harbor anticipated stigma with regard to society in general, and healthcare in particular. The Obesity Action Coalition (OAC) reports that people who are obese have less access to cancer screenings, are more likely to cancel or delay appointments, and receive less time with physicians, less intervention, and less discussion (OAC 2019). Thus, the valid anticipated stigma that persons of size experience as a result of weight bias in healthcare has the potential to exacerbate cardiovascular disease in people who are overweight/obese.

According to the Center for Disease Control and Prevention (CDC), cardiovascular disease (CVD) is one of the most common causes of death in America (CDC 2022). In addition, people who are overweight are generally considered more likely or more susceptible to developing CVD (Powell-Wiley et al. 2021). Interestingly, studies suggest that when one perceives themselves as "overweight" they experience an increased 10-year risk of undergoing a cardiovascular event when compared to those perceiving their weight as "about right," regardless of body composition (Cullin and White 2019). In other words, a patient's view of themselves plays a vital role in their physical wellbeing. Therefore, it stands to reason that weight bias has a negative influence on the health of people who are overweight/obese and may increase the likelihood of developing CVD. The increased CVD risk among those who perceive themselves as "overweight" may be due in part to an increased vulnerability to experienced stigma, anticipated stigma, felt stigma, and self-stigma compared to those with similar body fat percentages perceiving themselves as "about right" (Cullin and White 2019). Therefore, weight bias in society and healthcare plays an important role in the prevalence of CVD. This phenomenon may be due to a number of reasons such as people who are overweight being victims of weight bias in society who are less likely to receive the same quality healthcare as people who are considered thin (OAC 2019). Moreover, the available literature on the subject of weight bias and CVD also points to internalized bias as a major factor in the prevalence of CVD. Studies show that internalized bias is associated with significantly higher triglyceride levels (Pearl et al. 2017). Triglycerides are a common type of body fat that is typically found in the blood, and high triglyceride levels are indicative of a potential thickening or fatty buildup of the arteries which is the cause of coronary heart disease (Mayo Clinic 2022). Internalized bias is a major factor in high triglyceride levels because it typically elicits a chronic stress response in the patient, similar to that observed in reaction to

experiences of weight stigma. This chronic stress response includes heightened levels of oxidative stress and cortisol secretion (Pearl et al. 2017). To put it another way, trauma as a result of chronic weight bias often results in internalized biases that can cause severe negative health outcomes. A study discovered that internalized bias was seen to have negative effects on a patient's psychological well-being (low self-esteem and depression), as well as physical well-being (increased stress and cortisol levels) (Jung et al. 2019). Furthermore, internalized weight bias experienced by persons of larger size has been shown to lead to negative health effects, but the evidence does not suggest that externalized weight bias alone leads to the same negative effects. The increased stress and cortisol levels in people who experience internalized weight bias leads to a greater risk of CVD, as high levels of cortisol can increase blood triglyceride levels (Jung et al. 2019). In fact, felt stigma was found to double the 10-year risk of high allostatic load (Vadiveloo and Mattei 2016). Allostatic load refers to the compounding burden of chronic stress on the body. A high allostatic load often results in poor heart function as chronic stress weighs on the body and increases regular cortisol levels in the body. It is suggested that eliminating weight bias and stigma could reduce this physiological dysregulation and increase a patient’s lifespan (Vadiveloo and Mattei 2016).

Black people in America tend to be more likely to experience higher blood pressure and, consequently, are more likely to experience CVD (Graham 2015). Additionally, Black people in America experience disparities in the treatment of disease. Physicians often recommend more potentially effective medical procedures (such as coronary bypass surgery) for white patients rather than for Black patients (Dovidio and Fiske 2012). This disparity occurs because physicians assume that Black patients are less educated and less willing to be active. In other words, implicit racial biases influence the decision-making of physicians even if explicit racial bias may be perceived as decreasing in society over the years. Moreover,

Black patients report that they feel less respected by their healthcare providers, leading to them liking their physicians less and having less confidence in them when they exhibit greater implicit racial bias (Dovidio and Fiske 2012). The reactions of Black patients to their physicians seem to be similar to the reactions of people who are overweight. As all Black people do not have the same body type, some Black people face discrimination as a result of the intersectionality of all their identities, such as Black people who are overweight. This interconnectedness of identities means that Black people who are overweight may experience a compounding effect of discrimination because of their weight and their race.

Racial discrimination has also been named as a contributing factor to CVD. Adults with perceived lifetime racial discrimination had a 38% increased risk of incident CVD than those who reported no lifetime racial discrimination (Panza et al. 2019). Interestingly, everyday racial discrimination was associated with incident CVD in men only. Lifetime racial discrimination was described as chronic racial discrimination over time, and everyday racism was described as individual daily acts of racism. This means that higher levels of stress caused by racial discrimination contribute to the prevalence of CVD; for women, this is a result of the accumulation of racial discrimination over time. However, only men were shown to likely develop CVD as a result of daily racial discrimination. Furthermore, perceived weight and racial discrimination are associated with a greater likelihood of myocardial infarction, atherosclerosis, and minor heart conditions among adult men and women (Udo and Grilo 2017). This clearly shows how the intersectionality of race and weight discrimination can increase the possibility that one develops CVD.

