Change in weight-based bias over a decade: A longitudinal nationally representative survey

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Summary

Background Globally, the prevalence of obesity has almost tripled in the last 45 years, and almost 2 billion adults are considered overweight or obese. Such individuals have been shown to experience bias and stigma in their everyday life. While some prior research suggests that there has been an increase in weight-based bias over time, there have also been active efforts to counteract weight-based bias over the past decade. The current study uses cohort-sequential growth curve modelling on a nationally representative survey to examine change in weight-based bias over the last decade. The study also investigates whether changes in weight-based bias reflect developmental changes that occur with age, or whether there are cohort-based differences in such bias. The current study also examines whether there are gender differences in weight-based bias over the past decade.

Methods We used data from the New Zealand Attitudes and Values Survey (NZAVS). The NZAVS is an ongoing study that has been conducting an annual longitudinal panel survey of adult New Zealanders since 2009. There were 61,051 participants who responded to at least 1 out of the 11 waves available from the NZAVS. We used a feeling thermometer measure to assess attitudes toward people who are overweight over eleven years.

Findings We found that weight-based bias has remained relatively stable over the last decade. Small cohort-based differences occurred for women within four younger birth cohorts (those born 1990–1986; 1980–1976; 1975–1971; and 1970–1966) revealing a small increase in warmth towards people who are overweight. Both men and women showed a slight gradual increase in warmth toward people who are overweight, which peaked in middle age.

Interpretation Weight-based bias appears relatively stable over the past decade. These small changes do not appear to reflect developmental changes as a function of ageing. However, small decreases in weight-based bias among younger birth cohorts of women may reflect shifting societal norms about the acceptability of weight-based bias, although future work is needed to better understand this.

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Keywords: Obesity; Weight-based prejudice; Obesity stigma; Obesity bias; Weight bias; Gender differences; Birth-cohort differences; Age differences

Introduction

The number of individuals who are overweight and obese has been steadily rising. According to the World Health Organisation, in 2016, 39% of adults were overweight and 13% were obese. Individuals who are overweight and obese experience stigma and bias in their everyday life, with psychological, social, and physical consequences for those targeted by such prejudice.[1] For example, weight-based bias leads to negative mood, anxiety, and low self-esteem,[2] as well as limited social support and social isolation.[3] Weight-based bias has also been shown to impact employment opportunities, with individuals who are overweight or obese being less likely to be hired or promoted.[4] In health settings, health professionals have been shown to inadvertently stigmatize their patients who are overweight or obese by withholding appropriate medical advice or treatment.[5] Experiencing weight-based bias has been shown to increase maladaptive eating behaviours and decrease motivation to exercise, suggesting that not only is weight-based

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Panel: Research in context

Evidence before this study

Previous research found that weight-based bias had increased by 66% over a ten year period ending in 2006. However, such work used independent samples a decade apart and examined subjective perceptions of weight-based bias. We searched for scholarly articles and reviews published between Jan 1, 1975 and May 1, 2021, using the search terms "weight" OR "obesity" AND "stigma" OR "prejudice" OR "discrimination" OR "bias" AND "time" OR "generational" OR "changes" to determine whether there had been any longitudinal studies to determine an increase in weight-based bias over time.

Added value of this study

Using longitudinal data from a nationally representative sample of adults, we were able to determine whether weight-based bias had increased the last decade by examining changes over time. Additionally, using cohort-sequential growth curve modelling, we were able to test if such changes reflect developmental changes expected from ageing or if these are unique to specific birth cohorts. And finally, we were able to examine if the above changes are especially evident among men or women. Our data revealed minimal changes in weight-based bias toward individuals who have overweight in the past decade.

Implications of all the available evidence

This work provides rare insight into changes in weight-based bias at a population level by considering cohort-based changes alongside gender differences across a decade. The current findings reveal minimal change in weight-based bias over the last decade among both men and women.

bias harmful to the individual, it also does not promote weight loss or engagement in healthy behaviours.[6] Across multiple disciplines including medicine, psychology, and sociology, weight bias has been shown to be pervasive, and is often referred to as the last socially acceptable form of prejudice.[7]

Although many studies demonstrate the pervasiveness of weight-based bias, it is important to determine whether such bias has been increasing, decreasing, or has remained stable over time. One hypothesis is that weight-based bias should have decreased over the last decade as attempts have been made by weight-based bias researchers to design measures and interventions to decrease weight-based bias[8] both in wider society as well as specific professions such as medicine.[9] For example, there has been a surge in weight stigma education, and movements related to weight stigma and bias such as the Body Positivity movement, the Health at Every Size (HAES) movement, and the Fat Acceptance movement which have become particularly prevalent on social media.[10] These movements may be particularly visible to younger generations, with research showing 89% of young adults utilise social media.[11] Therefore, it may be that there has been a decrease in weight based bias, especially among younger generations. These worldwide efforts to create awareness and tackle obesity bias may have contributed to a decrease in weight-based bias over the past decade.

