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# The Body Advocacy Movement-Health: a pilot randomized trial of a novel intervention targeting weight stigma among health professional students

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## Abstract

**Background** Weight stigma among healthcare professionals is associated with negative health impacts on patients, yet there are few effective strategies to combat weight stigma among health professional learners. The Body Advocacy Movement-Health (BAM-Health) is a novel group-based, peer-led stigma reduction intervention for health professional students that targets weight stigma across intrapersonal, interpersonal, and structural levels. The present study (1) assesses short-term impacts of BAM-Health participation on intrapersonal and interpersonal weight bias compared to an informational brochure control condition and (2) explores the feasibility and acceptability of BAM-Health among a sample of health professional students.

**Methods** Sixty-seven health professional students participated in BAM-Health ( $n = 34$ ) or received an informational brochure about weight stigma ( $n = 33$ ). Participants completed validated self-report surveys assessing internalized weight/ appearance concerns and interpersonal weight stigma prior to their assigned intervention (baseline), immediately following intervention (post-intervention), and four weeks after intervention (follow-up). Baseline to post-intervention and baseline to follow-up effect sizes on each measure were calculated. At post-intervention, participants completed feedback surveys for thematic assessment.

**Results** BAM-Health participation had a large baseline to post-intervention effect on internalized weight/ appearance concerns that diminished slightly at follow-up (Cohen's  $d = -0.88$ ;  $d = -0.62$ ). Receipt of the informational brochure had a small effect on internalized weight/ appearance concerns ( $d = -0.27$ ); however, these changes were not sustained at follow-up ( $d = 0.04$ ). BAM-Health participation resulted in reductions in interpersonal obesity stigma and anti-fatness with small effect sizes ( $d = -0.32$ ;  $d = -0.31$ ). The effect on obesity stigma was slightly amplified at follow-up ( $d = -0.43$ ); however, decreases in anti-fatness were not sustained ( $d = -0.13$ ). The brochure condition failed to demonstrate effects on anti-fatness ( $d = 0.13$ ,  $d = 0.14$ ) or obesity stigma ( $d = -0.12$ ;  $d = -0.12$ ) at either time point.

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Between-session attrition rates of 4.5%, favorable quantitative ratings on post-session acceptability surveys, and free responses demonstrating appreciation of the virtual group environment and session activities reflect feasibility and acceptability of BAM-Health.

**Conclusions** BAM-Health is a novel peer-led intervention that aims to reduce weight stigma among health professional students. BAM-Health met feasibility benchmarks and received positive feedback from participants, demonstrating acceptability and indicating interest among health professional students in analyzing and reducing weight stigma in their personal lives and careers. The intervention led to promising decreases in internalized and interpersonal weight stigma at post-intervention, some of which were sustained at follow-up. However, lack of effect on internalized weight/ appearance concerns measures may indicate that BAM-Health participants are more likely to reject weight stigma directed toward others following intervention, while maintaining thin ideals for themselves. Further investigation of BAM-Health with a larger sample and continued program development is warranted.

### Plain English Summary

Weight stigma refers to negative attitudes or harmful behaviors directed toward oneself (internalized weight stigma) or others (interpersonal weight stigma) on the basis of body weight. Structural weight stigma refers to policies or norms that harm people who have higher body weights. Weight stigma in healthcare in particular can contribute to negative physical and emotional health outcomes among patients. To examine strategies to mitigate weight stigma in healthcare, health professional students at a large university in the United States – including students in medical, nursing, and physical therapy programs – participated in the Body Advocacy Movement-Health (BAM-Health), a program created to decrease weight stigma in this population. Participants completed surveys prior to and after BAM-Health that indicated modest reductions in internalized and interpersonal weight stigma four weeks after completion of the intervention, whereas those in the comparison arm did not demonstrate sustained changes in measures of weight stigma. Furthermore, participants indicated that they enjoyed involvement in BAM-Health and found it useful both personally and professionally. Future research with larger, more diverse sample sizes is necessary to determine whether BAM-Health is effective at reducing weight stigma among health professional students and whether it improves quality of care for patients in larger bodies.

**Keywords** Weight stigma, Implicit bias training, Body image, Medical education

## Background

### Weight stigma and health

Stigma – the co-occurrence of stereotypes, discrimination, alienation, disempowerment, and status loss [1] – harms both individual and population health [2]. A growing body of evidence has elucidated negative physical and mental health impacts of weight stigma, a term that is used interchangeably with “weight bias,” “anti-fat bias,” and “weight prejudice.” On an individual or interpersonal level, weight stigma refers to individuals’ internalization of weight-based stereotypes, their perception of others and themselves based on these stereotypes, and their evaluation of their own and others’ worth by how well they conform to societal weight ideals. Interpersonal weight stigma includes weight-based discrimination that arises in conversations and group settings. Finally, structural weight stigma describes discrimination that is embedded in societal organizations, institutions, policies, and norms and that can appear in myriad forms, such as inaccessible medical equipment and medical school curricula that reinforce weight-based stereotypes (i.e., that those of a higher weight are necessarily unhealthy) [3].

On an individual level, experiencing weight stigma is associated with psychological harms including more depressive symptomatology, higher levels of anxiety,

lower self-esteem [4], greater body image dissatisfaction, and increased risk of eating pathology [5]. Experiences of weight stigma have also been associated with pathologic changes, including higher levels of circulating C-reactive protein [6] and cortisol [7], higher allostatic load [8], and greater overall risk of mortality [9].

Interpersonally, healthcare providers have been identified as having conceptions that high body mass index (BMI) patients are responsible for their weight status, that they will be less adherent to treatment recommendations, and that they are less disciplined and motivated than lower-BMI patients [10–12]. Attitudes reflecting weight stigma, while often unintentional and unconscious, can hinder rapport between patients and providers [13] and lead to interactions that patients may perceive as disrespectful and patronizing [14]. Experiencing weight stigma in healthcare settings is associated with greater patient mistrust of providers and with avoidance or delay of healthcare services [14, 15].

