Explicit and implicit weight bias among health care students: a cross-sectional study of 39 Australian universities

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Summary

Background Weight bias exhibited by health care students may continue into their future practice, compromising the provision of care that people living with overweight or obesity receive. This highlights the need to comprehensively examine the extent to which weight bias is present among health care students and the factors that may be associated with students' weight bias.

Methods In this cross-sectional study, Australian university students enrolled in health care courses were invited via social media advertisements, snowball and convenience sampling, and by making direct contact with universities to complete an online survey. Students provided demographic information including discipline of study, perceived weight status, and state of residence. Students then completed several measures which assessed their explicit and implicit weight bias, and empathy. Descriptive statistics established the presence of explicit and implicit weight bias, and ANCOVAs, ANOVA, and multiple regression analyses were conducted to examine the potential factors associated with students' exhibited weight bias.

Findings Between March 08, 2022, and March 15, 2022, 900 eligible health care students attending 39 Australian universities participated in the study. Students reported varying levels of explicit and implicit weight bias, with minimal differences between disciplines on most outcome measures. Students who identified as men (vs. women) exhibited higher of both explicit and implicit bias (Beliefs About Obese Persons (BAOP): $p = 0.0002$, Antifat Attitudes Questionnaire (AFA)—Dislike: $p = 0.019$, AFA Willpower $p < 0.0001$, Empathy for Obese Patients: $p = 0.0011$, Implicit Association Test: $p = 0.022$), and students who displayed greater (vs. less) empathic concern exhibited lower levels of explicit bias (BAOP, AFA Dislike and Willpower, and Empathy for Obese Patients: $p < 0.0001$). Having witnessed the enactment of weight stigma sporadically (vs. regularly) by role models was associated with greater attribution of the causes of obesity to willpower (a few times a month vs. daily: $p = 0.020$, a few times a year vs. daily: $p = 0.022$), and less time spent with people living with overweight or obesity outside of study was associated with more dislike (a few times a month vs. daily: $p = 0.0048$, once a month vs. daily: $p = 0.0002$) and less fear of fat (once a month vs. daily: $p = 0.036$, and once a month vs. a few times a week: $p = 0.0028$).

Interpretation Results demonstrate the presence of both explicit and implicit weight bias among Australian health care students. Several characteristics and experiences of students were associated with their weight bias. Validity of the exhibited weight bias should be established in practical interactions with people living with overweight or obesity and novel interventions should be developed to ameliorate weight bias.

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Keywords: Weight bias; Weight stigma; Health care students; Overweight and obesity

Introduction

Overweight and obesity, characterised by excess adiposity have been recognised as a global health priority.[1] In 2016, it was estimated that 39% of the global adult population were living with overweight and 13% were living with obesity.[2] Australian estimates revealed

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Research in context

Evidence before this study

Weight bias exhibited by practicing health care professionals negatively impacts how people living with overweight or obesity are treated. Preliminary research shows that health care students and trainees also exhibit weight bias, which has the potential to continue into students' future practice impacting the care that people living with overweight or obesity receive. Thus, there was a need to comprehensively examine weight bias and potential factors associated with students' weight bias amongst health care students across diverse disciplines. We searched MEDLINE, PsycINFO and Web of Science on 20 January 2022 using the search strategy: ((weight OR body weight OR overweight OR obesity OR adiposity) AND (health OR allied health OR health care) AND (studen* OR traine* OR professiona* OR undergraduate OR postgraduate OR inter*)). We included cross-sectional, cohort, randomised controlled trials, and longitudinal studies and excluded non-human or case studies, editorials and comment articles. We found no examinations of weight bias among health care students across diverse disciplines at multiple universities.

Added value of this study

To our knowledge, this is the first study within the weight bias literature to comprehensively examine weight bias among Australian health care students across many disciplines at multiple universities. We found that Australian health care students exhibited explicit and implicit weight bias, which was associated with a number of factors (e.g., Body Mass Index, and experiences such as having witnessed the enactment of weight stigma by role models). We also found that greater empathic concern contributed to lower explicit weight bias.

Implications of all the available evidence

Our findings, together with previous research demonstrate that explicit and implicit weight bias is present among health care students globally. The exhibited weight bias has the potential to negatively impact the care that people living with overweight or obesity receive, contributing to worse health outcomes and quality of life. As attempts to reduce students' weight bias have shown partial success or were unable to produce long-term reductions in weight bias, future research is warranted that aims to develop novel weight bias reduction interventions. Additionally, it is essential for educators to devise methods aimed at reducing students' weight bias in classroom, practical and curriculum settings.

that in 2017–18, 36% of the adult population were living with overweight, and 31% were living with obesity.[3] Prevalence rates are predicted to rise, and 23% of the global and 35% of the Australian adult population are expected to be living with obesity by 2025.[1,4] It has been established that the development of overweight and obesity is driven by a complex interaction of factors between an individual and their environment[5–7]; however, evidence also demonstrates that an additional psychosocial contributor; weight bias, may aid in its maintenance.[8–10]

Weight bias is defined as holding negative beliefs, attitudes, judgements and assumptions about people living with overweight or obesity, and can be explicit (conscious and overt) or implicit (unconscious and covert).[11,12] People living with overweight or obesity may be subjected to derogatory comments or behaviour in social, workplace, intimate, educational, and online settings.[13–15] People living with overweight or obesity may seek treatment from health care professionals for needs both related and unrelated to their weight. However, weight bias held by health care professionals may lead to the development of physical and mental health concerns or exacerbate physical and mental health concerns associated with overweight or obesity.[16–18]

Evidence has demonstrated that health care professionals hold weight bias towards people living with overweight or obesity, even when the presenting concerns are unrelated to excess weight.[19–21] Health care professionals including physicians, nurses, dietitians and psychologists have been reported to provide unsolicited weight loss advice, prescribe differential treatments, be unwilling to perform certain examinations, spend less time in consultations, and unintentionally display negative facial expressions and use less eye contact potentially impeding the provision of care to people living with overweight or obesity.[17,22–27] Weight bias held by health care professionals results in people living with overweight or obesity experiencing weight stigma, which often leads to cancellation or delaying of appointments, avoidance of preventative care, engaging in doctor shopping, and reducing continuing care, contributing to worse health outcomes and quality of life.[28–30] Inevitably, university students studying health care courses will become the next generation of health care professionals, and the continued rise in the rates of overweight or obesity will mean that the majority of patients they will provide care for, will be living with overweight or obesity. The provision of care to people living with overweight or obesity in students' future practice may be compromised, as preliminary evidence demonstrates the presence of both explicit and implicit weight bias among health care students.[31–38]

Medical students who perceived that negative attitudes toward people living with overweight or obesity were the norm in medical school were associated with

objectionable patient-related behaviours including low levels of respectfulness, responsiveness, interactivity, and attentiveness.[31] In a sample of 4732 medical students, students with a lower (vs. higher) Body Mass Index (BMI) were found to hold higher levels of both explicit and implicit weight bias.[32] Similarly, implicit weight bias has been reported amongst nursing and psychology students.[33] Some students were unaware of the strength of their weight bias with George and colleagues having reported that 65% of nursing students incorrectly predicted their self-perceived level of implicit bias.[34] Dietetic students rated people living with overweight or obesity to be less adherent to treatment, even when there was no information indicating non-adherence to previous treatment,[35] and marriage and family therapy students held a stronger belief that people living with overweight or obesity lacked willpower.[37] Physician associate, clinical psychology and psychiatric residency students reported feelings of frustration and pessimism in treating people living with overweight or obesity,[39] and Australian health care students across several disciplines held similar levels of both explicit and implicit weight bias, with little difference between health care and non-health care students.[38] The presence of explicit and implicit weight bias as evidenced by the aforementioned studies may consciously or unconsciously continue into interactions with people living with overweight or obesity in future practice, thus reflecting the evidenced weight bias of current practising health care professionals.[16,33] The experience of weight stigma may be conducive to the exacerbation of existing or the development of new health concerns, contributing to an inverse outcome of the aim of health care. Therefore, a greater understanding of weight bias among health care students is imperative.