By contrast, a conflicting hypothesis is that weight-based bias has actually been increasing over time. While there have been attempts to reduce weight-based bias in certain settings, there have been few policy actions to address weight-based bias.[12] Importantly, a recent study which looked at explicit and implicit attitudes towards body weight over a 13 year period between 2007 and 2016 (among other social-group attitudes) showed that attitudes towards individuals who are overweight or obese have worsened over time.[14] However, this study relied on convenience samples of respondents completing an online measure of implicit and explicit attitudes toward body weight and did not examine population level change. A widely cited paper from more than a decade ago argued that the prevalence of weight/height discrimination in US adults went up from 7·3% in 1995–1996 to 12·2% in 2004–2006, implying a significant increase of 66%.[13] However, this work did not examine population level changes in weight-based bias and instead examined population level changes in self-perceived discriminatory experiences (i.e., self-reported occurrences of perceived discrimination) at two time points a decade apart to assess weight-based bias. While such work is valuable, this differs from examining changes in the prejudicial attitudes of the general population *toward* people who are overweight, as this provides a more direct index of the prevalence of weight-based bias within the general population.

Given limited evidence of whether there has been a change in weight-based bias over time, the current study uses a longitudinal nationally representative survey to examine change in weight-based bias over the past decade. In addition to examining change in weight-based bias over the last decade, the current work also examines whether any changes in weight-based bias are especially evident among certain birth cohorts over others. Using cohort-sequential growth curve modelling, the current study is able to test whether any changes in weight-based bias over the past decade reflect developmental changes in what one would expect with ageing as opposed to changes observed in specific birth cohorts. Using this kind of approach allows us to test whether any changes in bias towards people who are overweight are part of normal developmental change that people show over time, as opposed to changes that are a function of being in a specific age cohort. Therefore, this tool of analysis is particularly suited to answer the question of age and generational shifts at a cohort level.

Another goal of the present work is to examine whether there are gender differences in changes to weight-based bias over the past decade. Gender differences are important to explore because previous research shows that males have more negative attitudes towards individuals who are overweight than females.[15–18] Moreover, rates of obesity tend to be higher among women than men.[19,20] While much research on gender in weight-based bias reveals that women who are overweight perceive worse discrimination than men,[21] here we examine whether men and women differ in the extent to which they *express* weight-based bias toward individuals who are overweight.

To summarize, the current work examines 3 major questions:

(1) Has weight-based bias changed over the past decade?
(2) Do changes in weight-based bias reflect developmental changes that occur with age, or are there cohort-based differences in such prejudice?
(3) Are there gender differences in these changes to weight-based bias over the past decade?

We examine these questions using 11 years of longitudinal data from a nationally representative sample of New Zealanders. New Zealand is a suitable country to examine these questions as like many other western nations, the adult obesity rate has dramatically increased over the past few decades (rates have more than tripled since the 1970s).[22] The latest data available from the Ministry of Health in New Zealand shows that for the 2020/2021 period, 34.3% of New Zealand adults are classified as 'obese' compared to only 25% in 2008, just prior to first wave of data collected for this study. Therefore, during the duration of this study, the rate of obesity in New Zealand has increased over 40%. New Zealand even has the third highest adult obesity rate in the Organisation for Economic Co-operation and Development (OECD), only behind the USA and Mexico. Therefore, it serves as a suitable context to examine changes in weight-based bias over time.

Birth cohorts	Age at Time 1 (~2009)	Age at Time 11 (~2019)	Warmth Toward Overweight People	
			Women	Men
1990-1986	19	29	3137	1493
1985-1981	24	34	3200	1547
1980-1976	29	39	3626	1830
1975-1971	34	44	4230	2209
1970-1966	39	49	5927	3374
1965-1961	44	54	5718	3469
1960-1956	49	59	5928	4016
1955-1951	54	64	4139	3125
1950-1946	59	69	1291	943
1945-1941	64	74	679	562
1940-1936	69	79	313	295
n			38188	22863
N			61051	

***Table 1*: Age and sample sizes by birth cohort and gender for warmth toward overweight people.**
Note. Youngest age in birth cohort taken as indication of participants' age at Time 1.

Methods

Sampling procedure and sample

Participants The models presented here were based on 61,051 participants who responded to at least 1 out of the 11 waves available from the New Zealand Attitudes and Values Survey (NZAVS). The NZAVS is an ongoing study that has been conducting an annual longitudinal panel survey of adult New Zealanders since 2009. Each wave of data was collected from the middle of one year to early in the following year. The data included here was therefore collected starting in 2009-2010 (Time 1) all the way until 2019-2020 (Time 11). The average age of the sample in 2009 (Wave 1) was 42.52 years (*SD* = 12.22). Refer to Sibley (2021) for full details regarding NZAVS sampling and methodology.[23] For the purposes of the present analyses (in estimating the multi-group cohort-sequential latent growth models), participants were grouped into 5-year cohorts based on the year of their birth. These birth cohorts and their respective sample sizes are presented in Table 1. Additionally, throughout the current study, "Wave" refers to which of the 11 years the data was collected (e.g., Wave 1 through to Wave 11), and "birth cohort" refers to the cohort that participants were grouped into, based on the 5-year time period that their year of birth occurs within.

The majority of participants (79.6%) identified as NZ European (the majority ethnic group) with 12.7% identifying as Māori, 5.0% Asian, and 2.7% Pacific. A majority were female (60%), and socioeconomic status was assessed using the NZ Deprivation index (M = 5.17, SD = 2.83), a decile based measure of deprivation in neighborhood units across the country, with 1 representing the most affluent neighborhoods and 10 representing the most deprived (for details, see[24–26]). The analyses highlight the relatively low levels of attrition with over 38.4% of participants retained from the first wave (2009) and approximately 80% wave to wave retention, with the exception of Time 9 and Time 11 which had retention rates from the previous year of ~72%.