Weight stigma has also been identified among health professional students [16], and in fact tends to increase over the course of medical training [17]. For example, in a sample of 4,732 first-year medical students in the United States, 74% exhibited implicit (unconscious and automatic) and 67% exhibited explicit (conscious and

intentional) markers of weight stigma [18]. Health professional students also report witnessing attitudes reflecting weight stigma in curricula and among mentors during their training, which may reinforce or bolster existing biases over time [18]. Moreover, perceived and internalized weight stigma is associated with higher levels of anxiety and depression among medical students in larger bodies, suggesting that harmful psychological effects of experiencing weight stigma in healthcare learning settings may extend to medical students themselves [19].

The socioecological model is a conceptual framework that highlights the impact and interdependence of intrapersonal, interpersonal, and structural factors on human behavior and wellbeing [20] and provides a useful framework for conceptualizing and addressing weight stigma. Prior weight stigma reduction interventions for clinicians and health professional students have focused predominantly on singular aspects of the socioecological model, with a majority targeting interpersonal weight stigma (i.e., interpersonal interactions between providers and patients) with mixed results [21]. For example, one study targeting interpersonal weight stigma explored an educational activity, guided reflection, and structured encounter between first-year medical students and standardized patients self-identifying as overweight and resulted in a significant decrease in stereotyping, an increase in students' confidence, and an increase in students' empathy at post-intervention. These effects were maintained for empathy and confidence, but not for stereotyping, at 1-year follow-up [22].

In terms of studies addressing intrapersonal weight stigma, a study of nursing students [23] employed a 10-minute guided Loving-Kindness meditation focused on self-compassion. The students were then asked to direct this meditation toward an image of a woman in a larger body. The intervention did not lead to a significant difference in weight stigma as measured by the Implicit Association Test (IAT) at post-intervention. While this intervention did employ an element of self-direction via the meditation, the meditation itself did not address intrapersonal weight stigma specifically, but rather self-compassion more broadly.

To our knowledge, there have been no weight stigma reduction interventions for health professional students that target structural weight stigma explicitly. A systematic review of weight stigma reduction interventions for clinicians and health professional students concluded that effectively and sustainably addressing weight bias would likely require strategies that address weight stigma across all levels of the socioecological model [24].

### Study aims

The current study explores the short-term impacts of the Body Advocacy Movement-Health (BAM-Health),

a novel weight stigma reduction intervention for health professional students that addresses weight stigma across intrapersonal, interpersonal, and structural levels, and includes an acceptability and feasibility analysis. Aims for the pilot testing of this intervention include:

#### **Aim 1**

*Estimating intervention effects.* BAM-Health participation will be associated with baseline to post-intervention and baseline to follow-up effect sizes consistent with small to moderate intervention-related reductions in internalized weight and appearance concerns and interpersonal weight stigma, whereas participation in the control condition will fail to show reductions in scores across time points.

#### **Aim 2**

*Confirming the acceptability and feasibility of BAM-Health.* BAM-Health will demonstrate initial acceptability (H1a), evidenced by low attrition rates (<20%) and average ratings of 4 out of 5 or higher and positive feedback on post-intervention acceptability surveys, and feasibility (H1b), evidenced by high levels of intervention adherence and facilitator competence scores (average ratings of 80% or higher), as well as comparable attrition rates between BAM-Health and the control condition and greater than 80% completion of between-session activities.

## **Methods**

### **Participants and procedure**

Study data were collected and managed using REDCap (Research Electronic Data Capture) tools hosted at the University of Wisconsin [25, 26]. In June 2021, recruitment emails with a link to an online screening survey were sent to all students enrolled in a medicine (MD) program at the University of Wisconsin. In June 2022, eligibility criteria were expanded to include students enrolled in one of four health professional programs at the university – MD, bachelor of science in nursing (BSN), physician associate (PA), or physical therapy (DPT) – in order to better capture individuals who will work in a variety of patient care settings. Study participants were considered eligible if they (1) were enrolled at time of recruitment in an MD, BSN, PA, or DPT program, (2) were between the ages of 20 and 45 years old, (3) had access to the internet and an electronic device with a webcam and a microphone, and (4) were available during session dates and times. The study and all changes of protocol were approved by the Institutional Review Board (IRB; ID: 2021–0564).

Eligible participants received the consent form online via REDCap. Those who provided informed consent were randomized to either an intervention condition

consisting of two small-group, peer-led virtual BAM-Health sessions, or a control condition consisting of an informational brochure about weight stigma from the Obesity Action Coalition and the Yale Rudd Center for Food Policy and Obesity [27]. Participants assigned to BAM-Health were further divided into small groups of six to nine participants each. Once randomized, participants received emails with information about their assigned condition (i.e., how to access the BAM-Health sessions) and links to study measures at three different timepoints: at pre-intervention (baseline), immediately following intervention completion (post-intervention), and at four weeks following intervention completion (follow-up). Those assigned to the control condition were provided informational brochures via email on the date of the first BAM-Health session. All study participants received automated email reminders to complete the post-intervention and follow-up surveys within one week of receipt. Participants were compensated with \$40 gift cards for completion of all assessments and BAM-Health sessions if assigned to the BAM-Health condition.

### Intervention

BAM-Health is a group-based, peer-led intervention intended to target weight stigma on intrapersonal,

interpersonal, and institutional levels. BAM-Health was adapted from the original Body Advocacy Movement (BAM) curriculum, which was designed to reduce eating disorder (ED) risk by addressing fear of weight gain and weight stigma among young adults [28]. BAM utilizes psychoeducation, cognitive dissonance, and exposure-based strategies to target participants' attitudes and behaviors related to their own bodies. While BAM focuses primarily on challenging weight stigma to reduce ED risk among young adults, the BAM-Health curriculum includes additional emphasis on aspects of health and healthcare, encouraging health professional students to consider how weight stigma manifests not only in their personal lives, but also in patient care practices and in healthcare institutions. Adaptations to the BAM manual for use among medical trainees were led by medical student co-authors (SF, EB, TM, AK) and overseen by a clinical psychologist (KS). In two, two-hour sessions held one week apart, with three between-session activities, BAM-Health aims to critically examine weight stigma in health professional students' personal and professional lives across all levels of the socioecological model (see Table 1).