Despite both recent and former research examining this topic, the extant literature has been unsuccessful in capturing the full extent of weight bias that is present among health care students. Many studies have included students across limited health care disciplines at large individual universities, often within the United States.[31,34,40] In Australia, studies investigating weight bias among health care students are scarce. Furthermore, some studies have found factors such as student BMI, level of study and witnessing the enactment of weight bias by role models may be associated with students' weight bias; however, the lack of consistency of results across studies and methodologies renders it difficult to establish whether these factors apply to health care students across all disciplines.[37,41,42] The association of empathy on health care students' weight bias has also not been adequately investigated, even though empathy is a key element that predicts successful patient outcomes.[43,44] Additionally, the absence of a substantiated body of evidence to explain the origins of weight bias may indicate that largely unexplored factors such as geographical location (e.g., state of residence) time spent with people living with overweight or obesity, perceived weight status, year at university, university of study and ethnicity may also affect students' weight bias. Therefore, this cross-sectional study aimed to investigate the extent to which explicit and implicit weight bias is present among Australian health care students across all relevant health care disciplines, and to determine what factors may be associated with students' weight bias.

Methods

Study design and participants

An initial sample of 1815 students (who self-reported as) studying courses (undergraduate and postgraduate) related to health care at Australian universities was recruited via social media advertisements, snowball and convenience sampling, and by making direct contact with universities to take part in this online cross-sectional study. Participants were informed of the requirement to complete the survey on a desktop or laptop computer device due to the incompatibility of the Implicit Association Test (IAT) with mobile devices. However, approximately half of the sample (N = 848) attempted the survey on a mobile device, which did not permit completion of the IAT, and hence the measures of explicit bias, as participants were required to complete the IAT before the explicit measures. Therefore, their data were excluded. Further exclusions were made on the basis of having completed the IAT with excessive speed (<300 ms, N = 39), being a practising health care professional (N = 1), studying at an American university (N = 15), systematic missing data on multiple demographic questions and/or measures (N = 8), having scored a 0 for all attention-check questions with pattern responding (e.g., having selected 'strongly agree' for all statements) on measures (N = 3), and studying at a university specialising in agriculture (N = 1). The final sample included 900 health care students from 39 universities across Australia. Participants had a mean age of 24.18 years (SD = 7.60, IQR = 7.00) and a BMI of 24.20 kg/m^2 (SD = 5.45, IQR = 5.96) Further demographic characteristics of the sample and scores for each outcome measure can be found in Table 1 below, and in Tables S1 and S2 contained in the Supplementary Materials. This study has been reported in adherence to The Strengthening and Reporting of Observational Studies in Epidemiology (STROBE) Statement.[45]

Materials

Participants accessed an online survey hosted on Qualtrics between March 08, 2022, and March 15, 2022. The survey contained four validated measures of explicit weight bias including the Beliefs About Obese Persons Scale (BAOP) which assessed beliefs about the causes and controllability of weight,[46] the Antifat Attitudes