Measures We used the well-established feeling thermometer as our measure of weight-based bias.[27–29] On a 7-point scale ranging from 1 (least warm) to 7 (most

warm), participants indicated their feelings toward "Overweight people." This exact item was repeated across all waves of data collection with reasonably high correlations across time points (*rs* = 0.53-0.64). The feeling thermometer measure is widely regarded as a gold standard for assessing prejudicial attitudes toward a range of social groups having become popularized by the American National Election Survey over 50 years ago.[27–30] The measure is widely utilized because it has high face validity and provides a versatile tool for scientists to assess attitudes or feelings toward a broad range of target groups thereby allowing for comparisons between people's attitudes toward a range of variety of groups unlike other attitudinal measures that are designed only to assess toward a specific target group.[27–29] The measure has also been shown to work effectively in New Zealand.[30]

Analysis

We estimated a multigroup model based on 11 sequential birth cohorts so that we could arrange their estimates across the adult lifespan (ages 19–79) by gender (for sample sizes, see Table 1). All analyses were conducted using Mplus version 8.4 with full information maximum likelihood (FIML) to handle missing data.[31] We use FIML to handle missing data and include all available data because it allows us to utilise all available information and weights it accordingly reducing the risk of Type I error. This approach is more efficient than arbitrarily selecting an inclusion criterion that only uses data from participants who complete a specific number of waves in the data collection. This reduces the risk of systematically excluding some participants. For example, older participants may not have had the opportunity to complete later waves of data collection due to health issues or even death. Similarly, younger participants who only recently began in the study would not have had the chance to respond to earlier waves due to their age, so this provides us with the means to include all available data.

In order to elucidate whether attitudes toward people who are overweight reflected ageing processes or historical influences (either through shared environment or specific birth cohorts), we estimated three increasingly less restrictive multigroup cohort-sequential latent growth models, which we describe in more detail below.

Ageing Model. The ageing model allowed for the possibility that attitudes toward people who are overweight differed based on normative change across the lifespan. The sample was sorted into 11 sequential birth cohorts based on year of birth. This spanned the years 1990 back to 1936, or ages 19 to 79. The youngest possible age within a birth cohort was used as an indicator of participants' age in 2009 (Time 1). Therefore, the 1990-1986 birth cohort reflected change from ages 19 to 29 (i.e., 11 years). The ageing model constrained the intercepts and slopes to equality between all 11 birth cohorts. We also accounted for curvilinear rates of change over time and so included both linear and quadratic components in our estimations. The variances and covariances of the intercepts and slopes were constrained to equality across birth cohorts. We then conditioned these estimates by age in years so that we could plot these values across a continuum from ages 19 to 79. Finally, we also investigated the possibility that there would be differences across birth cohorts based on gender. To do so, we estimated separate intercepts and slopes for each birth cohort by gender, but constrained their variances to equality.

Period Model We estimated an intermediate model, the period model, between the ageing model (described above) and the cohort model (described next) which accounted for the possibility that birth cohorts differed in their initial levels of warmth toward people who are overweight, but were changing at identical rates over time. This model thus allowed the intercepts for each cohort to vary, but constrained the slopes to equality (as in the ageing model).

Birth Cohort Model The cohort model examined differences in the initial levels and rates of change across birth cohorts, in which the historical period a person was born may uniquely affect their warmth toward people who are overweight. This model allowed both the intercepts and slopes to vary between birth cohorts.

Role of the funding source

The funder had no involvement with the study design, data collection, data analysis, interpretation, or the writing of the manuscript.

Results

Ageing Model. The results in Table 2 show that women and men had comparable changes in their attitudes toward people who are overweight, with women (s = 0·03, SE = 0·01, p < ·001, 95% CI [0·02, 0.04], q = -0·02, SE = 0·00, p < ·001, 95% CI [-0·02, -0·01]) and men (s = 0·02, SE = 0·01, p = ·01, 95% CI [0·00, 0·03], q = -0·02, SE = 0·00, p < ·001, 95% CI [-0·03, -0·01]) both reporting small, significant positive linear increases in warmth over time with a downward curve. We then plotted these estimates by age as shown in Figures 1 (women) and 2 (men) by the black lines revealed warmth toward people who are overweight slightly increased until about age 49 and then began to decline thereafter, although this pattern appeared more subtle among women.

Period Model. Table 5 shows the parameter estimates for this model. Older birth cohorts generally exhibited lower initial levels of warmth toward people who are overweight than younger birth cohorts, irrespective of gender. However, while women showed a positive linear increase over time with a downward curve (s = 0·10,

	Estimate	SE	Est./S.E	p	95% CI Lower	95% CI Upper	Variances
	Warmth Toward Overweight People						
Women							
Intercept (*i*)	4.43	0.01	566.54	< .001	4.41	4.44	1.07*
Linear Slope (*s*)	0.03	0.01	5.43	< .001	0.02	0.04	0.04*
Quadratic Slope (*q*)	-0.02	0.00	-5.10	< .001	-0.02	-0.01	0.00
Men							
Intercept (*i*)	4.02	0.01	394.65	< .001	4.00	4.04	1.07*
Linear Slope (*s*)	0.02	0.01	2.51	.01	0.00	0.03	0.04*
Quadratic Slope (*q*)	-0.02	0.00	-5.21	< .001	-0.03	-0.01	0.00

***Table 2*: Parameter estimates for the ageing model for warmth toward overweight people.**

SE = 0·01, *p* < ·001, 95% CI [0·07, 0·13], *q* = -0·01, *SE* = 0·00, *p* = ·02, 95% CI [-0·02, -0·00], men only showed a positive linear increase (*s* = 0·05, *SE* = 0·02, *p* = ·01, 95% CI [0·01, 0·08], *q* = -0·00, *SE* = 0·01, *p* = ·90, 95% CI [-0·01, 0·01].