In 2022, BAM-Health peer facilitators held a compensated, voluntary focus group with five members of the

**Table 1** BAM-Health sessions outline, sample activities, sample discussion questions (*italicized*), and level(s) of the socioecological model targeted within each section

BAM-Health	Section	Sample Activities and Discussion Questions	SEM Targets
<b>Session 1</b>	Size Terminology	Participants discuss their feelings and reactions to the word "fat." Terminology such as a thin, straight-size, plus-size, people with larger bodies, and obese are also discussed.	Intrapersonal, Structural
	Definition of Fatphobia/Anti-Fat Bias	Participants create a list of how weight stigma manifests at intrapersonal, interpersonal, and structural levels in their personal lives and in healthcare and discuss the costs of weight stigma at each of these levels. <i>Weighing the costs of weight stigma and bias in our society, in what ways might you be personally and professionally invested in dismantling anti-fat bias?</i>	Intrapersonal, Interpersonal, and Structural
	Weight and Health	<i>Who gets to define health? What might be overlooked or lost if we leave the definition of health up to the healthcare system?</i> <i>According to what we're generally taught about health, how are [weight, health, and worth] related to each other?</i>	Structural
	Body Mass Index	<i>When you see BMI in a patient's chart, what does it mean to you? What initial judgments do you have when you see that someone has an elevated BMI?</i> <i>What are some examples where individuals may have different access to care based on their BMI?</i> <i>Have you ever experienced discrimination based on your BMI? What was that like?</i>	Intrapersonal, Structural
<b>Session 2</b>	Debriefing "Worst Case Scenario" Activity	Between sessions, participants are asked to write about their fears related to weight gain, which was then discussed during the session. <i>Take a minute to think about your core values. How would living with a fear of weight gain affect your ability to live in accordance with the things you care about most?</i>	Intrapersonal
	Debriefing "Up-rooting Internalized Anti-Fat Bias" Activity	Between sessions, participants are asked to brainstorm a list of 10 actions they can take to dismantle internalized weight stigma and to share their plans for making 2 to 3 of those actions happen. This was discussed during the session.	Intrapersonal
	Role Plays and Quick Comebacks	Participants practiced how they might respond to weight stigma in their personal and professional lives.	Interpersonal
	Debriefing "Fat Activism" Activity	Between sessions, participants are asked to brainstorm a list of 10 actions they can take to dismantle structural weight stigma in the healthcare system and to share their plans for making 2 to 3 of those actions happen. This was discussed during the session.	Structural

medical school's Student Assembly for Minority Concerns recruited by email to assess the BAM-Health curriculum's cultural relevance, applicability, and utility for students of diverse backgrounds. Focus group participants did not formally participate in BAM-Health, but reviewed the intervention manual and provided feedback. Thereafter, minor changes to language were made to the intervention script (i.e., addition of a Diversity, Equity, and Inclusion acknowledgement in the intervention introduction, alteration of names and characters in role-play activities to reflect individuals of

varied backgrounds). The overall composition of the BAM-Health intervention, in terms of discussion content and activities, remained the same between 2021 and 2022.

### Training

Peer facilitators were MD students who underwent a 16-hour training program led by a clinical psychologist specializing in EDs, trained in Body Project and BAM facilitation, and who oversaw development of the BAM-Health manual (KS). During training, facilitators divided into two groups of two to three and practiced delivering and receiving the intervention and received constructive feedback, a training method supported in similar peer-facilitated programs [28]. In 2021, 4 peer facilitators were trained. In 2022, 5 peer facilitators were trained. Table 2 describes the components of the two-day training program in further detail.

### Measures

#### Demographics

At baseline, participants provided demographic information including age, gender identity, race and ethnicity, sexual identity, and health professional program affiliation.

#### Measures targeting internalized weight and appearance concerns

**Goldfarb fear of fat scale (GFFS)** Participants completed the GFFS [29], a 10-item questionnaire that assesses respondents' internalized fear of fatness, at all three assessment timepoints. Participants indicated the extent to which they believed statements were true on a four-point Likert scale from (1) "Very untrue" to (4) "Very true," and responses were summed to create a total score. Sample items include "My biggest fear is of becoming fat" and "There is nothing that I can do to make the thought of gaining weight less painful and frightening." The GFFS has demonstrated strong internal consistency ( $\alpha = 0.85$ ), 1-week test-retest reliability ( $r = .88$ ), and discriminant validity [29]. Internal consistency in the present sample was good ( $\alpha = 0.86$ ).

**Ideal-body stereotype scale-revised (IBSS-R)** Thin-ideal internalization was assessed with the IBSS-R [30], a 10-item, self-report scale which asks participants to rate items such as "Slender women are more attractive" and "Women with long legs are more attractive" on a five-point Likert scale from (1) "Strongly disagree" to (5) "Strongly agree." Higher mean ratings across the 10 items indicate a greater degree of thin-ideal internalization. The IBSS-R has strong internal consistency among undergraduate women ( $\alpha = 0.91$ ) [31], as well as test-retest reliability