	N	BAOP	AFA dislike	AFA fear of fat	AFA willpower	Empathy for obese patients	Confidence in clinical interaction with obese patients	Implicit association test
Discipline								
Medicine	90	20.2 (8.8)	2.1 (1.5)	5.6 (2.4)	3.9 (2.1)	12.2 (2.7)	8.3 (3.1)	0.48 (0.39)
Paramedicine	37	19.9 (8.4)	1.6 (1.5)	6.1 (2.1)	4.5 (2.3)	12.1 (2.5)	8.3 (3.1)	0.59 (0.47)
Medical imaging/radiation therapy	15	22.5 (11.1)	2.4 (2.2)	5.6 (2.1)	3.3 (2.3)	12.9 (1.8)	7.2 (3.0)	0.55 (0.42)
Dentistry	16	20.8 (6.9)	2.7 (2.2)	5.1 (2.3)	4.0 (1.8)	11.2 (2.4)	8.1 (3.7)	0.74 (0.26)
Oral health therapy	20	17.9 (8.9)	2.0 (1.6)	5.6 (2.0)	4.5 (2.2)	11.0 (2.3)	8.0 (3.4)	0.52 (0.34)
Nursing	147	20.0 (7.5)	1.5 (1.4)	5.8 (2.5)	3.7 (1.9)	12.0 (2.3)	8.8 (2.9)	0.50 (0.38)
Midwifery	26	19.3 (6.0)	2.1 (1.6)	6.0 (2.0)	3.9 (1.9)	12.4 (1.7)	8.3 (2.5)	0.54 (0.26)
Dietetics	39	17.7 (5.6)	1.7 (1.4)	5.8 (2.1)	4.0 (1.9)	12.1 (2.5)	10.1 (2.7)	0.64 (0.34)
Nutrition	26	17.8 (5.6)	1.9 (1.6)	4.7 (2.6)	3.9 (1.7)	12.5 (2.7)	9.4 (3.3)	0.57 (0.37)
Psychology	138	20.5 (7.7)	1.7 (1.5)	5.5 (2.5)	3.7 (2.1)	12.3 (2.0)	7.5 (3.3)	0.44 (0.37)
Counselling	3	26.3 (11.0)	1.7 (2.4)	3.2 (2.9)	2.4 (2.3)	12.0 (2.6)	7.0 (2.6)	0.17 (0.42)
Social work	24	22.0 (6.9)	1.5 (1.1)	5.9 (2.4)	3.1 (1.8)	12.5 (2.5)	7.3 (3.4)	0.47 (0.40)
Physiotherapy	39	18.0 (7.5)	2.0 (1.3)	5.1 (2.2)	4.1 (2.0)	11.9 (1.8)	7.5 (3.1)	0.68 (0.34)
Occupational therapy	59	20.2 (8.2)	1.8 (1.8)	5.9 (2.3)	3.5 (2.0)	12.2 (2.0)	8.4 (3.0)	0.57 (0.41)
Speech pathology	25	19.8 (5.8)	1.6 (1.4)	5.7 (2.2)	4.3 (1.6)	12.9 (1.5)	6.2 (2.2)	0.52 (0.44)
Chiropractic	4	12.0 (6.1)	2.3 (0.7)	3.8 (3.6)	6.0 (0.7)	11.3 (1.5)	9.3 (2.1)	0.78 (0.57)
Exercise science	34	16.8 (7.0)	1.4 (1.4)	5.7 (2.2)	4.3 (1.9)	12.4 (1.9)	10.4 (3.2)	0.58 (0.30)
Audiology	2	28.0 (1.4)	2.1 (1.2)	4.3 (3.8)	2.5 (0.2)	12.0 (1.4)	3.5 (0.7)	0.48 (0.03)
Optometry	26	15.9 (6.2)	2.2 (1.4)	5.7 (2.2)	4.4 (2.0)	11.9 (2.2)	8.1 (3.2)	0.67 (0.36)
Public health & health promotion	27	20.9 (8.3)	1.7 (1.6)	5.4 (2.7)	3.8 (2.4)	12.9 (1.6)	8.5 (3.7)	0.49 (0.47)
Pharmacology	31	20.3 (9.4)	1.9 (1.5)	6.3 (1.8)	3.9 (1.8)	12.7 (1.8)	7.2 (2.8)	0.57 (0.37)
Prefer not to answer	3	19.7 (4.5)	1.8 (0.8)	4.7 (4.0)	4.1 (1.4)	11.7 (3.1)	7.3 (1.5)	0.48 (0.43)
Other	69	20.4 (8.5)	2.0 (1.7)	5.5 (2.6)	4.1 (2.2)	12.3 (1.9)	8.2 (3.2)	0.56 (0.41)
Discipline—Grouped								
Medicine	299	19.9 (7.8)	1.8 (1.5)	5.7 (2.4)	3.8 (2.0)	12.0 (2.4)	8.5 (3.0)	0.51 (0.37)
Allied health	502	19.5 (7.7)	1.8 (1.5)	5.6 (2.3)	3.9 (2.0)	12.3 (2.1)	8.1 (3.3)	0.55 (0.39)
Public health	27	20.9 (8.3)	1.7 (1.6)	5.4 (2.7)	3.8 (2.4)	12.9 (1.6)	8.5 (3.7)	0.49 (0.47)
Other	72	20.4 (8.3)	2.0 (1.7)	5.5 (2.6)	4.1 (2.1)	12.3 (1.9)	8.2 (3.2)	0.56 (0.41)
Level of study								
Undergraduate	726	19.5 (7.7)	1.7 (1.5)	5.7 (2.4)	3.9 (2.0)	12.2 (2.2)	8.2 (3.2)	0.54 (0.38)
Postgraduate	174	20.8 (8.0)	2.0 (1.7)	5.3 (2.3)	3.9 (2.0)	12.3 (2.3)	8.4 (3.2)	0.51 (0.42)
Gender identification								
Men	172	16.9 (6.8)	2.2 (1.7)	5.0 (2.4)	5.1 (1.9)	11.4 (2.3)	9.4 (3.2)	0.60 (0.39)
Women	718	20.4 (7.9)	1.7 (1.5)	5.8 (2.4)	3.6 (1.9)	12.4 (2.1)	8.0 (3.1)	0.52 (0.38)
Non-Binary	6	16.5 (8.3)	2.6 (2.5)	6.9 (2.1)	3.8 (2.1)	14.2 (0.8)	7.2 (4.4)	0.37 (0.40)
Transgender people	2	11.5 (0.7)	2.0 (1.4)	7.8 (0.7)	6.0 (0.0)	14.0 (0.0)	7.5 (3.5)	−0.04 (0.21)
Other	2	20.0 (7.1)	0.8 (0.1)	6.3 (2.4)	2.0 (0.0)	10.5 (4.9)	10.5 (6.4)	0.01 (0.24)
Ethnicity								
Caucasian	582	19.8 (7.8)	1.7 (1.5)	5.7 (2.4)	3.9 (2.1)	12.5 (2.1)	8.2 (3.2)	0.54 (0.38)
Asian	153	18.5 (7.5)	2.2 (1.6)	5.6 (2.4)	4.0 (1.9)	11.3 (2.3)	8.6 (3.1)	0.54 (0.43)
Indian or South-East Asian	67	21.4 (8.0)	1.8 (1.7)	5.8 (2.5)	3.8 (2.0)	12.0 (2.0)	7.8 (3.5)	0.55 (0.33)
African	9	19.7 (6.5)	2.0 (1.1)	5.1 (3.0)	3.9 (2.1)	11.0 (2.7)	6.3 (3.0)	0.38 (0.44)
Hispanic/Latino	10	22.7 (10.0)	1.2 (1.5)	5.6 (2.4)	3.5 (2.5)	12.8 (2.4)	6.6 (2.0)	0.66 (0.27)
Aboriginal or Torres Strait Islander	7	19.3 (6.8)	1.4 (1.2)	6.3 (2.0)	4.3 (2.1)	12.7 (2.0)	8.9 (3.5)	0.42 (0.49)
Middle Eastern	20	19.0 (9.7)	1.4 (1.1)	5.8 (2.2)	3.9 (2.0)	12.2 (2.8)	7.8 (3.1)	0.60 (0.34)
African American	2	21.0 (1.4)	1.1 (0.6)	3.8 (2.1)	3.7 (1.9)	9.5 (3.5)	6.5 (4.9)	0.12 (0.49)
Pacific Islander	3	22.7 (7.6)	2.0 (1.5)	5.2 (1.8)	3.4 (0.5)	12.0 (3.0)	8.7 (3.5)	0.46 (0.16)
Other	43	19.9 (8.2)	1.8 (1.6)	5.7 (2.5)	3.7 (1.9)	12.3 (2.2)	8.8 (3.5)	0.51 (0.39)
Prefer not to answer	4	24.0 (7.8)	0.6 (1.0)	2.6 (1.3)	3.0 (1.1)	12.8 (1.7)	7.0 (2.2)	0.19 (0.57)

Each demographic section totals N = 900. AFA: Antifat attitudes questionnaire (Dislike, Fear of Fat and Willpower subscales); BAOP: Beliefs about obese persons scale.

Table 1: **Participant demographic information and mean (with standard deviation) scores for each outcome measure.**

Questionnaire (AFA) which assessed attitudes towards people living with overweight or obesity,[47] Empathy for Obese Patients and Confidence in Clinical Interaction with Obese Patients scales which assessed attitudes towards treating people living with overweight or obesity,[48] and the Implicit Association Test (IAT) a computerised image-word association task which assessed implicit weight bias,[49,50] a measure of empathy; the Empathic Concern (EC), Perspective Taking (PT) and Personal Distress (PD) subscales of the Interpersonal Reactivity Index (IRI),[51] and a demographic questionnaire which assessed influential factors of weight bias. Higher scores on each measure indicated the following: the belief that people living with overweight or obesity were not able to control their own weight status (BAOP), stronger negative attitudes towards people living with overweight or obesity (AFA), greater empathy and confidence in interactions with patients (Empathy for Obese Patients and Confidence in Clinical Interaction with Obese Patients), stronger implicit attitudes (IAT), and greater empathy (EC, PT, and PD of the IRI).[46–51] Refer to section two of the Supplementary Materials for an extended description of the materials.

