Changing from the inside out?

Examining relationships between overweight identification, dieting behaviours, and body measurements over time

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Acknowledgements: We would like to thank Hilary Aime, Maeve Cyr, Sara Frankenberger, Mackenzie Robertson, and Angelina Yiu for their help with data collection and entry, Thomas Morton for comments on earlier drafts of this manuscript.

Word count: 5089 (excluding title page, abstract, references, tables, supplement)

Statement of contribution

What is already known on this subject?

- Psychological factors, such as self-concept clarity and weight stigma, are associated with dieting behaviours and body measurements.
- Qualitative data suggests that identity change may be tied to dieting behaviours and weight loss.

What does this study add?

- New insights into the nature of another psychological factor, overweight identification, among individuals with overweight and obesity attempting to lose weight.
- The first quantitative evidence that different aspects of overweight identification, and changes in these aspects of overweight identification over time, influence body measurements and dieting behaviours.

Abstract

Objective: To investigate whether changes in overweight identification were associated with dieting behaviours and body measurements over time.
Design: Longitudinal study with assessments at three time points: Before and twice during (i.e., baseline, 6 months, 12 months) a 1 year self-directed weight loss attempt.
Method: Eighty individuals with overweight or obesity (classified by BMI >=25) reported their *personal* (i.e., I see myself as overweight), *social* (i.e., I identify/feel strong ties with other overweight people), and *affective* (i.e., I am pleased to be overweight) overweight identification; dieting behaviours (e.g., eat less, exercise; eat more fruit and vegetables); and had their body measurements taken (i.e., weight, height, body fat, waist circumference).
Results: Linear mixed modelling was used to examine between-person differences and within-person changes in overweight identification on dieting behaviours and body measurements over time. Between-person differences mattered for measurements: Higher *personal* overweight identification was associated with higher BMI, body fat, and waist circumference over time. Higher *social* overweight identification was associated with higher BMI over time. Within-person changes mattered for behaviours over time: At 12 months, decreases in *social* overweight identification were associated with increases in a subset of 'eat less, move more' dieting behaviours, but not the subset 'healthy' dieting behaviours. At 12 months, decreases in *affective* overweight identification were also associated with increases in 'eat less, move more' dieting behaviours.
Conclusion: Addressing different aspects of overweight identification and how they change over time, may harness an important psychological pathway to support behavioural change and health irrespective of weight lost.

Word count: 250

Keywords: overweight identification, identity change, dieting behaviours, body measurements

Introduction

Overweight and obesity, where people have excess fat accumulation, affects 33% of adults worldwide (WHO, 2015). Given that overweight and obesity is associated with health risks including type-2 diabetes, heart disease, and stroke, health care professionals recommend shedding at least 5-10% in body weight to reduce these risks (Jensen et al., 2014). Unfortunately weight loss efforts are typically ineffective, with minimal losses maintained in the long term (Dombrowski, Knittle, Avenell, Araújo-Soares, & Sniehotta, 2014). This ineffectiveness may be tied to the focus on changing dieting behaviours (e.g., Eat Less, Move More) to promote weight loss to the exclusion of psychological factors (e.g., self-esteem, weight status) that have recently been found to influence poor eating habits and weight gain over time (Palmeira et al., 2010; Robinson, Hunger, & Daly, 2015). The present research sought to provide insights into an additional psychological factor that might underlie individuals' behaviours and measurements – group identification. Drawing on an identity-based framework (i.e., the social identity approach: Tajfel, 1981; Turner, Oakes, Haslam, & McGarty, 1994; identity-based motivation model: Oyserman, 2015, Oyserman, Smith & Elmore, 2014), we investigated the specific role of *overweight identification* - the extent to which individuals see themselves as overweight, feel connected to other overweight people and feel pleased to be overweight – and changes in overweight identification, on dieting behaviours and body measurements over time. We contend that decreases in overweight identification reflect a key component of behavioural and physical changes when individuals attempt weight loss.

Understanding overweight identification

The social identity approach (i.e., social identity and self-categorization theories; Tajfel, 1981; Turner et al., 1994) and identity-based motivation (IBM) model (Oyserman, 2015; Oyserman, Smith, & Elmore, 2014) offer important insights into the role of identity in weight loss efforts. According to these approaches individuals derive a sense of identity, where they

come to understand who they are, how they should act, and their place in the world, from their group memberships. Whether these groups shape individuals' perceptions of themselves and others, and/or influence their behaviours, depends on their strength of identification: *Higher identifiers* see themselves as exemplifying the characteristics of the group, feel good about their group membership, and feel connected to fellow group members whereas *lower identifiers* do not see themselves as exemplifying, or feel good about or connected to, the group or its members. Consequently, higher identifiers are more likely to be motivated to adhere to the norms and behaviours that characterize the group and its members and may act in identity-congruent ways even when these norms and behaviours may be associated with negative rather than positive outcomes. This is because the group is part of the self ('who we are') and its standards are used as a guide for which actions and outcomes are possible (what 'we' do). In contrast, lower identifiers are less likely to be motivated to adhere to the norms and behaviours that characterise the group and its members and may act in identity-incongruent ways because the group a less important part of the self ('not who I am'), so its standards do not guide actions or outcomes. Supporting these ideas, Oyserman, Fryberg, and Yoder (2012) found that members of minority groups in the United States (i.e., African Americans, Mexican Americans, Native Americans) associated healthy behaviours (e.g., watching weight, eating salads) with the White and middle class American majority group, and less healthy behaviours (e.g., adding salt, eating fried foods) with their minority groups. Critically, members of minority groups reported engaging in fewer healthy behaviours, and a greater number of less healthy behaviours relative to majority group members. Translating this identity-based framework to the current context, patterns of identification should inform how overweight and obesity contributes to individuals' perceptions of themselves and others, but also to their behaviour and measurements. Although individual perceptions related to the self and weight such as self-concept clarity, self-esteem, weight bias, and weight satisfaction have been linked to individual

behaviours and measurements (e.g., Neumark-Sztainer, Paxton, Hannan, Haines, & Story, 2006; Palmeira et al., 2010; Robinson et al., 2015; Vartanian, 2009), we believe that an identity-based framework offers a novel explanation for how perceptions related to overweight and obesity might also shape individual behaviours and measurements overall and over time.