The effects of weight and racial biases on the cardiovascular health of patients has proved to be deserving of further exploration. Therefore, the present study aimed to evaluate how the attitudes and beliefs of healthcare providers towards people who are considered overweight and obese affects the management and treatment of cardiovascular disease in this same population. In addition, the study sought to explore the intersectionality of health disparities along both weight and racial lines. To conduct this research a 15 minute survey analyzing the behaviors, attitudes, feelings, cardiovascular disease outcomes, and demographics of the healthcare providers in the Lynchburg area.

Materials and Methods:

This study has a cross-sectional design in which physicians were invited to participate in an IRB-approved survey (Appendix) using an advertisement in the Lynchburg Academy of Medicine's quarterly newsletter. The advertisement included a Quick Response (QR) code and contact information for the Principal Investigator. The QR code directed the participant to a Google Doc containing a welcome letter, informed consent, and a link to the survey. The study survey was estimated to take about 15 minutes to complete in one session. It was composed of questions from the Attitudes Towards Obese Persons (ATOP), Belief Towards Obese Persons (BAOP), and Thermometer scale. Additionally, it had a demographics section which included items to assess the participant's age, gender, field of practice, etc.

The ATOP scale measures the participant's prejudiced attitudes towards people of larger size on a 6-point Likert scale (Allison et al. 1991). Twenty statements are presented to respondents, such as "Obese people are often less aggressive than non obese people" and asked to indicate their level of agreement from strongly disagree to strongly agree (scored +3 to -3) (Appendix). Higher ATOP scores indicate positive attitudes towards people of larger size, ranging from 0 to 120. Adequate internal reliability for this scale has been demonstrated in adult populations (Allison et al. 1991). The BAOP scale measures the participant's beliefs towards the cause of obesity on a 6-point Likert scale (Allison et al. 1991). Eight statements are presented to respondents, such as "In many cases, obesity is the result of a biological disorder" and asked to indicate their level of agreement on a range from strongly disagree to strongly agree (scored +3 to -3) (Appendix). Higher BAOP scores indicate a belief that obesity is not able to be controlled, ranging from 0 to 48. Sufficient internal reliability for the BAOP scale has been demonstrated in adult populations (Allison et al. 1991). The Thermometer scale questions consisted of one likert scale preference question and two visual analog scale (VAS)

questions (Cline et al. 1992). The two VAS questions, or feeling thermometer questions, assess participants' explicit bias by requiring the participant to indicate how warm or cold they feel towards people who are thin and people who are of larger size (Appendix). These feeling thermometer questions demonstrate adequate reliability (Lupton and Jacoby 2016). Three measures of explicit bias were used with the intent to triangulate results to accurately evaluate the respondent's explicit bias.

Once physicians completed the survey, they completed their participation by clicking on the submit button. Available resources to address potential psychological distress from participation were provided via web address. Data collection via the QR code-linked survey in the Lynchburg Academy of Medicine's newsletter continued until April 13, 2023. A 30% response rate (133 participants) was not reached by the survey, therefore, an IRB modification was sought and approved to expand the survey target population to include graduate students, faculty, and staff who interact with patients in a healthcare setting. A link to the survey was sent through an email, including a welcome letter to participate after obtaining informed consent. The survey accepted responses until April 19, 2023. Data was downloaded onto a Google Sheet Spreadsheet and processed through the Statistical Package for Social Sciences (SPSS) software version 28. Data was analyzed inside the parameters of included variables: level of weight bias (explicit), the racial composition of the provider's patient load, if they treat patients with cardiovascular disease, their medical specialty, amount of time practicing, age, gender, and recency of weight bias training.

Results

The survey was sent to a total of 981 persons resulting in 24 responses (2.45% response rate). Our original goal was to have at least 295 respondents (30% response rate), however, challenges in recruiting resulted in a lower than desired response rate. The respondents came from many different aspects of healthcare (Table 1). Additionally, 13 out of the 14 respondents who are currently practicing healthcare providers see patients with cardiovascular disease, regardless if the diagnosis is primary or secondary.

Table 1 - Comparison of Respondents based on Descriptive Characteristics as expressed in frequencies of percentages. Age of respondents and years of practice are reported with a mean and standard deviation.

Characteristic	*n* (%)	Mean (SD)
Responses	24	
Persons who interact with patients in a medical/clinical setting	18 (75.0)	
Persons who do not interact with patients in a medical/clinical setting	6 (25.0)	
Gender Identity of persons who interact with patients in medical/clinical setting (*n* = 18)		
Male	4 (22.2)	
Female	14 (77.8)	
Other	0 (0)	
Age of Respondents, years (*n* = 18)		41.9 (14.9)
Student Status (*n* = 18)		
Student	12 (57.1)	
Non-student	6 (28.6)	
Practicing Healthcare Provider (*n* = 14)*		
Not practicing	1 (4.8)	
Practicing Part-time (<32 hours per week)	3 (14.3)	
Practicing Full-Time (≥32 hours per week)	10 (47.6)	