Birth Cohort Model. Table 6 shows the parameter estimates for the birth cohort model. The estimates, separated by age in years, are denoted by the grey lines in each panel in Figures 1 (women) and 2 (men). Five of the 11 birth cohorts for women showed small but significant rates of change in warmth toward people who are overweight over the 11 years. Four of these were the younger birth cohorts and 1 was the oldest birth cohort. Specifically, the 1990-1986 (*q* = -0·33, *SE* = 0·16, *p* = ·05, 95% CI [-0·65, -0·00]), 1980-1976 (*q* = -0·32, *SE* = 0·14, *p* = ·03, 95% CI [-0·60, -0·04]), and 1975-1971 birth cohorts (*s* = -0·31, *SE* = 0·14, *p* = ·02, 95% CI [-0·57, -0·04]; *q* = -0·36, *SE* = 0·13, *p* = ·01, 95% CI [-0·60, -0·11]) showed curvilinear decreases over time. The 1970-1966 birth cohort showed a significant positive linear increase over time but with a downward curve (*s* = 0·09, *SE* = 0·03, *p* = ·007, 95% CI [0·02, 0·15]; *q* = -0·28, *SE* = 0·10, *p* = ·008, 95% CI [-0·48, -0·07]). Finally, the oldest birth cohort in our sample (1940-1936) exhibited a linear decrease over time with an upward curvature (*s* = -9·56, *SE* = 1·57, *p* < ·001, 95% CI [-12·64, -6·47]; *q* = 1·61, *SE* = 0·27, *p* < ·001, 95% CI [1·08, 2·14]).

Similarly to women, only 4 out of the 11 birth cohorts for men showed small but significant rates of change in warmth toward people who are overweight over the 11 annual waves. However, in contrast, the majority of these were clustered around the *older* birth cohorts, rather than younger birth cohorts. Specifically, the 1985-1981 birth cohort showed significant linear declines with a downward curve (*s* = -1·56, *SE* = 0·78, *p* = ·05, 95% CI [-3·09, -0·04]; *q* = -0·54, *SE* = 0·26, *p* = ·04, 95% CI [-1·05, -0·04]). The oldest three birth cohorts, 1950-1946 (*s* = -1·60, *SE* = 0·66, *p* = ·02, 95% CI [-2·90, -0·31]; *q* = 0·45, *SE* = 0·17, *p* = ·01, 95% CI [0·11, 0·78]), 1945-1941 (*s* = -3·26, *SE* = 1·05, *p* = ·002, 95% CI [-5·31, -1·21]; *q* = 0·67, *SE* = 0·22, *p* = ·002, 95% CI [0·25, 1·09]), and 1940-1936 (*s* = -7·59, *SE* = 1·60, *p* < ·001, 95% CI [-10·72, -4·46]; *q* = 1·27, *SE* = 0·27, *p* < ·001, 95% CI [0·73, 1·81]) exhibited significant linear declines over time with an upward curve.

Comparison of models

We compared the relative fit and parsimony between all three models using widely used model fit indices and their standard benchmarks. These include the Comparative Fit Index (CFI ≥ ·95),[32] the Root Mean Square Error of Approximation (RMSEA ≤ ·06),[33] the Standardized Root Mean Square Residual (SRMR ≤ ·08).[32] We also report the chi-square test statistic (χ^2) as conventional in the literature but its sensitivity to large sample sizes means this is not an appropriate test of model fit for our analyses (see[34]). As shown in Table 3, the ageing, period, and birth cohort models all fit these data well, with only trivial deviations between each model in terms of the relative fit indices. This suggests a combination of these processes may be involved in the development of weight-based bias over time.

To examine where birth cohort effects were occurring, we graphically constructed the estimates for the aging model and the cohort model conditioned by age which allowed us to pool the estimates for each birth cohort as shown in Figures 1 (women) and 2 (men). Crucially, we were able to visually inspect whether the estimates for each birth cohort overlapped (reflecting normative change) or not (reflecting cohort differences). Figures 1 and 2 show that the cohorts estimates tended to overlap the ageing estimates amongst younger cohorts, but there were some clearer cohort effects amongst the oldest cohorts (particularly for men).

Discussion

The current study examined an important and foundational question in public health research: has weight-