**Table 2** Sample BAM-Health facilitator training schedule

Training Day 1	Associated Components	Training Day 2	Associated Components
Welcome	<i>Attendees introduce themselves</i>	Welcome	<i>Attendees re-introduce themselves</i>
Introduction to Manual and Session 1 Overview	<i>Review the premise of BAM Health Discuss training agenda Trainees divide into 2 groups and discuss who will lead each part of the script</i>	Session 2 Overview	<i>Provide overview of Session 2 Participants remain in the same groups as on Day 1 and decide who will lead each part of the script</i>
Group 1, Session 1	<i>Group 1 facilitates while Group 2 acts as participants</i>	Group 2, Session 2	<i>Group 2 facilitates while Group 1 acts as participants</i>
Feedback and Discussion	<i>Trainer(s) and participants provide feedback Facilitators discuss what went well and areas for improvement</i>	Feedback and Discussion	<i>Trainer(s) and participants provide feedback Facilitators discuss what went well and areas for improvement</i>
Lunch Break		Lunch Break	
Group 2, Session 1	<i>Group 2 facilitates while Group 1 acts as participants</i>	Group 1, Session 2	<i>Group 1 facilitates while Group 2 acts as participants</i>
Feedback and Discussion	<i>Trainer(s) and participants provide feedback Facilitators discuss what went well and areas for improvement</i>	Feedback and Discussion	<i>Trainer(s) and participants provide feedback Facilitators discuss what went well and areas for improvement</i>
10 min Break		10 min Break	
Implementation	<i>Discuss resources provided to participants Practice responding to difficult situations Discuss where participants will submit between-session activities</i>	Implementation	<i>Discuss logistics of Zoom implementation Discuss plan for participant distress Discuss how to prep for sessions</i>
Wrap Up	<i>Time offered for final questions</i>	Wrap Up	<i>Time offered for final questions</i>



and convergent and predictive validity [32]. Participants completed the IBSS-R at all three assessment timepoints. Internal consistency in the present sample was good ( $\alpha = 0.85$ ).

#### **Measures targeting interpersonal weight stigma**

**Universal measure of bias – fat version (UMB-FAT)** The UMB-FAT [33], a 20-item, four-factor scale, assesses respondents' opinions of individuals in larger bodies. Participants indicate their agreement with each item on a seven-point Likert scale (for example, "I would be comfortable having a fat person in my group of friends") from (1) "Strongly agree" to (7) "Strongly disagree." Higher mean scores indicate greater bias. In a university sample, the UMB-FAT displayed strong internal consistency ( $\alpha = 0.87$ ), inter-item correlation (0.25), and less susceptibility to social desirability response bias than comparable assessments [33]. Participants completed the UMB-FAT at all three assessment timepoints. Internal consistency in the present sample was good ( $\alpha = 0.91$ ).

**Eating pathology symptoms inventory – negative attitudes towards obesity subscale (EPSI-NATO)** The EPSI [34] is a comprehensive, 45-item eating pathology scale with eight validated subscales, including a subscale measuring "Negative Attitudes Towards Obesity" (NATO), which was analyzed in this study as a measure of interpersonal weight stigma. The NATO subscale includes five items assessing thoughts towards individuals in larger bodies. Participants are asked to consider each item in the context of the previous four weeks and indicate its frequency on a five-point Likert scale from (0) "Never" to (4) "Very often." Responses are summed to create a score for the subscale. Sample EPSI-NATO items include, "I thought that obese people lack self-control" and "I felt that overweight people are lazy." The EPSI has good convergent and discriminant validity, internal consistency, and two to four week test-retest reliability in clinical and university samples [34–36]. Participants completed the EPSI at all three assessment timepoints; however, only the EPSI-NATO is discussed here. Internal consistency for the EPSI-NATO subscale in the present sample was good ( $\alpha = 0.88$ ).

#### **Acceptability and feasibility**

Acceptability and feasibility were assessed only in 2022. Given the pilot nature of this study, in 2021, research activities focused primarily on developing the BAM-Health manual and addressing initial challenges of implementation. In 2022, an added focus was assessing acceptability of the intervention from participants' perspective and feasibility of implementation.

#### **Acceptability**

In 2022, feedback surveys were provided at post-intervention that evaluated overall enjoyment of the intervention, comfort in participating in group discussions, relevance of the discussions and information presented, readiness to apply BAM-Health concepts in daily life, perceptions of body image improvement, and quality of peer facilitators' instruction. Participants rated their responses on a Likert scale from (1) "Strongly disagree" to (5) "Strongly agree." Internal consistency was good ( $\alpha = 0.87$ ).

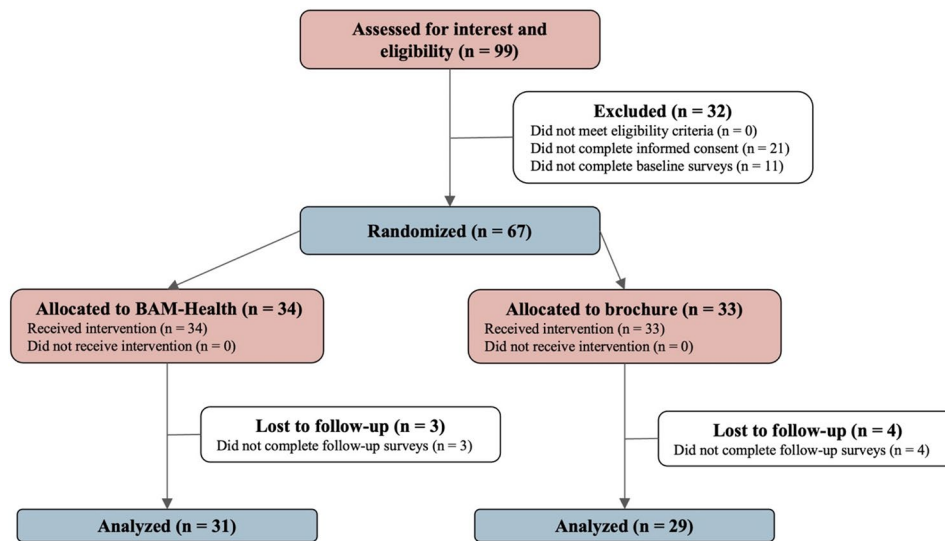
Participants were also asked to provide written responses to several open-ended questions, including: (1) What did you like most about BAM Health? Do any particular activities or moments stand out for you? (2) What did you like least about BAM Health? Do any particular activities or moments stand out for you? (3) How did you feel about the Zoom environment? Feel free to share both positives and negatives. (4) Was there anything missing from BAM Health that you wish had been included? and (5) Do you have any other comments you would like to share?