Years of Practice for those who are active healthcare providers (n = 13)		20 (10.95)
Discipline Area of Practice or Study of Respondents (n = 18)		
Doctor of Physical Therapy	4 (22.2)	
Master of Physician Assistant Medicine	3 (16.6)	
Doctor of Medical Science	9 (50.0)	
Master of Athletic Training	1 (5.6)	
Medical Doctor	1 (5.6)	
Specialty Area for those currently practicing (n = 12)		
Family Medicine/Family Practice	3 (25)	
General Internal Medicine	2 (16.7)	
Pediatrics	1 (8.3)	
Gastroenterology	1 (8.3)	
Urgent Care	1 (8.3)	
Infectious Disease	1 (8.3)	
Clinical Research	1 (8.3)	
Acute Care, but not Hospitalist	1 (8.3)	
Radiology/Oncology	1 (8.3)	
Patient Population Mix (n = 14)		
0% Black / 100% White		
10% Black / 90% Non-Black	5 (35.7)	
20% Black / 80% Non-Black	1 (7.1)	
30% Black / 70% Non-Black	3 (21.4)	
40% Black / 60% Non-Black	0 (0)	
50% Black / 50% Non-Black	3 (0)	
60% Black / 40% Non-Black	1 (7.1)	
70% Black / 30% Non-Black	0 (0)	
80% Black / 20% Non-Black	1 (7.1)	
90% Black / 10% Non-Black	0 (0)	

100% Black / 0% Non-Black	0 (0)	
Received training about Weight Bias in the past 5 years (n = 14)		
Yes	7 (50)	
No	7 (50)	

*Some DMSc students are currently practicing Physician Assistants.

In order to address potential concerns with validity of a single explicit bias measurement tool, repeated measures of explicit bias were applied to triangulate findings using ATOP, BAOP, and Thermometer scales. The ATOP scale measured the respondent's weight bias attitudes, the BAOP scale measured respondent's weight bias informed beliefs about obesity, and the Thermometer scale measured temperature and preference towards people of varying body sizes. Normality testing was performed to evaluate explicit weight bias scores prior to proceeding with parametric or non-parametric statistical analysis. While a normal Q-Q plot of ATOP and BAOP scores demonstrated no violation of normality (Figures 1 and 2), more objective analysis of the Shapiro Wilks test was applied to verify normality.

Figure 1. Normal Q-Q plot of ATOP score distribution demonstrates high-likelihood of normal distribution based on visual assessment.

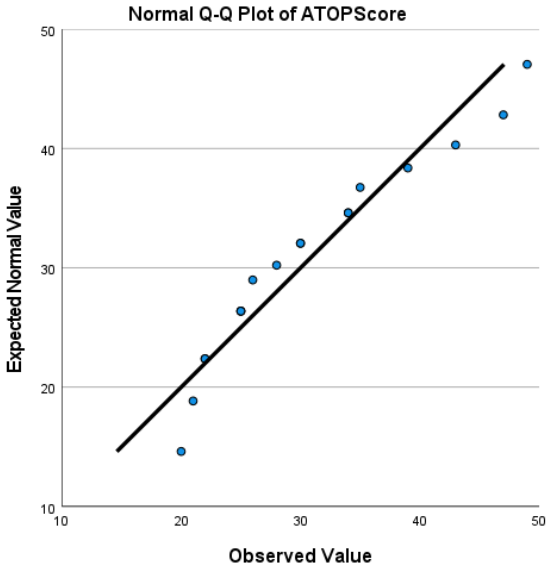
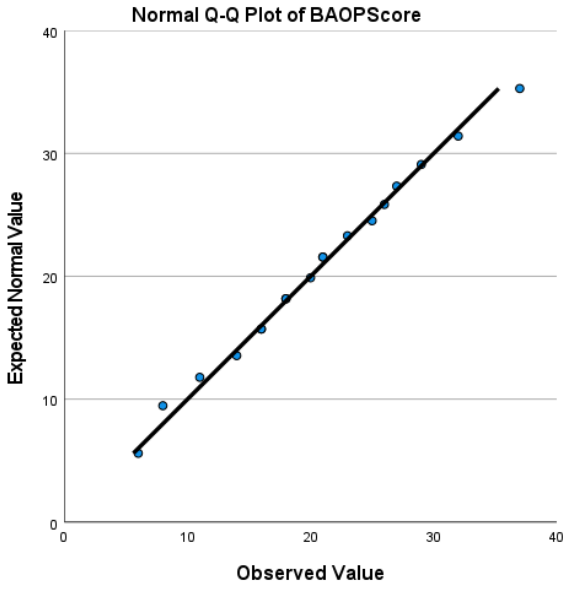


Figure 2. Normality Q-Q plot of BAOP score distribution demonstrates high-likelihood of normal distribution based on visual assessment.



The normality testing of ATOP and BAOP scores were supported by non-significant Shapiro-Wilk Test values (Figure 3). The ATOP scores had a non-significant Shapiro-Wilk Test value of 0.096 ($p>0.05$). The BAOP scores had a non-significant Shapiro-Wilk Test value of 0.999 ($p>0.05$).

Table 2. A more detailed analysis of normality of ATOP and BAOP Scores, using Shapiro-Wilk verifies normal distribution objectively

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
ATOPScore	.151	18	.200*	.913	18	.096
BAOPScore	.084	18	.200*	.990	18	.999