Procedure

Upon clicking the online survey link provided in the recruitment materials, Australian health care students were directed to the study information form. Students who provided consent to participate by clicking 'Agree' then completed the demographic questions followed by the validated measures detailed above. The measures of explicit weight bias were presented at the end of the survey to reduce participant response bias or recognition of the intent to assess weight bias. Participants were presented with the debrief message and the option to enter their email into a draw to win one of ten $50 AUD gift cards. This study was approved by the Human Research Ethics Committee (HREC) at Curtin University (HREC2021-0740).

Statistical analysis

The Statistical Package for Social Sciences (SPSS, V. 28)[52] was used for data analysis. Descriptive statistics, between-groups tests, and multiple regressions were performed to examine the presence and the factors associated with students' weight bias. The ANCOVAs, ANOVA, and multiple regressions were initially performed with the entire dataset and were then repeated without categorical groups (e.g., discipline) with fewer than ten participants to reduce comparison variability (e.g., comparison of categories comprising nine participants with categories comprising 15 participants). Repeated analyses have been labelled as '*factor* small groups removed*' to differentiate the results in findings. Covariates were identified via significant Spearman's correlations and controlled for in multiple regressions. p values of post-hoc tests were adjusted for multiple comparisons where necessary. Refer to Tables S5–S8 and section three of the supplementary materials to view the main ANCOVA, ANOVA, and t-test output results, and refer to Tables S1 and S4 of the Supplementary Materials to view descriptive statistics of each measure and factor, and correlations between the outcome measures.

Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the article. Authors R.S.J. and B.J.L. had full access to the dataset. All authors, R.S.J., M.O., S.W.F., E.H. and B.J.L. were responsible for the decision to submit the paper for publication.

Results

Beliefs about obese persons

Participants' mean BAOP score was 19.71 (*SD* 7.82), indicating the belief that obesity was personally controllable. Post-hoc pairwise comparisons conducted for ANCOVA analyses revealed that postgraduate students (N = 174) scored higher than undergraduate students (N = 726, p = 0.026), students who identified as women (N = 718) scored higher than students who identified as men (N = 172, p = 0.0002). Additionally, students who attended universities in Victoria (N = 257) scored higher than students who attended universities in Queensland (N = 148, p = 0.042) in university by state small groups removed. Multiple regression analysis indicated a positive relationship between Empathetic Concern and BAOP scores, where for every 1 unit increase in Empathic Concern, there was a 0.32 unit increase in BAOP scores (p < 0.0001). No differences were found for the remaining demographic variables and IRI subscales.

Antifat attitudes—dislike

Participants' mean score on the Dislike subscale of the AFA was 1.80 (*SD* 1.53), indicating the presence of dislike towards people living with overweight or obesity. Post-hoc comparisons revealed that students who identified as men (N = 172) scored higher than students who identified as women (N = 718) in gender small groups removed (p = 0.019), students who spent a few times a month with people living with overweight or obesity in general (N = 128) scored higher than students who spent time on a daily basis (N = 266, p = 0.0048). Additionally, students who spent time once a month with people living with overweight or obesity in general (N = 47) scored higher than students who spent time on a daily basis (N = 266, p = 0.0002), a few times a week (N = 217, p = 0.0041), and once or twice a week (N = 114, p = 0.0013). Multiple regression analysis indicated that for every 1 unit increase in Empathic Concern, there was –0.11 unit decrease in dislike (p < 0.0001), and for

every 1 unit increase in perspective taking, there was a –0.04 unit decrease in dislike ($p = 0.0068$). No differences were found for the remaining demographic variables and IRI subscales.

Antifat attitudes—fear of fat

Participants' mean score on the Fear of Fat subscale of the AFA was 5.64 (*SD* 2.37), indicating the presence of fear of fat. Post-hoc comparisons revealed that students who identified as women ($N = 718$) scored higher than students who identified as men ($N = 172$, $p = 0.0079$), students who perceived themselves as living with a healthy weight ($N = 587$, $p = 0.0003$), overweight ($N = 203$, $p < 0.0001$), and obesity ($N = 57$, $p < 0.0001$) scored higher than students who perceived themselves as living with underweight ($N = 47$), students who perceived themselves to be living with overweight ($N = 203$, $p < 0.0001$) and obesity ($N = 57$, $p = 0.013$) scored higher than students who perceived themselves to be living with a healthy weight ($N = 587$). Further comparisons revealed that students who spent time on a daily basis with people living with overweight or obesity in general ($N = 266$, $p = 0.036$) and a few times a week ($N = 217$, $p = 0.0028$) scored higher than students who spent time once a month ($N = 47$). Multiple regression analysis indicated that for every 1 unit increase in BMI, there was 0.09 unit increase in fear of fat ($p < 0.0001$), and for every 1 unit increase in personal distress, there was a 0.08 unit increase in fear of fat ($p < 0.0001$). No differences were found for the remaining demographic variables and IRI subscales.

Antifat attitudes—willpower

Participants' mean score on the Willpower subscale of the AFA was 3.88 (*SD* 2.01), indicating the presence of the belief that people living with overweight or obesity lack willpower. Post-hoc comparisons revealed that students who identified as men ($N = 172$) scored higher than students who identified as women ($N = 718$, $p < 0.0001$), and students who have never witnessed the enactment of weight stigma by role models ($N = 542$, $p = 0.011$), witnessed the enactment of weight stigma a few times a month ($N = 58$, $p = 0.020$), and a few times a year ($N = 196$, $p = 0.022$) scored higher than students who witnessed the enactment of stigma on a daily basis ($N = 14$). Multiple regression analysis indicated that for every 1 unit increase in empathic concern, there was a –0.11 unit decrease in willpower ($p < 0.0001$). No differences were found for the remaining demographic variables and IRI subscales.

Empathy for obese patients

Participants' mean Empathy for Obese Patients score was 12.22 (*SD* 2.19), indicating the presence of empathy towards patients living with obesity. Post-hoc comparisons revealed students who identified as women ($N = 718$, $p = 0.0011$) and non-binary ($N = 6$, $p = 0.039$) scored higher than students who identified as men ($N = 172$), and students who identified as being Caucasian ($N = 582$) scored higher than students who identified as being Asian ($N = 153$, $p < 0.0001$). Multiple regression analysis indicated for every 1 unit increase in empathic concern, there was a 0.14 unit increase in empathy ($p < 0.0001$), and for every 1 unit increase in personal distress, there was a –0.04 unit decrease in empathy ($p = 0.017$). No differences were found for the remaining demographic variables and the IRI subscale.