#### **Feasibility**

Feasibility was assessed in 2022 through evaluation of BAM-Health facilitator competence and session adherence to the intervention manual and associated script. Sessions were recorded in 2022, and two independent raters (AL and MG) reviewed all session videos, assessing adherence and facilitator competence using scales adapted from prior trials of the Body Project, a similar peer-facilitated intervention [37], with content checks changed to reflect BAM-Health content. Session adherence (Appendix A) was rated on a Likert scale from 1 ("No adherence. This section was skipped entirely") to 10 ("Perfect! Absolutely all material in the section was presented exactly as written"). Facilitator competence (Appendix B) was assessed based on pace, clarity, organization, ability to keep the group on task, ability to provide equal speaking time for all members of the group, listening skills, respectfulness, warmth, and enthusiasm, with each item graded on a ten-point scale from 1 (Poor) to 10 (Superior). Completion of between-session activities (Table 1) by participants was also tracked to assess feasibility. Participants anonymously uploaded their activities via an online form and submissions were rated based on general completion.

#### **Analysis plan**

Aim 1 was evaluated using baseline to post-intervention and baseline to follow-up effect sizes on internalized weight and appearance concerns and interpersonal weight stigma measures. Effect sizes were chosen rather than null hypothesis significance testing due to the



**Fig. 1** Flow diagram of the progress through phases of BAM-Health pilot randomized study

**Table 3** Demographic characteristics of study participants as reported at baseline. Cells containing less than 10 individuals hidden to protect participant confidentiality

Participant Demographic Characteristics	Total (n = 67)
<i>Mean (SD)</i>	
<i>Median (ICR)</i>	
<i>N (%)</i>	
Age (Mean)	26.0 (2.8)
BMI (Mean)	25.6 (6.0)
BMI (Median)	23.4 (5.8)
Gender Identity	
Man	17 (25.4)
Woman	50 (74.6)
Program	
MD	58 (86.6)
Didactic (pre-clinical) phase	41 (61.2)
Clinical phase	24 (35.8)
Other (i.e., BSN, PT)	**
Race	
Asian / Pacific Islander	**
Black / African American	**
Latinx and/or Hispanic	**
White	50 (74.6)
Sexual Identity	
LGBTQIA+	16 (23.9)
Heterosexual	51 (76.1)

\*\* Cells with  $n < 10$  suppressed to preserve confidentiality

limited power and pilot nature of the study. When comparing effect sizes, Cohen's  $d$  absolute effect sizes greater than 0.20 were considered small, greater than 0.50 were considered moderate, and greater than 0.80 were considered large [38].

Acceptability of BAM-Health (Aim 2) was assessed via attrition rates across the two intervention sessions, with the goal of attaining attrition rates of less than or equal

to 20%. Average ratings from post-intervention feedback surveys were calculated for each item, with the goal of attaining an average rating of greater than or equal to four out of five (80%) on each item. A thematic analysis of free responses to open ended questions at post-intervention was conducted to elucidate main themes. To assess feasibility (Aim 2), average ratings for facilitator competence and session adherence were determined, with the goal of achieving average ratings of greater than or equal to eight out of 10 (80%). To calculate interrater reliability, percent agreement of scores were compared with a goal of agreement between the two reviewers of greater than or equal to 80%. Feasibility was also assessed via completion rates of between-session activities and comparison of attrition rates between BAM-Health and the control condition.

## Results

### Demographic information

Ninety-nine students expressed interest in the study through completion of the online screening survey and all of them were eligible. Of these students, 78 returned the informed consent and 67 completed pre-intervention questionnaires (see Fig. 1).

Table 3 presents descriptive statistics for the 67 participants. Participants ranged in age from 20.5 to 36.0 years ( $M=26.0$ ) and were largely MD students (86.6%). Participants were mostly woman-identifying females (74.6%) and the majority reported their race as White (85.1%). Most participants self-identified as heterosexual (76.1%) followed by bisexual/bi+/pansexual (16.4%). Participants' BMIs ranged from 18.2 to 51.9, with a mean of 25.6 (SD: 6.0) and a median of 23.4 in the sample. The two groups did not differ significantly based on mean age, BMI,

program affiliation, race, or sexual identity per one-way analysis of variance (ANOVAs).

**Effects on intervention targets**

Both BAM-Health and the brochure condition produced reductions in internalized weight and appearance-related concerns between baseline and post-intervention based on the IBSS-R thin idealization measure, with large effect sizes for BAM-Health and small effect sizes for the brochure (BAM-Health:  $d = -0.88$ ; Brochure:  $d = -0.27$ ). A moderate reduction in IBSS-R scores was sustained at follow-up for BAM-Health, while the small reduction was not sustained for the brochure group (BAM-Health:  $d = -0.62$ ; Brochure:  $d = 0.04$ ). A change meeting benchmarks for small, moderate, or large effects in GFFS scores was not observed for either arm at post-intervention (BAM-Health:  $d = -0.12$ ; Brochure:  $d = -0.09$ ) or follow-up (BAM-Health:  $d = -0.15$ ; Brochure:  $d = -0.06$ ).

BAM-Health produced small reductions in interpersonal weight stigma as measured by the EPSI-NATO obesity stigma subscale ( $d = -0.32$ ) and the UMB-FAT anti-fatness measure ( $d = -0.31$ ) between baseline and post-intervention. This effect was amplified slightly at follow-up for the EPSI-NATO subscale ( $d = -0.43$ ), but was not sustained for UMB-FAT ( $d = -0.13$ ). Receipt of the informational brochure was not associated with a

change meeting benchmarks for small, moderate, or large effects in either measure of interpersonal weight stigma at either time point (EPSI-NATO  $d = -0.12, -0.12$ ; UMB-FAT  $d = 0.13, 0.14$ ; see Fig. 2).