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

A conglomeration of the ATOP and BAOP respective mean test scores and standard deviation of all the demographic groups in the study and their significance was included (Table 3). A potential difference in ATOP and BAOP scores between the male and female genders was investigated. No significant difference was noted in ATOP scores between male (38.0 ± 12.57, $n = 4$) and female participants (28.79 ± 6.85, $n = 14$, $p = .066$) based on an independent sample t-test (Table 3). ATOP scores were higher in male participants than what was measured in female participants. Additionally, no significant difference was noted in BAOP scores between male (24.25 ± 2.75, $n = 4$) and female participants (19.36 ± 8.91, $n = 14$, $p = .303$) based on an independent sample t-test (Table 3). Similar to the differences by gender analysis in ATOP score, the males demonstrated higher BAOP scores than the female respondent. A potential difference in ATOP and BAOP scores between the healthcare students and non-student healthcare participants was investigated. No significant difference was noted in ATOP scores between persons who were classified as students (31 ± 9.81, $n = 12$) compared to those who were not students (30.50 ± 7.61, $n = 6$, $p = .915$) based on an independent samples t-test (Table 3). Additionally, no statistically significant difference was noted in mean BAOP scores between persons who were classified as students (21.42 ± 8.86, $n = 12$) compared to those who were not students (18.50 ± 6.80, $n = 6$, $p = .491$) based on an independent samples t-test (Table 3). A potential difference between ATOP and BAOP scores when comparing persons who work as practicing healthcare providers part-time (<32 hours per week) versus full-time (≥32 hours per week) was investigated. No statistically significant difference was found in mean ATOP scores between persons who were classified as working part-time or less than 32 hours per week (34.00 ± 11.53, $n = 3$) compared to those who worked full-time or equal to or more than 32 hours per week (31.60 ± 9.49, $n = 10$, $p = .719$) based on an independent samples t-test (Table 3). Additionally, no statistically significant difference was

noted in mean BAOP scores between persons who were classified as working part-time or less than 32 hours per week (19.33 ± 4.73, $n = 3$) compared to those who worked full-time or greater than or equal to 32 hours per week (22.2 ± 6.60, $n = 10$, $p = .504$) based on an independent samples t-test (Table 3). A potential difference between ATOP and BAOP scores when comparing healthcare practitioners who work with a patient population of <50% Black and those whose patient population is ≥50% Black was investigated. No statistically significant difference was noted in ATOP scores between healthcare practitioners who work with a patient population of <50% Black (33.22 ± 10.65, $n = 9$) compared to those whose patient population is ≥50% Black (28.00 ± 7.25, $n = 5$, $p = .351$) based on an independent samples t-test (Table 3). A statistically significant difference was noted in BAOP scores between healthcare practitioners who work with a patient population of <50% Black (23.89 ± 5.58, $n = 9$) compared to those whose patient population is ≥50% Black (14.60 ± 4.98, $n = 5$, $p = .009$) based on an independent samples t-test with a Cohen's D of 1.725 indicating a large effect size (Table 3). A potential difference in participants' ATOP scores in those who had previous weight bias education compared to those without previous weight bias education was investigated. No significant difference was noted in ATOP scores between persons who had received weight bias education in the past 5 years (30.86 ± 9.14, $n = 7$) compared to those who did not (31.86 ± 10.81, $n = 7$, $p = .855$) based on an independent samples t-test (Table 3). A potential difference in participants' BAOP score in those who had previous weight bias education compared to those without previous weight bias education was investigated. No significant difference was noted in BAOP scores between persons who had received weight bias education in the past 5 years (21.86 ± 6.59, $n = 7$) compared to those who did not (19.29 ± 7.54, $n = 7$, $p = .255$) based on an independent samples t-test (Table 3).

Table 3. Group Comparison of ATOP and BAOP Scores based on demographic categories as expressed in mean and standard deviation. Statistical significance in p-value is recorded.

Group	ATOP (mean ± SD)	Significance *p*-value*	BAOP (mean ± SD)	Significance *p*-value*
Gender Identity (*n* = 18)				
Male (*n* = 4)	38.0 ± 12.57	.066	24.25 ± 2.75	.303
Female (*n* = 14)	28.79 ± 6.85		19.36 ± 8.91	
Student Status (*n* = 18)				
Student (*n* = 12)	31 ± 9.81	.915	21.42 ± 8.86	.491
Non-student (*n* = 6)	30.50 ± 7.61		18.50 ± 6.80	
Practicing Healthcare Provider (*n* = 13)^				
Practicing Part-time, <32 hours per week (*n* = 3)	34.00 ± 11.53	.719	19.33 ± 4.73	.504
Practicing Full-Time, ≥32 hours per week (*n* = 10)	31.60 ± 9.49		22.2 ± 6.60	
Discipline Area of Practice or Study of Respondents (*n* = 16)^#				
Doctor of Physical Therapy (*n* = 4)	24.50 ± 4.04	.189	20.00 ± 12.51	.581
Master of Physician Assistant Medicine (*n* = 3)	37.33 ± 4.93		15.67 ± 9.50	
Doctor of Medical Science (*n* = 9)	31.78± 10.67		21.89 ± 6.64	
Patient Population Mix (*n* = 14)				
<50% of population Black (*n* = 9)	33.22 ± 10.65	.351	23.89 ± 5.58	.009$^{\phi}$
≥50% of population Black (*n* = 5)	28.0 ± 7.25		14.60 ± 4.98	
Received training about weight bias in the past 5 years (*n* = 14)				

Yes (n = 7)	30.86 ± 9.14	.855	21.86 ± 6.59	.255
No (n = 7)	31.86 ± 10.81		19.29 ± 7.54	

* α = 0.05 for independent sample t-tests
^Categories with only 1 respondent were not included in the analysis
[#]One-way ANOVA analysis conducted given one independent variable with three levels; all other comparison of means were independent t-tests
[Φ]statistically significant difference detected

No significant differences were noted in ATOP or BAOP scores across the three major healthcare disciplines represented by study participants. If only one respondent was available, that category of healthcare provider was not included. The ATOP Analysis Of Variance (ANOVA) mean ± standard deviation values for DPT, MPAM, and DMSc are: 24.50 ± 4.04, 37.33 ± 4.93, 31.78± 10.67 respectively. The BAOP ANOVA mean ± standard deviation values for DPT, MPAM, and DMSc are: 20.00 ± 12.51, 15.67 ± 9.50, and 21.89 ± 6.64 respectively.