Confidence in clinical interaction with obese patients

Participants' mean score on the Confidence in Clinical Interaction with Obese Patients scale was 8.24 (*SD* 3.19), indicating the presence of confidence. Post-hoc analyses revealed that dietetic students ($N = 39$) scored higher than psychology ($N = 138$, $p = 0.0007$), speech pathology ($N = 25$, $p = 0.0004$) and pharmacology ($N = 31$, $p = 0.044$) students, exercise science students ($N = 34$) scored higher than psychology ($N = 138$, $p = 0.0008$), social work ($N = 24$, $p = 0.050$), speech pathology ($N = 25$, $p = 0.0003$) and pharmacology ($N = 31$, $p = 0.035$) students. In addition to the aforementioned differences, nursing students ($N = 147$) scored higher than speech pathology students ($N = 25$, $p = 0.048$), and dietetics students ($N = 39$) scored higher than social work students ($N = 24$, $p = 0.048$) in discipline small groups removed. Further, students who identified as men ($N = 172$) scored higher than students who identified as women ($N = 718$, $p < 0.0001$). Multiple regression analysis indicated for every 1 unit increase in age, there was a 0.06 unit increase in confidence ($p = 0.0002$), for every 1 unit increase in hours spent learning about overweight and obesity during university study, there was a 0.00 unit increase in confidence ($p = 0.0017$; however, this finding is unlikely to carry any practical significance, as it may have been a result of the large sample size.). Additionally, for every 1 unit increase in empathic concern, there was a –0.07 unit decrease in confidence ($p = 0.018$), and for every 1 unit increase in personal distress, there was a –0.05 unit decrease in confidence ($p = 0.037$). No differences were found for the remaining demographic variables and the IRI subscale.

Implicit weight bias

Participants' mean IAT score was 0.53 (*SD* 0.38), indicating the presence of unconscious weight bias. T-test analyses indicated that students who identified as men ($N = 172$) scored higher than students who identified as women ($N = 718$) in gender small groups removed t (888) = 2.29, $p = 0.022$, $d = 0.19$, 95% CI [0.01, 0.14]. Post-hoc comparisons revealed that students who perceived themselves as living with a healthy weight ($N = 587$) scored higher than students who perceived themselves as living with obesity ($N = 57$, $p = 0.010$,

d = 0.21), students who witnessed the enactment of weight stigma by peers a few times a month (N = 116) scored higher than students who witnessed the enactment on a daily basis (N = 22, p = 0.037, d = 0.21), students who attended universities in Queensland (N = 148) scored higher than students who attended universities in Western Australia (N = 254, p = 0.031, d = 0.21). Multiple regression analysis indicated that for every 1 unit increase in BMI, there was a –0.01 unit decrease in IAT scores (p = 0.0085). No differences were found for the remaining demographic variables and IRI subscales. The main multiple regression output results for each outcome measure are shown below in Table 2.

Discussion

Findings from this study show that Australian health care students held explicit and implicit weight-biased attitudes and beliefs towards people living with overweight or obesity. Students believed that obesity was within a person's control and that people living with overweight or obesity lacked willpower. Students also expressed dislike and empathy towards people living with overweight or obesity, exhibited fear of fat, confidence in clinical interactions with people living with overweight or obesity, and unconscious weight bias. These beliefs and attitudes may potentially continue into students' future practice, compromising the provision of care to people living with overweight or obesity. Analogous to weight bias exhibited by practising health care professionals, students may provide differential treatments and spend an inadequate amount of time in consultations.[17] Sutin and colleagues explored associations between perceived weight discrimination and mortality and found that independent of BMI, individuals who experienced weight bias had a 60% greater risk of mortality.[53] Experiencing weight bias is also associated with chronic stress, and individuals who recognised perceived weight bias were 2.5 times more likely to experience mental health disorders, such as anxiety.[54,55] Although inferences of causality cannot be made due to the cross-sectional nature of the current study, research has shown that individuals' beliefs and attitudes are in turn able to predict their behaviour,[56,57] meaning that students' exhibited weight bias may negatively impact the well-being of people living with overweight or obesity. The presence and strength of both explicit and implicit bias among samples of public health,[58] physical therapy,[59] marriage and family therapy[37] and medical students[31,48] were comparable to the current sample, indicating that Australian health care students' exhibited weight bias was similar to that of health care students in other countries. Robinson et al[38] sample of Australian health care students (11 disciplines) at an individual university scored slightly higher (albeit moderately higher on the Fear of Fat subscale) on the AFA, indicating that the current sample exhibited lower negative attitudes towards people living with overweight or obesity. Additionally, Robinson et al.[38] also found the presence of implicit bias, corroborating the current findings. Together with the extant literature, our findings provide further evidence that weight bias is present among health care students.

Findings from the current study demonstrate that explicit and implicit weight biases were associated with students' characteristics and experiences. Students who identified as women (vs. men) exhibited lower levels of explicit and implicit bias and greater empathy for patients living with obesity, but more explicit fear of fat. Students who identified as women (vs. men) also exhibited lower confidence in clinical interactions with patients living with obesity. Research has demonstrated that individuals who identify as women are more vulnerable to internalising concerns about body image (hence greater fear of fat).[60,61] Additionally, the pervasive nature of the 'thin ideal' and weight loss advertisements targeted at women[62] likely contributes to developing concerns about body image, which may lead to lower confidence in interacting with others living with overweight or obesity. Puhl et al.[63] stated that the lower weight bias exhibited by women may be due to their generalised increase in sensitivity (compared to men) to biases associated with weight, as a result of being more susceptible to societal judgements based on physical appearance. Several previous studies with health care students found similar results, such that students who identified as women exhibited lower explicit bias,[58,64] but more fear of fat,[37] while others found no differences between genders on implicit bias,[65] or that greater implicit bias was exhibited by students who identified as women.[66] Why such differences are present among studies conducted within the same country[58,65,66] is unclear; however, a clear difference exists between gender identification in the expression of students' weight bias. Despite the differences found between men and women in this study, caution is to be applied when interpreting them due to the sample's greater proportion of students who identified as women. It is proposed that future studies recruit samples of equally distributed gender representations for a more accurate comparison.

Greater (vs. less) empathic concern (the ability to feel sympathy and concern for others)[51] was associated with the belief that obesity is less personally controllable, less dislike towards people with overweight or obesity, less attribution of the causes of obesity to willpower, and more empathy towards patients living with obesity. Research exploring bias toward gender and sexually diverse individuals[67] shows that cognitive and emotional empathy were associated with less explicit bias. It is possible that students with more empathic concern are able to view people living with overweight or obesity with compassion, understand their emotions, and the ongoing challenges of attempting to lose weight and maintain weight loss.[68] However, students exhibited less