**Acceptability**

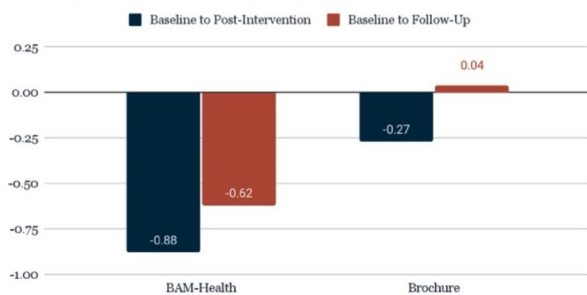
In 2021 and 2022, attrition rates from Session 1 to Session 2 were 4.5% ( $n = 3$ ). In 2022, eight of ten items met average acceptability ratings of four out of five (Table 4). Sixteen out of 19 respondents submitted at least one comment, resulting in a total of 44 comments. Free responses indicated overall satisfaction with and acceptance of BAM-Health. The following themes emerged for at least 20% of respondents: (1) positive comments regarding the virtual environment (56.3%); (2) perceptions of session activities (43.8%); (3) elements missing from the sessions (37.5%; i.e., lack of male participation, lack of discussion surrounding when weight should be discussed in healthcare encounters); (4) sentiment that the time commitment was too high (31.3%); and (5) positive comments regarding the group atmosphere (25.0%). Themes and representative comments are in Table 5.

**Feasibility**

In 2022, 68% of participants fully completed the between-session activities (i.e., participant completed all portions

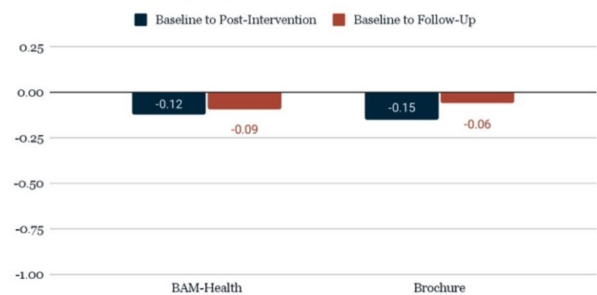
**Construct A: Internalized Thin Idealization**

Ideal-Body Stereotype Scale-Revised (IBSS-R)



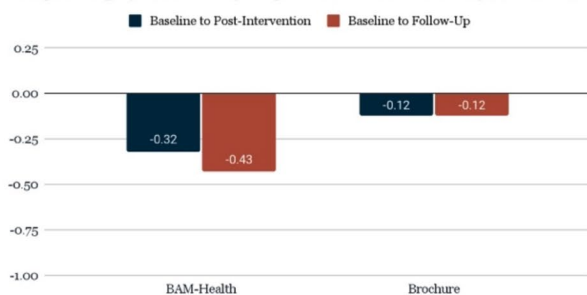
**Construct B: Internalized Fear of Fatness**

Goldfarb Fear of Fat Scale (GFFS)



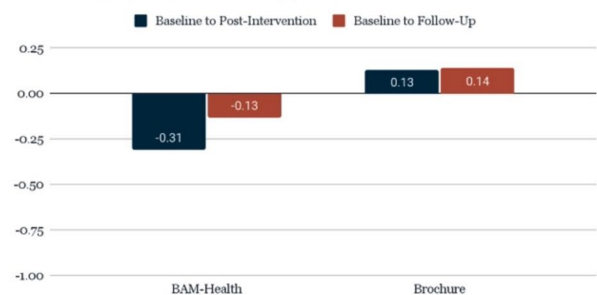
**Construct C: Interpersonal Obesity Stigma**

Eating Pathology Systems Inventory - Negative Attitudes Towards Obesity (EPSI-NATO)



**Construct D: Interpersonal Anti-Fatness**

Universal Measure of Bias - Fat Version (UMB-FAT)



**Fig. 2** Effect sizes for quantitative measures of internalized weight and appearance concerns (Constructs **A** and **B**) and interpersonal weight stigma (Constructs **C** and **D**) from baseline to post-intervention and baseline to follow-up across intervention and comparison arms. Negative effect sizes represent decreased average weight stigma scores from baseline, and were characterized as being small (-0.20 to -0.49), moderate (-0.50 to -0.79), or large (-0.80 to -1.0)



**Table 4** Quantitative results of post-intervention acceptability feedback survey

Item	Strongly Agree (5)	Agree (4)	Neither Agree nor Disagree (3) or Disagree (2)	Average Rating
	N (%)			Mean (SD)
I enjoyed participating in BAM-Health.	8 (42.1)	11 (57.9)	-	4.4 (0.5)
I felt comfortable participating in the group discussions.	9 (47.4)	10 (52.6)	-	4.5 (0.5)
The discussions were led well by the peer facilitators.	14 (73.7)	5 (26.3)	-	4.7 (0.5)
The information presented and discussed during the sessions was relevant to me.	8 (42.1)	11 (57.9)	-	4.4 (0.5)
After participating in BAM-Health, I feel empowered to combat anti-fat bias in my personal life.	8 (42.1)	10 (52.6)	1 (5.3)	4.4 (0.6)
After participating in BAM-Health, I feel empowered to combat anti-fat bias in my health professional program, either in class or in clinic.	5 (26.3)	8 (42.1)	6 (31.6)	3.9 (0.9)
Participating in BAM-Health has helped me feel better about my own body.	3 (15.8)	9 (47.4)	7 (36.6)	3.7 (0.9)
During BAM Health, I learned something new.	8 (42.1)	10 (52.6)	1 (5.3)	4.4 (0.6)
Participating in BAM Health was a good use of my time.	10 (52.6)	6 (31.6)	3 (15.8)	4.3 (0.9)
I would recommend BAM Health to other students in my health professional program.	9 (47.4)	10 (52.6)	-	4.5 (0.5)

of the activities based on activity instructions), 26% partially completed the between-session activities (i.e., participant did not complete one or more portion(s) of the activities based on activity instructions), and 5% did not complete the between-session activities (i.e., participant uploaded a blank activities form). The average score for session adherence was 8.1 (SD=1.7) and the average score for facilitator competence was 9.1 (SD=1.0). For session adherence, the percent agreement between the two reviewers was 77.8%. For facilitator competence, the percent agreement between the two reviewers was 66.7%.