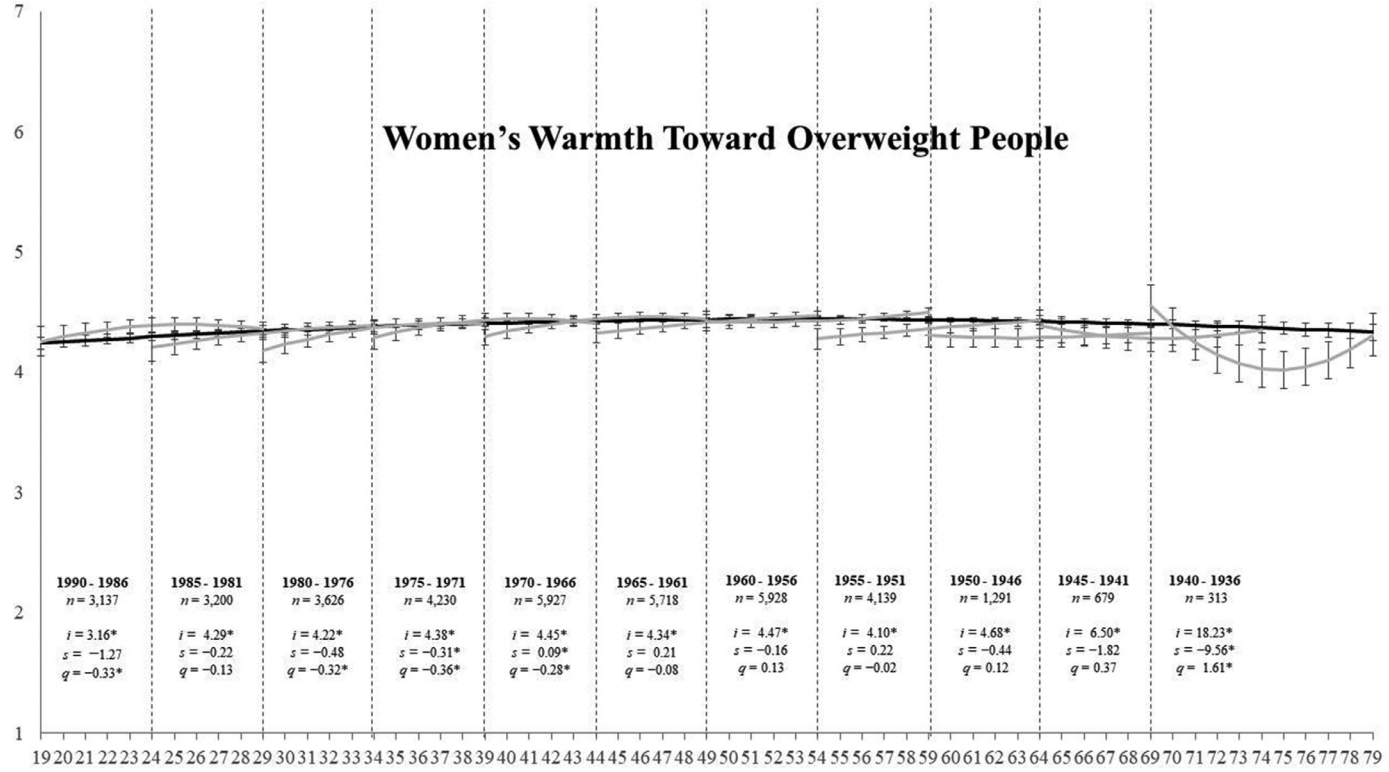

Figure 1. Women's warmth across a decade in five-year birth cohorts.

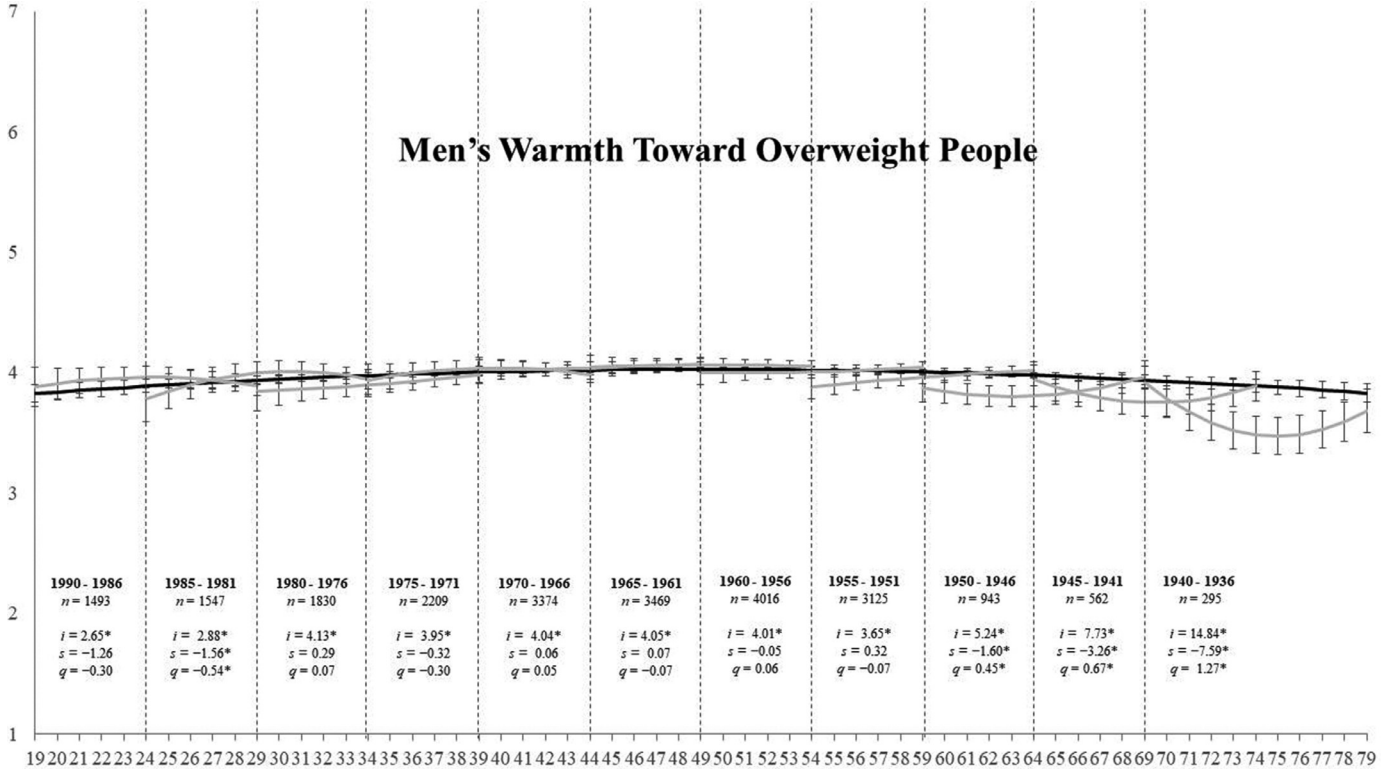

Figure 2. Men's warmth across a decade in five-year birth cohorts.