A Kendall's tau-b correlation analysis was conducted to determine the relationship between ATOP score and response to the question "How warm do you feel towards thin people" amongst 18 of the respondents, as well as the relationship between BAOP score and the same question. There was no correlation found between ATOP and a feeling of warmness toward thin people, $\boldsymbol{\tau}_b$ = -.090, p = .634 (Table 4). Additionally, there was no correlation found between the BAOP score and a feeling of warmth toward thin people, $\boldsymbol{\tau}_b$ = .155, p = .406 (Table 4). A Kendall's tau-b correlation analysis was conducted to determine the relationship between ATOP score and response to the question "How warm do you feel towards fat people" amongst 18 of the study participants, as well as the relationship between BAOP score and the same question. There was no correlation found between ATOP and a feeling of warmth towards people who are overweight, $\boldsymbol{\tau}_b$ = -.154, p = .410 (Table 4). Additionally, there was no

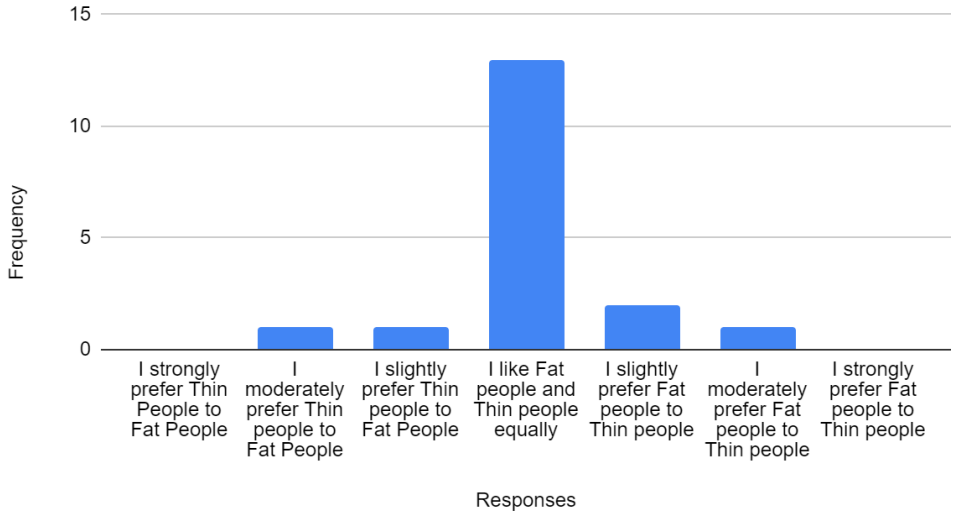
correlation found between the BAOP score and a feeling of warmth toward people who are overweight, τ_b = -.080, p = .667 (Table 4).

Table 4. Correlation Analysis between ATOP and BAOP Scores and Thermometer Scales by Kendall's tau-b coefficient. Statistical significance in p-value is recorded.

	ATOP Kendall's tau-b Coefficient	Significance p<0.05	BAOP Kendall's tau-b Coefficient	Significance p<0.05
Thermometer Question: How warm do you feel towards thin people?	-.090	.634	.155	.406
Thermometer Question: How warm do you feel towards fat people?	-.154	.410	-.080	.667

Furthermore, with regard to the last temperature question, the majority of study participants indicated that they equally prefer fat and thin people (n = 13, 72.2%) (Figure 3).

Figure 3. Preference statement responses based on weight. Response frequencies are depicted below, demonstrating higher frequency of equality responses.



Discussion

The purpose of this research was to evaluate the attitudes and beliefs of healthcare providers towards people who are considered overweight and obese and how it may affect their management and treatment of patients with cardiovascular disease. The data collection survey acquired responses to the ATOP and BAOP explicit weight bias validated tools, temperature gauges towards fat and thin persons, a singular preference question, and a variety of demographic questions to facilitate categorical comparison. The potential group differences by gender for the ATOP and BAOP scores was investigated. Many other group differences were explored, including: healthcare graduate students versus healthcare professionals, healthcare professionals that work part-time (<32 hours per week) versus full-time (≥32 hours per week), healthcare professional's patient population race group, and healthcare professional's exposure to weight bias education.

The study sample of this research comprised 2.45% of the potential 981 sample size, this small sample size was the result of numerous logistical failings external to the purview of the researchers and impacted the generalizability of the results. The demographics of the survey respondents were recorded and provided variables to be analyzed (Table 1). As represented in Table 1, 13 out of the 14 active healthcare providers regularly see patients with cardiovascular disease (CVD). Therefore, no comparison analysis was done along this variable since the sample is skewed towards persons who see patients with cardiovascular disease. Additionally, although this sample size alone may not indicate prevalence, it is noticeable that healthcare professionals in an array of fields other than cardiology treat patients with cardiovascular disease. These health professionals and students spanned the disciplines of: Doctor of Physical Therapy, Masters of Physician Assistant Medicine, Doctor of Medical Science, Masters of Athletic Training, and Medical Doctor.