Measure of bias	R^2	Adjusted R^2	F	p	Cohen's f^2	B [95% CI]	β	sr^2	p
BAOP	0.03	0.03	(5, 894) = 6.02	<0.0001	0.034				
Age						−0.02 [−0.09, 0.05]	−0.02	0.00	0.55
BMI						0.02 [−0.08, 0.12]	0.01	0.00	0.68
IRI EC						0.32 [0.18, 0.46]	0.17	0.02	<0.0001
IRI PT						0.04 [−0.11, 0.19]	0.02	0.00	0.59
IRI PD						−0.06 [−0.16, 0.05]	−0.04	0.00	0.31
Hours*	0.00	−0.00	(1, 802) = 0.01	0.93	0.000	0.00 [−0.00, 0.00]	0.00	0.00	0.93
AFA Dislike	0.13	0.12	(5, 894) = 25.57	<0.0001	0.143				
Adjusted Alpha: 0.017									
Age						0.01 [−0.01, 0.02]	0.03	0.00	0.33
BMI						−0.02 [−0.04, 0.00]	−0.06	0.00	0.055
IRI EC						−0.11 [−0.13, −0.08]	−0.29	0.06	<0.0001
IRI PT						−0.04 [−0.07, −0.01]	−0.10	0.01	0.0068
IRI PD						0.02 [−0.00, 0.04]	0.06	0.00	0.067
Hours*	0.00	0.00	(1, 802) = 1.08	0.30	0.000	0.00 [−0.00, 0.00]	−0.04	0.00	0.30
AFA fear of fat	0.06	0.06	(5, 894) = 11.93	<0.0001	0.067				
Adjusted Alpha: 0.017									
Age						−0.02 [−0.04, 0.00]	−0.06	0.00	0.11
BMI						0.09 [0.06, 0.12]	0.20	0.04	<0.0001
IRI EC						0.02 [−0.03, 0.06]	0.03	0.00	0.47
IRI PT						−0.04 [−0.08, 0.01]	−0.06	0.00	0.11
IRI PD						0.08 [0.04, 0.11]	0.16	0.02	<0.0001
Hours*	0.00	0.00	(1, 802) = 0.76	0.38	0.000	0.00 [−0.00, 0.00]	−0.03	0.00	0.38
AFA willpower	0.06	0.06	(5, 894) = 11.72	<0.0001	0.065				
Adjusted Alpha: 0.017									
Age						0.01 [−0.01, 0.03]	0.03	0.00	0.41
BMI						0.01 [−0.02, 0.04]	0.03	0.00	0.45
IRI EC						−0.11 [−0.14, −0.07]	−0.22	0.04	<0.0001
IRI PT						−0.03 [−0.06, 0.01]	−0.05	0.00	0.19
IRI PD						0.01 [−0.02, 0.04]	0.03	0.00	0.39
Hours*	0.00	−0.00	(1, 802) = 0.02	0.89	0.000	−0.00 [−0.00, 0.00]	−0.01	0.00	0.89
Empathy for obese patients	0.09	0.08	(5, 894) = 17.43	<0.0001	0.098				
Age						−0.01 [−0.03, 0.01]	−0.03	0.00	0.40
BMI						0.03 [−0.00, 0.05]	0.06	0.00	0.071
IRI EC						0.14 [0.10, 0.17]	0.26	0.05	<0.0001
IRI PT						0.03 [−0.01, 0.07]	0.06	0.00	0.13
IRI PD						−0.04 [−0.06, −0.01]	−0.08	0.01	0.017
Hours*	0.00	−0.00	(1, 802) = 0.00	0.99	0.000	0.00 [−0.00, 0.00]	0.00	0.00	0.99
Confidence in clinical interaction with obese patients	0.04	0.04	(5, 894) = 7.65	<0.0001	0.043				
Age						0.06 [0.03, 0.08]	0.13	0.01	0.0002
BMI						0.03 [−0.01, 0.07]	0.05	0.00	0.16
IRI EC						−0.07 [−0.13, −0.01]	−0.09	0.01	0.018
IRI PT						0.04 [−0.02, 0.10]	0.05	0.00	0.22
IRI PD						−0.05 [−0.09, −0.00]	−0.07	0.00	0.037
Hours*	0.01	0.01	(1, 802) = 9.91	0.0017	0.000	0.00 [0.00, 0.00]	0.11	0.01	0.0017
Implicit association test	0.01	0.01	(5, 894) = 1.96	0.082	0.011				
Age						−0.00 [−0.00, 0.00]	−0.01	0.00	0.76
BMI						−0.01 [−0.01, −0.00]	−0.09	0.01	0.0085
IRI EC						−0.00 [−0.01, 0.01]	−0.01	0.00	0.84
IRI PT						0.00 [−0.01, 0.01]	0.00	0.00	0.92
IRI PD						−0.00 [−0.01, 0.00]	−0.06	0.00	0.12
Hours*	0.00	0.00	(1, 802) = 1.20	0.27	0.000	0.00 [0.00, 0.00]	0.04	0.00	0.27

Hours* is defined as the number of hours participants spent learning about overweight and obesity during university study. *N* for Age, BMI (Body Mass Index), IRI EC (Interpersonal Reactivity Index Empathic Concern), IRI PT (Interpersonal Reactivity Index Perspective Taking) and IRI PD (Interpersonal Reactivity Index Personal Distress) is 900. *N* for Hours* is 804.

Table 2: **Multiple regression results for each outcome measure.**

confidence in clinical interactions. When supporting patients living with obesity, professionals need to use appropriate language, such as patient-centred terms,[69] which requires training. Students may lack confidence when communicating with patients, evidenced by the need expressed by nursing students for advanced communication skills training.[70] Interestingly, fear of fat and implicit weight bias was not associated with empathic concern in this sample of health care students, suggesting that despite other-oriented feelings of sympathy, unconscious negative attitudes towards overweight and obesity may persist, and students may also fear gaining weight. Burke et al. also found that more empathy was not associated with implicit bias.[67] These findings may indicate that implicit biases may remain ingrained within individuals and that effort must be exerted to understand why implicit biases remain despite attempts to ameliorate them.[71]

Greater (vs. less) perspective taking (the ability to adopt the view of others)[51] was associated with less dislike for people living with overweight or obesity. Evidence within racial bias research has shown that perspective taking decreases treatment discrepancies and increases patient satisfaction.[72,73] Students who are able to adopt the viewpoint of a person living with overweight or obesity may be able to recognise the complexity of excess weight, and therefore exhibit less dislike. Furthermore, greater personal distress (self-oriented feelings of unease in view of another's discomfort)[51] was associated with more fear of fat and less empathy for patients living with obesity, and less confidence in clinical interactions. In university, health care students are more likely to learn about overweight and obesity as risk factors for other conditions, and the importance of diet and exercise in losing weight.[38,74] Therefore, increased feelings of unease associated with the aforementioned aspects of excess weight may explain students' fear of fat and lower empathy and confidence. These findings suggest that different aspects of empathy (e.g., empathic concern, perspective taking, and personal distress) were associated with different aspects of explicit weight bias. Similarly, an aspect of empathy (e.g., affective perspective taking) unexplored in the current study may be associated with students' implicit weight bias, particularly as some studies[75] have been able to improve implicit attitudes among teaching students within the field of racial bias (assessed with the IAT for implicit racial attitudes).