Model	χ^2	*df*	*p*	CFI	RMSEA	SRMR	AIC	Sample-size adjusted BIC
Ageing	4345.14	1684	< .001	.962	.024	.066	590008.94	590067.36
Period	4228.32	1664	< .001	.963	.024	.066	589932.12	590107.37
Cohort	4067.49	1624	< .001	.965	.023	.065	589851.29	590260.19

***Table 3*: Model fit for ageing, period, and cohort models for warmth toward overweight people.**
Note. χ^2 = chi-square, *df* = degrees of freedom, *p* = *p*-value, CFI = comparative fit index, RMSEA = root mean square error of approximation, SRMR = standardized root mean square residual; AIC = Akaike information criterion, BIC = Bayesian information criterion.
* $p < .001$.

based bias increased or decreased over the past decade? Using longitudinal data from a nationally representative survey, we found that for the New Zealand population weight-based bias has remained relatively stable over the past decade. This contrasts with earlier longitudinal research from more than a decade ago arguing that weight stigma and bias has been on the rise.[13] However, since prior work examined self-perceived experiences of weight stigma and could not examine population level changes in weight-based bias, here we provide unique insight into changes in people's biases toward people who are overweight over the past decade.

The current research also provides unique insight into whether there have been changes in weight-based bias among various birth cohorts, and whether this pattern differs for men and women. While four younger birth cohorts of women in particular showed a slight increase in warmth towards people who are overweight, these findings should be cautiously interpreted given the issue of multiple testing that increases the risk of Type 1 error. With that said, these findings are fairly consistent across multiple younger birth cohorts of women, and may, therefore, reflect very small increases in warmth toward people who are overweight over the last decade.

	Warmth Toward Overweight People					
	Women			Men		
	Age	Cohort	ΔDiff	Age	Cohort	ΔDiff
1990-1986	178	169	9	173	167	6
1985-1981	271	268	3	160	156	4
1980-1976	226	216	10	112	107	5
1975-1971	202	195	7	162	159	3
1970-1966	239	228	11	248	243	5
1965-1961	225	213	12	202	199	3
1960-1956	243	231	12	232	226	6
1955-1951	176	154	22	190	176	14
1950-1946	188	174	14	214	184	30
1945-1941	132	125	7	182	166	16
1940-1936	206	163	43	184	148	36

***Table 4*: Chi-Square contributions for the ageing and cohort models.**

Cohort-based differences occur in just under half of the eleven birth cohorts for women, with four of the younger birth cohorts (those born 1990-1986; 1980-1976; 1975-1971; and 1970-1966) showing a small increase in warmth towards people who are overweight. The oldest birth cohort (those born 1940-1936) showed a decline in warmth that accelerated upward again over time, however, this unusual result should be interpreted with caution as this birth-cohort was especially small (n = 313) compared to the remaining birth cohorts (n = 3137-5927). Nevertheless, if the overall findings, especially among younger birth-cohorts were robust, one explanation for these potentially small changes among women's weight-based bias could be due to shifting social norms around the acceptability of expressing weight-based bias may reduce these individuals' willingness to express negative feelings toward people who are overweight. Additionally, social media messaging around body positivity could be slightly increasing warmth toward people who are overweight, or at least making people more aware of reasons not to express negative attitudes toward such individuals. However, more research is needed to better understand the robustness of these findings and then explore mechanisms underlying it.

Among men, four birth cohorts showed significant change over time. However, only one of the birth cohorts that displayed changes was younger (1985-1981), while the three oldest birth cohorts (1950-1946; 1945-1941; 1940-1936) showed an initial decline in warmth before accelerating upward over time. Again, these three birth cohorts of men had smaller sample sizes (n = 295-943) compared to the remaining birth cohorts, so it is unclear how robust these effects are. More broadly, our results may suggest that both men and women showed a slight gradual increase in warmth toward people who are overweight which peaked in middle age (~49 years), but this began to decline after that which can be seen by the downward curves.