## Discussion

This study explored the acceptability, feasibility, and preliminary effects on weight stigma of BAM-Health, a peer-led, group-based weight stigma reduction intervention for health professional students. Recruitment data and low attrition indicated promising interest in BAM-Health, particularly among second-year MD students. There was not a significant difference in drop-out rates between intervention and control arms, highlighting the feasibility of utilizing a randomized design for future intervention testing in this population. After expanding recruitment to all BSN, DPT, and PA students, second-year MD students represented 61.2% of the total sample. This is likely due to the study taking place during summer, when second-year MD students were not enrolled in coursework whereas students in other years and programs had more academic demands that conflicted with session availability. Offering BAM-Health sessions throughout the academic year may boost participation among BSN, DPT, and PA students and MD students across years. High retention rates for BAM-Health may be due, in part, to its virtual setting given the positive feedback from participants on the remote nature of the program. However, post-intervention feedback also included concerns regarding the time commitment of the intervention. Embedding BAM-Health into required curricular activities may therefore reduce both time- and timing-related barriers to participation.

In terms of feasibility, the additional program cost of compensating participants may serve as a barrier to wider implementation, with a trade-off of possible reduced interest or lower retention if this incentive were to be removed. While the use of compensation may have contributed to participant attrition, it is unlikely to be the major driver. The compensation itself was relatively low; between intervention and survey completion, the study took approximately 5.33 hours to complete, resulting in a compensation equivalent to \$7.50/ hour. Both study arms received equal compensation.

All respondents to the post-intervention acceptability survey indicated that they enjoyed participating in BAM-Health, that they felt comfortable participating in group discussions, and that they would recommend BAM-Health to other students in their health professional program. Comments regarding session activities were positive overall, with comments highlighting enjoyment of the between session “Worst Case Scenario” activity, the “Uprooting Internalized Anti-Fat Bias” and “Fat Activism” activities, and the role play activities. However, of note, one participant expressed difficulty with sharing their “Worst Case Scenario” activity with the group. Participants also enjoyed the group-based environment of BAM-Health that allowed them to feel less alone in their “thoughts, fears, and perceptions.” As such, the small

**Table 5** Qualitative results analysis including themes and representative comments from post-intervention acceptability feedback survey

Theme	N (%)	Representative Comments
Enjoyment of the Zoom environment	9 (56.3%)	<ul style="list-style-type: none"> <li>• I appreciated Zoom because it is more convenient.</li> <li>• I liked the Zoom format. It allowed us to do our normal day then sit down after dinner and talk.</li> <li>• It was a lot easier to find room for 4 h of session over zoom than if I'd had to drive to a physical location.</li> <li>• I liked the Zoom environment. It felt open for discussion and gave the participants the freedom to join from whatever physical location was most convenient to them.</li> <li>• Zoom is great. It is easy to use and I like that we can shut our cameras off if needing a moment break.</li> </ul>
Perceptions of session activities	8 (50.0%)	<ul style="list-style-type: none"> <li>• Writing the story I think was very powerful and enlightening so we can understand our thoughts in the moment when our emotions are most high.</li> <li>• I liked the activity where we brainstormed 10 ideas personally and socially then shared and picked one to implement. It felt like I walked away with a concrete plan of action for what comes next, which was great.</li> <li>• I liked roleplaying confrontation about anti-fat bias.</li> <li>• I did not like the reading of our worst case scenarios. Summarizing the main points was fine, but I didn't expect to be reading it verbatim.</li> <li>• Feedback on the role plays [was missing from the sessions].</li> </ul>
The time commitment was too high.	5 (31.3%)	<ul style="list-style-type: none"> <li>• The long meetings [was what I liked least about BAM-Health].</li> <li>• Lengthy activities before and between sessions [was what I liked least about BAM-Health].</li> <li>• I honestly thought it could've been shorter. Some of the questions were redundant and doing the role play twice also was.</li> <li>• I did not like how long we spent on some of the activities. They could have been shortened.</li> </ul>
Elements were missing from the sessions.	5 (31.3%)	<ul style="list-style-type: none"> <li>• It stood out to me that it was all women participants. Men perpetuate anti-fat bias and I think it is important they are part of these conversations if BAM is intending to move the needle on anti-fat bias.</li> <li>• I think that it is incredibly important for healthcare providers to acknowledge and work around their own biases. I think the topics covered are 100% valid, informative, and important. The only gap for me was that sometimes it almost felt like we were being instructed to never suspect weight as a possible underlying health issue. I think it can be a factor for some and think a little more clarification in that realm would be helpful.</li> <li>• I wish there was more conversation around sexuality and pleasure.</li> </ul>
The group atmosphere was positive.	4 (25.0%)	<ul style="list-style-type: none"> <li>• I really enjoyed the open conversations. I didn't feel embarrassed for not being well informed on the subject.</li> <li>• I liked the small group atmosphere where we all contributed and shared and got to know one another and shared a brave space where it was ok to talk about difficult things. I liked realizing that everyone had some of the same thoughts and fears and perceptions as me and it made me feel less weird and less alone.</li> </ul>

group format for weight stigma reduction interventions may be especially appreciated by health professional students.

The intervention aimed to reduce internalized weight and appearance-related concerns and interpersonal weight stigma with small-to-moderate effect sizes. BAM-Health produced a sustained reduction in internalized weight and appearance-related concerns related to thin idealization (IBSS-R—moderate effect size) and interpersonal obesity stigma (EPSI-NATO—small effect size) at follow-up, but failed to show a sustained reduction in the internalized fear of fatness (GFFS) or interpersonal anti-fatness (UMB-FAT) scales. The different weight stigma constructs explored by these scales may explain the mixed results. The IBSS-R, for example, assesses participants' internalization of thin-ideal standards by asking the extent to which they agree with various generalized statements (i.e., Slender women are more attractive). Compared to the GFFS, which assesses participants' fear of gaining weight and becoming fat themselves (i.e., Becoming fat would be the worst thing that could happen to me), participants may be more likely to disagree with ideals of thinness when applied to others than when applied to themselves – a concept tackled