Before further analysis of ATOP, BAOP, and Temperature section score responses could be conducted, a normality testing of ATOP and BAOP score distribution was performed. This mode of testing was imperative as a violation of normality could indicate that further analysis results could be erroneous. The normal Q-Q plots for the ATOP and BAOP score distributions allowed for further study into these scores to be conducted as normality was not violated (Figure 1, Figure 2). This finding was corroborated by ATOP scores that had a non-significant Shapiro-Wilk Test value of 0.096 ($p>0.05$) and BAOP scores that had a non-significant Shapiro-Wilk Test value of 0.999 ($p>0.05$) (Table 2). A result of $p>0.05$ for the Shapiro-Wilk Test indicated that the ATOP and BAOP score distribution does not differ significantly from a normal distribution plot. Therefore, these non-significant scores indicate that the ATOP and BAOP scores are reasonable and should not be rejected.

A group difference test was performed to analyze the difference in ATOP scores based on gender (Table 3). There was no significant difference in gender to report in the ATOP scores. However, the ATOP scores for male respondents at (38.0 ± 12.57, $n = 4$) and the ATOP score for female respondents at (28.79 ± 6.85, $n = 14$, $p = .066$) showing that the ATOP score was overall higher for male respondents than female. A higher ATOP score is indicative of generally more positive attitudes towards persons who are obese. This may indicate that the male respondents have more positive attitudes towards persons who are obese compared to female respondents, but generalizability is not possible with a small sample size. The group difference by gender in ATOP score reported could potentially equalize with an equal amount of male and female respondents. The difference in BAOP score by gender was non-significant, with male respondents (24.25 ± 2.75, $n = 4$) and female respondents (19.36 ± 8.91, $n = 14$, $p = .303$) based on an independent sample t-test (Table 3). The presence of more participants, especially of a more equal male to female ratio would allow for further analysis on gender

differences on BAOP scores in healthcare students and professionals. Additionally, other gender identities were not able to be included in these group differences as there were no respondents who selected that they identified as a gender other than male or female (Table 1).

A group difference test was performed to analyze the difference in ATOP scores based on whether or not the respondent was a student or non-student healthcare provider. There was no significant difference to report in mean ATOP scores between persons who were classified as students (31 ± 9.81, $n = 12$) compared to those who were not students (30.50 ± 7.61, $n = 6$, $p = .915$) (Table 3). This may suggest that similar levels of weight bias are held across healthcare students and healthcare professionals. However, further research is needed to evaluate this finding. A group difference test was performed to analyze the difference in BAOP scores based on whether or not the respondent was a student or non-student healthcare provider. There was no statistically significant difference noted in mean BAOP scores between persons who were classified as students (21.42 ± 8.86, $n = 12$) compared to those who were not students (18.50 ± 6.80, $n = 6$, $p = .491$) (Table 3). This may suggest that health care students and healthcare professionals exhibit similar beliefs in weight bias. Conducting further research with a larger sample size may provide clarity on the belief differences of students and professionals. A finding of no significant difference may indicate that the foundation for present weight bias in belief systems may be caused by society at large.

A group difference test was performed to analyze the difference in ATOP scores when comparing persons who work as practicing healthcare providers part-time (<32 hours per week) versus full-time (≥32 hours per week) was investigated. There was no statistically significant difference to report in mean ATOP scores between persons who were classified as working part-time (34.00 ± 11.53, $n = 3$) compared to those who worked full-time (31.60 ± 9.49, $n = 10$, $p = .719$) (Table 3). This may suggest that healthcare professionals' weight bias

attitudes may not differ based on the amount of patient interaction. In addition, there was no statistically significant difference noted in mean BAOP scores between persons who were classified as working part-time (19.33 ± 4.73, $n = 3$) compared to those who worked full-time (22.2 ± 6.60, $n = 10$, $p = .504$) (Table 3). This may indicate that there is no difference in beliefs about obesity based on exposure and interactions with patients. Further study, with a larger sample size, is necessary to analyze any potential difference in healthcare professional attitude and belief based on length of patient interaction.

A potential difference in ATOP and BAOP scores between healthcare providers who see a patient population racial makeup of <50% Black and those whose patient population is ≥50% Black was investigated. There was no statistically significant difference in ATOP scores in healthcare practitioners who work with a patient population of <50% Black (33.22 ± 10.65, $n = 9$) compared to those whose patient population is ≥50% Black (28.00 ± 7.25, $n = 5$, $p = .351$) (Table 3). This may indicate that there is no difference in the weight bias attitudes of healthcare providers who treat Black patients of varying demographic percentages. Additionally, health care respondents who serve a patient population of ≥50% Black showed a slightly lower ATOP score, indicating more negative attitudes towards people who are obese. However, further research with a greater sample size into whether a healthcare provider's level of bias is increased in dealing with minority patients is needed to make conclusions on any correlations in this area. In contrast with the ATOP score, there was a statistically significant difference in BAOP scores between healthcare practitioners who work with a patient population of <50% Black (23.89 ± 5.58, $n = 9$) compared to those whose patient population is ≥50% Black (14.60 ± 4.98, $n = 5$, $p = .009$) (Table 3). Furthermore, a Cohen's D value of 1.725 was found, this indicates a large effect size which suggests that the statistical significance in the difference in BAOP scores has practical significance. However, one should proceed with

caution interpreting this finding as Cohen's *D* value is known to be over inflated when the sample size is less than 50 (Meyers et al. 2012). A higher BAOP score indicates a stronger belief that obesity is not under the obese person's control. Given the current outcome of interest, the data indicates that healthcare practitioners who treat a predominantly Black patient population indicate a stronger belief that obesity is chiefly under an obese person's control, and subsequently higher weight bias, compared to those who treat a predominantly non-Black patient population. It is known that adults who experience weight and racial discrimination, as well as other forms of discrimination, may be at heightened risk for certain forms of CVD (Udo and Grillo 2017). This is interesting because higher levels of weight bias in healthcare providers who treat patients who are likely to experience racial discrimination may lead to the potential worsening of their patient's cardiovascular health. This deserves a focused study with a larger sample size in order to examine the relationship.