The overarching take home message, however, is that weight-based bias is relatively stable across different birth cohorts and gender over an entire decade. This is despite many efforts made over the past decade to try and reduce stigma and bias. As prejudice reduction and bias reduction techniques have been shown to have

		Warmth Toward Overweight People											
		Women						Men					
						95% CI						95% CI	
Birth Cohort		Estimate	SE	Est./S.E	*p*	LB	UB	Estimate	SE	Est./S.E	*p*	Lower	Upper
1990-1986	Intercepts	4.59	0.04	113.89	< .001	4.51	4.67	4.01	0.06	68.31	< .001	3.90	4.13
1985-1981	Freely	4.51	0.03	144.48	< .001	4.45	4.57	4.03	0.05	89.43	< .001	3.94	4.12
1980-1976	estimated	4.47	0.02	185.72	< .001	4.43	4.52	3.98	0.03	115.98	< .001	3.91	4.05
1975-1971		4.45	0.02	229.51	< .001	4.41	4.49	4.02	0.03	148.56	< .001	3.97	4.08
1970-1966		4.42	0.02	278.28	< .001	4.39	4.46	4.05	0.02	191.75	< .001	4.01	4.09
1965-1961		4.38	0.02	241.52	< .001	4.35	4.42	4.03	0.02	172.10	< .001	3.98	4.07
1960-1956		4.36	0.02	198.92	< .001	4.32	4.41	3.97	0.03	146.15	< .001	3.92	4.03
1955-1951		4.27	0.03	143.13	< .001	4.21	4.32	3.91	0.04	110.09	< .001	3.84	3.98
1950-1946		4.15	0.05	92.69	< .001	4.06	4.24	3.78	0.05	72.72	< .001	3.67	3.88
1945-1941		4.15	0.06	67.92	< .001	4.03	4.27	3.72	0.07	54.63	< .001	3.58	3.85
1940-1936		4.06	0.09	47.21	< .001	3.89	4.23	3.52	0.09	38.60	< .001	3.34	3.70
All cohorts	Linear slope constrained	0.10	0.01	7.60	< .001	0.07	0.13	0.05	0.02	2.61	.01	0.01	0.08
All cohorts	Quadratic slope constrained	-0.01	0.01	-2.33	.02	-0.02	-0.00	-0.00	0.01	-0.13	.90	-0.01	0.01

***Table 5*: Parameter estimates for the period models for warmth toward overweight people by gender.**

		Women								Men							
		Means						Variances		Means						Variances	
						95% CI								95% CI			
Birth cohort		*Estimate*	*SE*	*Est./S.E*	*p*	*Lower*	*Upper*	*Est*	*SE*	*Estimate*	*SE*	*Est./S.E*	*p*	*Lower*	*Upper*	*Est*	*SE*
1990-1986	*i*	3.16	0.66	4.83	< .001	1.88	4.45	1.07*	< .001	2.65	0.94	2.82	.01	0.81	4.50	1.07*	< .001
	s	-1.27	0.66	-1.91	.06	-2.57	0.03	0.04*	0.01	-1.26	0.95	-1.32	.19	-3.12	0.61	0.04*	0.01
	q	-0.33	0.16	-1.98	.05	-0.65	-0.00	0.00	0.00	-0.30	0.24	-1.29	.20	-0.76	0.16	0.00	0.00
1985-1981	*i*	4.29	0.36	12.02	< .001	3.59	4.99	1.07*	< .001	2.88	0.57	5.06	< .001	1.76	3.99	1.07*	< .001
	s	-0.22	0.49	-0.46	.65	-1.18	0.73	0.04*	0.01	-1.56	0.78	-2.01	.05	-3.09	-0.04	0.04*	0.01
	q	-0.13	0.16	-0.78	.44	-0.44	0.19	0.00	0.00	-0.54	0.26	-2.10	.04	-1.05	-0.04	0.00	0.00
1980-1976	*i*	4.22	0.14	30.65	< .001	3.95	4.49	1.07*	< .001	4.13	0.21	20.07	< .001	3.73	4.53	1.07*	< .001
	s	-0.48	0.29	-1.65	.10	-1.05	0.09	0.04*	0.01	0.29	0.44	0.66	.51	-0.57	1.14	0.04*	0.01
	q	-0.32	0.14	-2.23	.03	-0.60	-0.04	0.00	0.00	0.07	0.21	0.32	.75	-0.35	0.49	0.00	0.00
1975-1971	*I*	4.38	0.03	142.73	< .001	4.32	4.44	1.07*	< .001	3.95	0.04	89.71	< .001	3.87	4.04	1.07*	< .001
	s	-0.31	0.14	-2.26	.02	-0.57	-0.04	0.04*	0.01	-0.32	0.20	-1.63	.10	-0.70	0.06	0.04*	0.01
	q	-0.36	0.13	-2.83	.01	-0.60	-0.11	0.00	0.00	-0.30	0.18	-1.66	.10	-0.66	0.06	0.00	0.00
1970-1966	*i*	4.45	0.02	225.72	< .001	4.41	4.49	1.07*	< .001	4.04	0.03	152.88	< .001	3.99	4.09	1.07*	< .001
	s	0.09	0.03	2.69	.01	0.02	0.15	0.04*	0.01	0.06	0.05	1.42	.16	-0.02	0.15	0.04*	0.01
	q	-0.28	0.10	-2.67	.01	-0.48	-0.07	0.00	0.00	0.05	0.14	0.36	.72	-0.22	0.32	0.00	0.00
1965-1961	*i*	4.34	0.03	135.46	< .001	4.28	4.41	1.07*	< .001	4.05	0.04	102.79	< .001	3.97	4.13	1.07*	< .001
	s	0.21	0.11	1.84	.07	-0.01	0.43	0.04*	0.01	0.07	0.14	0.48	.63	-0.20	0.34	0.04*	0.01
	q	-0.08	0.11	-0.70	.49	-0.29	0.14	0.00	0.00	-0.07	0.13	-0.52	.60	-0.33	0.19	0.00	0.00
1960-1956	*i*	4.47	0.10	43.61	< .001	4.27	4.67	1.07*	< .001	4.01	0.13	31.24	< .001	3.76	4.26	1.07*	< .001
	s	-0.16	0.21	-0.74	.46	-0.57	0.26	0.04*	0.01	-0.05	0.26	-0.20	.84	-0.57	0.47	0.04*	0.01
	q	0.13	0.11	1.20	.23	-0.08	0.33	0.00	0.00	0.06	0.13	0.42	.67	-0.20	0.31	0.00	0.00
1955-1951	*i*	4.10	0.26	16.00	< .001	3.60	4.60	1.07*	< .001	3.65	0.30	12.15	< .001	3.06	4.24	1.07*	< .001
	s	0.22	0.36	0.61	.54	-0.48	0.91	0.04*	0.01	0.32	0.42	0.76	.45	-0.50	1.13	0.04*	0.01
	q	-0.02	0.12	-0.20	.84	-0.26	0.21	0.00	0.00	-0.07	0.14	-0.46	.64	-0.34	0.21	0.00	0.00
1950-1946	*i*	4.68	0.56	8.31	< .001	3.58	5.78	1.07*	< .001	5.24	0.63	8.33	< .001	4.01	6.47	1.07*	< .001
	s	-0.44	0.59	-0.74	.46	-1.60	0.72	0.04*	0.01	-1.60	0.66	-2.43	.02	-2.90	-0.31	0.04*	0.01
	q	0.12	0.15	0.81	.42	-0.18	0.42	0.00	0.00	0.45	0.17	2.63	.01	0.11	0.78	0.00	0.00
1945-1941	*i*	6.50	1.16	5.61	< .001	4.23	8.77	1.07*	< .001	7.73	1.26	6.15	< .001	5.27	10.20	1.07*	< .001
	s	-1.82	0.97	-1.88	.06	-3.72	0.08	0.04*	0.01	-3.26	1.05	-3.11	.002	-5.31	-1.21	0.04*	0.01
	q	0.37	0.20	1.87	.06	-0.02	0.76	0.00	0.00	0.67	0.22	3.10	.002	0.25	1.09	0.00	0.00
1940-1936	*i*	18.23	2.26	8.08	< .001	13.81	22.66	1.07*	< .001	14.84	2.31	6.44	< .001	10.32	19.35	1.07*	< .001
	s	-9.56	1.57	-6.07	< .001	-12.64	-6.47	0.04*	0.01	-7.59	1.60	-4.75	< .001	-10.72	-4.46	0.04*	0.01
	q	1.61	0.27	5.93	< .001	1.08	2.14	0.00	0.00	1.27	0.27	4.62	< .001	0.73	1.81	0.00	0.00