in the BAM-Health curriculum. The EPSI-NATO subscale addresses topics more directly discussed in BAM-Health, such as the construction of BMI and obesity and whether one's weight is under their own control (i.e., "I thought that obese people lack self-control" and "I felt that overweight people are lazy"). In contrast, the UMB-FAT focuses on stereotypes about people in larger bodies (i.e., "Fat people have bad hygiene"). Although scores on the UMB-FAT suggested reduced interpersonal weight stigma with a small effect size at post-intervention, this effect was not sustained at follow-up. The brief nature of the intervention may play a role in the lack of sustained results, as it is notoriously difficult to reduce deeply ingrained implicit biases – such as weight bias – through short-term interventions [39]. Inundation of societal and curricular messaging portraying anti-fat stereotypes in the weeks following the intervention may have contributed to the lack of sustained attitudinal change on this measure. Lengthening the intervention – for example, by embedding it longitudinally into health professional curricula – could potentially improve the amplitude and durability of reductions in interpersonal weight stigma. Overall, BAM-Health seems to have encouraged changes in internalized weight and appearance-related concerns

when applied to others more than when applied to oneself, and deeply-ingrained stereotypes regarding people in larger bodies prove difficult to eliminate in the long-term.

### Study limitations and future directions

There were several limitations to this study. First, as a pilot study, the sample size was relatively modest, limiting analytic power for inferential analysis. The primary objective of the current pilot study was to estimate potential effect sizes for future, well-powered trials. Participants in the study were primarily White, heterosexual, woman-identifying, and of a BMI in the normal to overweight range. In fact, BAM-Health participants noted the lack of gender diversity in their post-intervention feedback. In the same vein, an additional limitation relates to the language used in the IBSS-R and GFFS. The IBSS-R presents appearance ideals typically related to participants identifying as women, while the GFFS is written in a way that targets participants who are not currently living in larger bodies. However, the majority of participants identified as women, making measurement validity across the gender spectrum less of a concern in this specific sample. In addition, the GFFS has been validated in samples with BMI ranges similar to the one in this study [40]. More diverse samples in terms of race, gender, sexuality, and body size are needed to determine whether BAM-Health is useful for and generalizable to health professional students across a range of identities; as efforts are directed toward recruitment of diverse samples, selection of reflective measures will be paramount.

Also, because involvement in the study was voluntary and participants were not blinded, it is likely that the students who expressed interest in BAM-Health are not representative of the entire health professional student body, but instead represent those students with a pre-existing interest in critically examining their own and others' weight stigma in healthcare settings. As a result, both baseline and follow-up measures may be different amongst a more generalized health professional student body. Response bias – particularly, social desirability bias [41] – may have also impacted the results, though the inclusion of and comparison to the brochure group reduces the likelihood that social desirability itself is a major driver of results. Future studies would be prudent to include a measure of social desirability bias, as well as emerging measures of weight stigma specific to healthcare professionals [42].

Further studies are warranted to evaluate the impact of BAM-Health with a larger sample to allow for inferential testing and for cross-analyses of participant characteristics - such as program of study, point in training, and demographic characteristics including sex, BMI, and weight history - and their impact on program

effectiveness. In addition, as disordered eating may be a manifestation of intrapersonal weight stigma, future work will seek to analyze EPSI data collected during this study to examine the impact of BAM-Health on disordered eating behaviors among health professional students. Eventually, future work will examine whether participation in the intervention has any downstream effects on patient-provider interactions and care outcomes.

### Conclusions

BAM-Health, a novel weight stigma intervention, met benchmarks for preliminary acceptability and feasibility and received favorable reviews from participants. Acceptability analyses from this pilot study suggest that a peer-led, group-based weight-stigma reduction intervention among health professional students is acceptable and warrants additional study and program development. Analysis of participant feedback demonstrates that health professional students are interested in reducing intrapersonal, interpersonal, and structural weight stigma in their personal lives and in their careers, and in finding alternative methods that promote sustainable, holistic wellbeing for future patients. Quantitative measures revealed small-to-moderate reductions in internalized weight and appearance concerns and interpersonal weight stigma from baseline to post-intervention, some of which were sustained at follow-up. BAM-Health shows promise as a novel intervention to reduce weight stigma among health professional students, and therefore could help address a pressing concern that negatively impacts patient care and outcomes. Embedding BAM-Health activities and discussions into pre-existing health curricula may provide an avenue to reduce barriers to participation, diversify participants, and produce sustained reductions in weight stigma.

### Abbreviations

BAM-Health	Body Advocacy Movement-Health
BMI	Body Mass Index
SD	Standard deviation
MD	Doctor of Medicine
BSN	Bachelor of Science in Nursing
PA	Physician Associate
DPT	Doctor of Physical Therapy
IRB	Institutional Review Board
GFFS	Goldfarb Fear of Fat Scale
IBSS-R	Ideal-Body Stereotype Scale-Revised
UMB-FAT	Universal Measure of Bias – Fat Version
EPSI-NATO	Eating Pathology Symptoms Inventory – Negative Attitudes Towards Obesity
ED	Eating disorder
ANOVA	Analysis of Variance
IAT	Implicit Association Test

### Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s40337-024-01114-9>.

Supplementary Material 1

Supplementary Material 2

#### Author contributions

AK and TS led data collection, analysis and interpretation and wrote the main manuscript text; KS, EB and SF contributed to study conception, design and data collection; EB, SF, AL and MG assisted in data collection; LP performed data analysis; and all parties reviewed the manuscript.

#### Funding

The authors report that there are no funding sources to disclose.

#### Data availability

The datasets supporting the findings of this article are available from the corresponding author, KS, upon reasonable request.

#### Declarations

##### Ethics approval and consent to participate

Ethical approval for the study was overseen and provided by the UW Institutional Review Board under ID: 2021–0564. All study subjects provided written informed consent to participate.

##### Consent for publication

All authors have read and approved the submission and publication of this text.

##### Competing interests

The authors declare no competing interests.

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Received: 29 February 2024 / Accepted: 17 September 2024

Published online: 07 October 2024

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