A potential difference in ATOP and BAOP scores between healthcare providers who had previous weight bias education compared to those without previous weight bias education was investigated. There was no significant difference to report in ATOP scores between persons who had received weight bias education in the past 5 years (30.86 ± 9.14, $n = 7$) compared to those who did not (31.86 ± 10.81, $n = 7$, $p = .855$) (Table 3). This could suggest a lack of effectiveness in weight bias education as there seems to be no significant statistical difference in weight bias attitudes despite prior weight bias education. More research into the retention ability of weight bias education and its effectiveness in reducing weight bias among healthcare providers and students long-term is needed. In addition, there was no significant difference to report in BAOP scores between persons who had received weight bias education in the past 5 years (21.86 ± 6.59, $n = 7$) compared to those who did not (19.29 ± 7.54, $n = 7$, $p = .255$) (Table 3). This, again, may suggest a lack of longevity of current weight bias education

directed for healthcare professionals. Moreover, more research is needed into the way current weight bias education addresses beliefs and more effective intervention methods, to reduce weight bias in healthcare long-term.

A one-way Analysis of Variance (ANOVA) was conducted to compare the mean ATOP and BAOP scores of DPT, MPAM, and DMSc participants to detect any differences. No violations of the assumptions necessary to proceed with the ANOVA were demonstrated. Because there was no significance found in the ANOVA outcome comparing the mean scores of the DPT, MPAM, and DMSc participants, no post hoc testing was required.

A Kendall's Tau-b correlation coefficient analysis was performed in order to examine nonparametric data relative to the strength and direction of association between two variables with at least one being measured on an ordinal scale. It is considered a better alternative to other statistical correlation analysis methods such as the Pearson's correlation and Spearman's correlation analysis when dealing with violations of assumptions, in this case, monotonicity. The thermometer scale is considered ordinal in nature (Laerd Statistics 2018). The first two thermometer questions were analyzed with Kendall's Tau-b correlation analysis between ATOP and BAOP scores (Table 4). Interestingly, there was no correlation found between either ATOP scores or BAOP scores and warmth toward thin people (Table 4). This may be the result of people not wanting to overtly express bias because respondents who expressed strong weight bias in ATOP and BAOP scores did not correlate with their level of warmth towards thin people. Moreover, there was no correlation between either ATOP scores or BAOP scores and feelings of warmth towards people who are overweight (Table 4). This finding suggests that those respondents that may have had ATOP and BAOP scores that indicate higher levels of weight bias have no correlation with their direct feelings of warmth towards people who are overweight. This could be the expression of people attempting to make themselves look

honorable. Furthermore, in response to the third temperature question preference statement, an overwhelming majority of respondents chose a preference statement of equality (Figure 3). This result is again not surprising as the desire to demonstrate a lack of explicit bias agrees with expectations of social norms to minimize the appearance of bias.

This research survey sought to investigate the relationship between a healthcare provider's explicit weight bias and their patient population in order to serve as the groundwork for future research into intervention methods for healthcare providers who treat patients with cardiovascular disease with the goal of improving patient outcomes. The limitations of this study mainly revolved around the low response rate of 2.45% of the target population of Lynchburg area physicians and University of Lynchburg healthcare professionals and students. Therefore, the results discussed may not be generalizable, and reproduction of this survey with a response rate of at least 30% would be necessary. A reproduction of this survey may be more successful if it targets an academic hospital that is attached to a medical school as the healthcare providers in this population may be more willing to participate in a research study. Another limitation of the nature of this type of research is response bias. This occurs as respondents may represent a viewpoint that is more extreme than the actual group as those with more strong opinions on the issues of weight bias, whether negative or positive, will be more likely to respond, rather than those who have more moderate views.

Acknowledgments

First, I would like to thank Dr. Tonya Price for all of her support and guidance. As the principal investigator for this research, she has mentored me from the beginning of this research experience until the end, assisted me in the creation of a testable research question, survey formation, and data analysis. Through all the triumphs and pitfalls that I came to understand as a part of research, she has supported me through it all. Additionally, I have to thank Dr. Christine Terry for all her encouragement, insight, and useful discussions that helped to guide this research. Moreover, I must thank Dr. Price Blair and the Westover Honors for providing assistance in following a new direction for this research and for his support and thoughtfulness.

In addition, I would like to recognize the Lynchburg Academy of Medicine and the University of Lynchburg Masters of Physician Assistant, Doctor of Medical Science, Doctor of Physical Therapy, and Masters of Athletic Training for all their help in survey recruitment. Finally, I would like to acknowledge the funding that I received from the Schewel Student-Faculty Research Fund that was used to support survey recruitment methods.