***Table 6*: Parameter estimates for the cohort models for warmth toward overweight people by gender.**

limited impact in the real-world,[35–37] especially when considering long-term change, it may be that the relative stability of weight-based bias is reflected by such findings. As the current research provides unique insight into population level changes in weight-based bias over a decade while considering effects among different birth cohorts and gender, future work is needed to examine the robustness of these findings and explore the psychological processes underlying these.

Limitations and future research

A major limitation of the current work was that it relied on a single-item self-report measure of weight-based bias. While a comprehensive measure of weight-based bias, ideally one that distinguished between attitudes toward people who are obese compared to people who are overweight, would be valuable, the feeling thermometer used here is a gold standard measure of prejudicial attitudes and group-based warmth.[27-30]

Another limitation of the current work is that it does not shed light on whether certain moderating factors may influence changes within the past decade. Because of the nature of this kind of analysis, we have tracked population level attitudes. However, as the modelling approach utilised here requires particularly large sample sizes, we are unable to delve deeper into understanding changes in weight-based bias among different subgroups within the population such as by race, ethnicity, socioeconomic class, or profession. Future research is needed to determine whether such factors would moderate the observed effects beyond gender. Similarly, it would also be useful to look at the weight distribution of the participants within the NZAVS sample to determine whether participants' own weight (and how their weight changes over time) influences their attitudes towards individuals who are overweight. However, future work would benefit from examining these potentially important moderators of changes in weight-based bias. In addition to examining moderating factors, future research should also investigate the role of various governmental and non-governmental efforts to decrease weight bias to examine its population level impact.

Despite these limitations of the current data, this work provides rare insight into changes in weight-based bias at a population level by considering cohort-based changes alongside gender differences across a decade.

Summary

Using more than a decade of longitudinal data from a nationally representative sample of adults, the results of this study show that, at least within New Zealand, weight-based bias has remained largely unchanged over the last decade. These findings did not differ much by gender, or birth cohort, with some evidence that younger birth cohorts of women showed a small decrease in weight-based bias over the past decade. However, these findings collectively reveal that weight-based bias does not reflect developmental changes within the life-span, and there have been limited shifts in this form of prejudice during the past decade.

Contributors

KY and CS conceptualised and designed the study. EZ and CS analysed the data, while all authors interpreted the data. EC and KY drafted the manuscript, while EZ and CS made critical revisions to the manuscript. All authors have read and approved the final version of the manuscript. All authors also had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Data sharing statement

NZAVS data is hosted at the University of Auckland, New Zealand. Data cannot be made available due to ethical restrictions imposed by the University of Auckland Human Participants Ethics Committee. A de-identified dataset is available to appropriately qualified researchers upon request from the corresponding author, any member of the NZAVS advisory board, or the Chair of the University of Auckland Human Participants Ethics Committee. Moreover, syntax files for the reported analyses will be made available on the NZAVS website upon publication.

Declaration of interests

We declare no competing interests.

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