Older (vs. younger) age was associated with more confidence in clinical interactions with patients living with obesity. Phelan et al. found that younger age was associated with more dislike, fear of fat, and the belief that people living with overweight or obesity lacked willpower.[32] Despite confidence in clinical interactions with patients being unexplored by Phelan et al., the authors demonstrated that older age was associated with less explicit bias.[32] Therefore, the association between older age and greater confidence observed in this study may be a result of students regarding themselves as more confident to communicate due to a perceived increase in percipience as they age. Similarly, postgraduate students (vs. undergraduate) held a greater belief that weight was not within one's control. However, year at university or the amount of time spent learning about overweight and obesity were not associated with weight controllability beliefs, indicating that more training was not associated with more positive beliefs. Explanatory reasons for these contradictory findings are unclear; however, it may be that older students hold a greater belief that obesity is not within an individual's control, and postgraduate students are almost always older than undergraduate students. Differing experiences at each stage of life may alter students' perceptions about the world, including attitudes towards and beliefs about overweight and obesity. Future studies could adopt longitudinal designs to explore health care students' weight bias during their training years, practice years, and post-work years.

Students who identified as Caucasian (vs. Asian) reported higher levels of empathy for patients living with obesity. Smith and colleagues found that physicians who identified as being Asian (vs. Caucasian) were less likely to prescribe surgical treatments for excess weight.[76] Furthermore, within countries located in Asia such as China, a low acceptance of non-lifestyle interventions (e.g., surgery and medication) to treat obesity has been reported among health care professionals and the general population.[77] It may be that students who identified as being Asian exhibited less empathy as a result of the belief that patient-led lifestyle changes are able to address patient concerns. However, more research is needed to examine students' treatment recommendations for concerns patients' related and unrelated to excess weight to support this conclusion. Previous research has found that exercise science[66] and marriage and family therapy[37] students who identified as being Caucasian (vs. Non-Caucasian) exhibited stronger implicit weight bias and beliefs that people living with overweight or obesity were able to control their weight, respectively, whereas such differences were not found in this study. Our findings, together with those of others[37,66] suggest that students' ethnicity and their likely associated upbringing, cultural values and beliefs, were associated with their weight bias.

Higher (vs. lower) BMIs were associated with more fear of fat, but less implicit bias in this sample of health care students. Previous studies have found similar results, with Pratt et al. reporting the association between higher BMIs and more fear of fat among marriage and family therapy students, and Phelan et al. reporting the association between higher BMIs and less implicit bias.[32,37] Students living with excess weight may be concerned about gaining even more weight, possibly due to internalising weight stigma, with an

understanding of the negative impact weight bias has on individuals' well-being. Interestingly, Phelan and colleagues found that perceived weight stigma among medical students living with overweight or obesity was associated with anxiety and depression, demonstrating that although health care students living with overweight or obesity are training to provide care for others, they may also be subjected to weight stigma.[42] Future research is needed to examine whether levels of weight bias internalisation among students living with higher BMIs moderates the relationship between exhibited weight bias and patient care.

Comparatively, perceived weight status (an individual's assumption of their own weight status)[78] was also associated with fear of fat, and implicit weight bias. Students who perceived themselves as living with a healthy weight (vs. underweight), overweight (vs. underweight and healthy weight) or obesity (vs. underweight and healthy weight) exhibited more fear of fat. And students who perceived themselves as living with obesity (vs. healthy weight) exhibited less implicit bias. Pratt et al. found that marriage and family therapy students who identified as living with overweight or obesity exhibited more fear of fat.[37] Students' knowledge that increased weight is a risk factor for other diseases[74] together with possible self-oriented concerns about weight gain in the future, and lived experiences associated with the demeaning nature of weight stigma, may explain this finding. Pratt and colleagues also found that students who did not identify as living with overweight held a greater belief that obesity was not within an individual's control, whereas the current study did not find this association.[37] It appears that objective, as well as subjective weight status, play a role in students applying the exhibited bias to themselves (fear of gaining weight) and to others (implicit weight bias).

Less time (vs. more time) spent with people living with overweight or obesity outside of study settings was associated with more dislike for people living with overweight or obesity. Among a sample of psychology students, Koball and Carels demonstrated that direct contact (vs. indirect) with people living with overweight or obesity led to a decrease in dislike for and increased intention to interact with people living with obesity.[79] Spending more time interacting with people living with overweight or obesity in casual environments may have enabled students to look past an individual's excess weight and value their personal qualities. Although the frequency of time spent with the target group was not associated with implicit bias among the current sample, Puhl et al.[18] suggests that exposure to people living with overweight or obesity that portray counter stereotypical traits may reduce implicit weight bias. However, students in the current study that spent time with people living with overweight or obesity on a regular (vs. sporadic) basis exhibited more fear of fat. Alperin et al. states that people living with a healthy weight having any contact with people living with overweight or obesity may induce a negative reaction, possibly as a result of 'seeing' whom they may become.[80] With an average BMI of 24.20 kg/m^2 (considered a healthy weight), perhaps students in the current study were witnesses to the possible complexities (e.g., comorbidities, mobility) associated with excess weight, which may have led to greater fear of fat. Although unexplored in the current study, Alperin et al. also demonstrated that the valence of interactions with people living with overweight or obesity was associated with fear of fat.[80] Alperin et al.[80] found that negative contact was associated with greater fear of fat, while positive contact was associated with more fear of fat among participants living with lower BMIs. Time spent with people living with overweight or obesity during university study was not associated with any outcome measures; however, Phelan et al.[42] found that positive interactions with patients living with obesity during medical school contributed to a decrease in both explicit and implicit weight bias. In addition to the amount of time spent with people living with overweight or obesity, it is imperative that future studies reflect as to whether their contact was positive or negative, which could assist in the development of weight bias reduction interventions (e.g., by exposing students to favourable interactions with people living with overweight or obesity).

Witnessing behaviours of weight stigma by role models sporadically or never (vs. daily) was associated with greater attribution of the causes of obesity to willpower. Phelan et al. in their longitudinal examination of weight bias among medical students found that students' explicit and implicit bias increased the more they witnessed faculty staff discriminating or making negative comments about patients living with overweight or obesity.[42] Although this factor did not affect students' implicit bias in the current sample, students' higher rating of willpower may have been a result of their inability to understand the demeaning nature of weight stigma. Similarly, witnessing weight stigma by peers sporadically (vs. daily) was associated with more implicit bias. Puhl and colleagues found that 63% of their sample of postgraduate health care students have witnessed peers making jokes about patients living with obesity.[39] While Puhl et al.[39] did not assess implicit bias, they suggested that weight bias may be socially acceptable in training settings, which is rarely challenged. Therefore, students who witness stigma by peers sporadically may be unable to comprehend its negative impact. While we found that witnessing stigma by role models or peers infrequently leads to more explicit and implicit bias, it is not recommended to expose students to witnessing stigma regularly. Instead, educators must be made aware of how training culture impacts students' formation of socially acceptable behaviours, and students must be informed of the derogatory nature of weight bias, and how to recognise its occurrence.