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Appendix

Lynchburg Academy of Medicine and University of Lynchburg Survey:

Informed Consent Affirmation -

I affirm that I have read the informed consent document and agree to participate in this research study.

a) Yes, No

Inclusion Criteria

1) Are you a graduate faculty, staff, or student at the University of Lynchburg who interacts with patients in a medical/clinical setting?
   a) Yes;No
      i) [Selecting no prompts participant to Survey Completion and Submission Page; Selecting yes prompts participant to continue with Survey]

Attitudes Toward Obese Persons (ATOP) Scale

I strongly disagree (-3); I moderately disagree (-2); I slightly disagree (-1); I slightly agree (+1); I moderately agree (+2); I strongly agree (+3)

1. Obese people are as happy as non obese people.

2. Most obese people feel that they are not as good as other people.

3. Most obese people are more self-conscious than other people.

4. Obese workers cannot be as successful as other workers.

5. Most non obese people would not want to marry anyone who is obese.

6. Severely obese people are usually untidy.

7. Obese people are usually sociable.

8. Most obese people are not dissatisfied with themselves.

9. Obese people are just as self-confident as other people.

10. Most people feel uncomfortable when they associate with obese people.

11. Obese people are often less aggressive than non obese people.

12. Most obese people have different personalities than non obese people.

13. Very few obese people are ashamed of their weight.

14. Most obese people resent normal weight people.

15. Obese people are more emotional than non obese people.

16. Obese people should not expect to lead normal lives.

17. Obese people are just as healthy as non obese people.

18. Obese people are just as sexually attractive as non obese people.

19. Obese people tend to have family problems.

20. One of the worst things that could happen to a person would be for him to

become obese.

Beliefs About Obese Persons (BAOP) Scale

I strongly disagree (-3); I moderately disagree (-2); I slightly disagree (-1); I slightly agree (+1); I moderately agree (+2); I strongly agree (+3)

1. Obesity often occurs when eating is used as a form of compensation for lack of

love or attention.

2. In many cases, obesity is the result of a biological disorder.

3. Obesity is usually caused by overeating.

4. Most obese people cause their problem by not getting enough exercise.

5. Most obese people eat more than non obese people.

6. The majority of obese people have poor eating habits that lead to their obesity.

7. Obesity is rarely caused by a lack of willpower.

8. People can be addicted to food, just as others are addicted to drugs, and these people usually become obese.

Temperatures and Preference Questions

Select your rating: How warm or cold do you feel towards Thin People?

10-Extremely warm

9- Very warm

8-Moderately warm

7-Somewhat warm

6-Slightly warm

5-Neither warm nor cold

4-Slightly cold

3-Somewhat cold

2-Moderately cold

1-Very cold

0-Extremely cold

Select your rating: How warm or cold do you feel towards Fat People?

10-Extremely warm

9- Very warm

8-Moderately warm

7-Somewhat warm

6-Slightly warm

5-Neither warm nor cold

4-Slightly cold

3-Somewhat cold

2-Moderately cold

1-Very cold

0-Extremely cold

Select the statement that best describes you?

I strongly prefer Fat people to Thin people.

I moderately prefer Fat people to Thin people.

I slightly prefer Fat people to Thin people.

I like Fat people and Thin people equally.

I slightly prefer Thin people to Fat people.

I moderately prefer Thin people to Fat people.

I strongly prefer Thin people to Fat people.

Demographics

1) How would you describe your gender identity? *(If you would rather self-describe your gender identity, please use the other option and write in your preferred terms.)*
    a) Male, Female, Other
2) What is your age? *(please report in years to the nearest whole number)*
3) Are you a student pursuing a graduate degree in healthcare?
    a) No; Yes

Healthcare Professional

1) If you are not a student, what member of the healthcare team best describes you?
    a) Physician Assistant (PA-C), Doctor of Physical Therapy (DPT), Doctor of Medical Science (DMSc); Physician (MD), Other
        i) [Participant selection of any of these options will prompt participant to complete demographic questions]

Healthcare Student

1) What degree are you pursuing?
    a) Physician Assistant (PA-C), Doctor of Physical Therapy (DPT), Doctor of Medical Science (DMSc)
        i) [PA-C and DPT selections will prompt the participant to Survey Completion and Submission page]
        ii) [DMSc selection will prompt the participant to complete the remaining demographic questions]
4) How many years have you been practicing as a licensed healthcare provider? *(please report in years to the nearest whole number)*; N/A
5) Are you currently practicing as a licensed healthcare provider?
    a) Yes, I currently practice as a licensed healthcare provider full-time (greater than or equal to 32 hours per week), Yes, I currently as a licensed healthcare provider part-time (less than 32 hours per week), I have retired from practicing., No
6) Which medical specialty area best describes your area of practice?
    a) Family Medicine/ Family Practice, Pediatrics, Hospitalist, General Internal Medicine, Cardiology, Endocrinology, Nephrology, Gastroenterology, Other, N/A
7) Do you see patients with heart disease, regardless if the diagnosis is primary or secondary?
    a) Yes, No
8) What percentage of your patient population is Black versus non-Black? (estimated)
    a) 100% Black, 0% non-Black; 90% Black, 10% non-Black; 80% Black, 20%

non-Black; 70% Black, 30% non-Black; 60% Black, 40% non-Black; 50% Black, 50% non-Black; 40% Black, 60% non-Black; 30% Black, 70% non-Black; 20% Black, 80% non-Black; 10% Black, 90% non-Black; 0% Black, 100% non-Black; N/A

9) Have you received any formal continuing education training about weight bias in the past 5 years?
    a) Yes, No, I don't know