Among the 22 disciplines examined in this study, dietetic, exercise science and nursing students (vs. psychology, speech pathology, pharmacology and social work students) demonstrated more confidence in interacting with patients living with obesity. Diet and exercise have been promoted as the primary treatments for obesity,[81] with many health care professionals being reluctant to prescribe other treatments such as pharmacotherapy.[82] Dietetic and exercise science students may have perceived themselves as confident in communicating weight loss strategies based on diet and exercise as they are most likely to become the first point of contact for patients living with overweight or obesity. Similarly, nursing students may have perceived themselves as confident as they are likely to spend more time interacting with patients to gain a comprehensive understanding of patient needs, including obtaining dietary and physical activity information. Notably, the lack of differences between disciplines on most measures of weight bias indicates that irrespective of study area, similar levels of explicit and implicit bias were present across this sample of health care students. Robinson and colleagues also found similar results, with the levels of explicit and implicit bias being similar across 11 health care disciplines.[38] Medical, nursing, dietetics and exercise science students will likely have the most direct contact with people living with overweight or obesity in practice; however, psychology, physiotherapy, social work, and optometry students will likely be a part of an interdisciplinary team also responsible for caring for these individuals. Similarly, public health students may direct policy changes that may affect people living with overweight or obesity. Therefore, it is essential that educators and researchers attempt to address and reduce weight bias among students across all health care disciplines.

No differences were found between individual universities in this study, indicating that similar levels of explicit and implicit weight bias were present among students across the 39 universities. Additionally, more time spent learning about overweight and obesity at university was associated with more confidence in clinical interactions with patients living with obesity. The proportion of contact that students will have with patients living with overweight or obesity will vary considerably, and most students are more likely to learn about excess weight being a risk for other diseases.[38,74] Therefore, it may be that as students learn more about excess adiposity as a risk factor for other conditions, they become more confident in communicating to patients about weight loss. Most existing weight bias reduction interventions include components aimed to highlight the multifactorial causes of excess weight in an attempt to broaden students' knowledge about overweight and obesity, and the requirement of diverse approaches to address the disease.[12,83] Despite the amount of time spent learning about overweight and obesity having no association with other aspects of weight bias, and the partial success of most weight bias reduction interventions, increased education on the complex causes of and varied treatment approaches to obesity will remain as essential to address weight bias among health care students.

When exploring potential geographical differences, university students in Victoria (vs. Queensland) held a greater belief that weight was not within an individual's control and university students in Queensland (vs. Western Australia) exhibited more implicit weight bias. Explanatory reasons for the differences in weight bias between geographical areas remain unclear, particularly as curriculums incorporating overweight and obesity likely vary by university, rather than geographical location. An associated factor unexplored in this study may explain the differences observed. Interestingly, Alvarenga and colleagues found that Brazilian undergraduate nutrition students who attended universities outside of the Brazilian capital or a private university exhibited more anti-fat attitudes (using a different measure) including the belief that people living with obesity were able to control their weight.[84] Our findings together with that of Alvarenga et al. may indicate that geographical differences in the display of weight bias exists, and more research is needed to explore why such differences occur.[84] Future studies may investigate potential differences between urban, rural, and remote regions within states and territories, rather than between them.

This study has several strengths. The inclusion of a large sample of health care students ($N = 900$), across 22 disciplines, and from 39 universities across Australia has enabled us to establish that explicit and implicit weight bias exists within Australian health care students. The current study is the first to extensively explore how demographic factors and empathy may be associated with weight bias among health care students. Additionally, this study utilised measures that assessed beliefs about and attitudes towards people living with overweight or obesity, as well as students' anticipated interactions with patients living with obesity, enabling us to gain an overall understanding of how students may interact and treat people living with overweight or obesity in future practice.

There are limitations of the current study. Data were collected at the beginning of the Australian academic year in 2022, therefore, the first-year students in this study may be inexperienced in their interaction with people living with overweight or obesity as part of their studies, amount of time spent learning about the subject, and in witnessing weight stigma by role models or peers, limiting the accuracy of findings. In addition, the low Cronbach's alpha value for the Empathy for Obese Patients scale indicates that the respective findings are to be interpreted with caution. Item-total statistics of the conducted reliability analysis revealed that if the item 'Very few obese are ashamed of their weight' was

removed, Cronbach's alpha would increase to 0.80, suggesting the need to investigate the psychometric properties of the Empathy for Obese Patients scale extensively in future studies. Furthermore, the self-report nature of this study may have permitted social desirability to influence student responses, given the sensitive nature of weight bias related to overweight and obesity.

Findings from the current study highlight important avenues for future research. Further research is needed to establish whether students' exhibited weight bias is present in a clinical practice environment (or in interactions with patients). Although some health care students may have reduced practical contact with people living overweight or obesity (e.g., public health and health promotion) compared to others (e.g., medicine), exposure to interactions with the target group is essential to establish the implication of students' weight bias in practice. The continued rise in the prevalence of overweight and obesity also highlights the need to develop novel interventions to ameliorate weight bias in health care settings and our society more broadly.[85] Existing weight bias reduction interventions aimed at health care students have sought to challenge and reduce beliefs that obesity is within a person's control, evoke empathy, raise awareness, promote weight acceptance and improve communication skills; however, the majority of interventions have only succeeded partially and have been unable to sustain long-term reductions in weight bias.[9,48,71,86–88] Current findings indicate that gender and empathy are significant factors that were associated with weight bias. While weight bias reduction interventions targeting individual genders are impractical, novel, multifaceted interventions to evoke distinct aspects of empathy may produce desirable outcomes, as research has demonstrated the association of low empathic concern with a greater level of generalised prejudice.[89] Findings from this study may aid researchers and educators in addressing weight bias exhibited by students, particularly in Australia. As the number of Australians living with overweight or obesity are projected to rise, it becomes increasingly obligatory to educate health care trainees as well as practising professionals[85] on the negative impact of weight bias in an effort to enhance the Australian health care system. Additionally, as current health care students are the next generation of health care professionals and are susceptible to many influences that shape beliefs and attitudes, the focus must be shifted from blame, to supporting students to develop skills and abilities that will enable people living with overweight or obesity to be treated with equity and dignity in health care settings.

Contributors

This study was planned by R.S.J. and B.J.L. R.S.J. developed the IAT using iatgen and survey using Qualtrics. Data collection was conducted by R.S.J., with contributions from B.J.L. R.S.J. conducted initial data cleaning and final statistical analyses. B.J.L. verified the underlying data. The manuscript was prepared by R.S.J., with contributions and revisions from B.J.L. M.O., S.W.F. and E.H. reviewed and edited the final version. All tasks completed by R.S.J. were supervised by B.J.L.

Data sharing statement

De-identified participant data will be made available upon request to author RSJ for non-commercial purposes to individuals associated with academic or public research and health institutions.

Declaration of interests

S.W.F. reports research grants and support for attending meetings from UK National Institute for Health Research, Public Health England, UK Office of Health Improvement & Disparities, UK Doncaster Council, West Yorkshire Combined Authority, Novo Nordisk, Johnson & Johnson, University of Leeds UK, the UK Royal College of General Practitioners, UK Parliament, and UK Safefood, as well as an unpaid leadership role at Obesity UK. E.H. reports receiving royalty fees for a book published on the topic of weight stigma. All declared interests relate outside the submitted manuscript. R.S.J., M.O., and B.J.L. declare no competing interests.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.eclinm.2023.101894.

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