The present research

Drawing on an identity-based framework, we propose that overweight identification can influence dieting behaviours and body measurements. More precisely, an individual's overall overweight identification (i.e., the extent to which they are higher or lower identifiers) might be related to their dieting behaviours and/or body measurements, and changes in overweight identification, where individuals shift their ideas about themselves by shifting in their identification with this group, might be related to changes in dieting behaviours and/or body measurements over time. If individuals' overweight identification increases, we might expect engagement in fewer dieting behaviours and higher body measurements over time, in keeping with their understanding of this group membership. Conversely, if individuals decrease their overweight identification, we might expect engagement in more dieting behaviours and lower body measurements over time. Although these latter patterns have been reported in qualitative research (Epiphaniou & Ogden, 2010; Gilmartin, Long, & Soldin, 2015), to our knowledge this study is the first to investigate whether there is quantitative support for these ideas.

To investigate these relationships, we followed adults with overweight or obesity as classified by BMI for 1 year taking measurements of overweight identification, dieting behaviours, weight, height, body fat, and waist circumference at three time points – before beginning, and at six and 12 months after the start of, a self-directed weight loss attempt. Between-person and within-person effects for overweight identification were modelled to understand how between-person differences in overweight identification, as well as within-person changes in overweight identification, influence behaviours and measurements over time

(Curran & Bauer, 2011; Wang & Maxwell, 2015). We hypothesized that higher between-person overweight identification (i.e., overall identification) would be negatively associated with dieting behaviours and positively associated with BMI, body fat and waist circumference (*Hypothesis 1; H1*) and that within-person decreases in overweight identification would be associated with increases in dieting behaviours and decreases in BMI, body fat and waist circumference over time (*Hypothesis 2; H2*). To isolate the unique effects of overweight identification relative to other psychological factors, we measured and adjusted for self-perceptions (i.e., self-esteem, self-concept clarity) and weight-perceptions (i.e., weight bias, weight dissatisfaction) that have been previously associated with dieting behaviours and body measurements (O'Brien et al., 2016, Neumark-Sztainer et al., 2006; Palmeira et al., 2010; Vartanian, 2009).

Method

Participants and Procedure

Participants were 80 Canadian adults[1] recruited from the community before starting a self-directed weight loss attempt (67.5% female; Age: *M*=30.85, *SD*=13.08; BMI: *M*=30.24, *SD*=3.79; Ethnicity: 56.3% White, 43.8% Non-White; Weight Loss Goal (lbs): *M*=32.10, *SD*=19.87; Number of times dieted in past year: 17.5% Never, 61.3% One-Four, 5% Five-Ten, 1.3% More than ten, 15% Always dieting). Participants self-directed weight loss attempt was self-reported as consisting of changing: diet and exercise (e.g., less processed foods, more regular exercise; *n*=66), exercise only (e.g., Insanity workout; *n*=4), diet only (e.g., eat less and try not to eat after 6PM; *n*=4), diet, exercise, and other aspects (e.g., no scale at home, half veggies at each meal, and increase sports and social activity; *n*=3) or other aspects (i.e., confronting personal issues; *n*=1). Two participants did not respond to this open-ended question. Of the participants who did respond, four also mentioned taking part in structured programs as part of their self-directed weight loss attempt (i.e., Weight Watchers; *n*=3; Healthy

Hearts; *n*=1) and two participants mentioned that they were considering joining Weight Watchers. Participants completed informed consent, measures of overweight identification, dieting behaviours, self-perceptions, weight-perceptions, demographics (age, gender, ethnicity), and had their weight (lbs), height (cm), body fat (%) and waist circumference (cm) recorded by one of six experimenters in the lab at baseline, 6 months and 12 months. Participants were compensated at each visit ($10 at baseline, $20 at 6 months and $20 at 12 months). Approval was received from the Office of Research Ethics at a Canadian university and adhered to Tri-Council guidelines for ethical research.

Materials and Measures[2]

Participants indicated their agreement with each item on all scales from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*) unless otherwise indicated. Means and standard deviations for all measures are included in *Table 1*.

Overweight identification (4 items; Doosje, Ellemers & Spears, 1995). This scale was adapted to specifically refer to overweight identification. Due to low scale reliability across times (Cronbach's α=.43 (baseline), .45 (6 months), .62 (12 months)), we considered the individual items for comparisons. At 12 months the first item, "I see myself as overweight", was weakly related to the fourth item, "I identify with other overweight people" (*r*=.12, *p*=.45 (baseline), *r*=.12, *p*=.46 (6 months), *r*=.30, *p*=.05 (12 months)), the second item "I am pleased to be an overweight person", was related to the third item, "I feel strong ties with overweight people" (*r*=.22, *p*=.16 (baseline), *r*=.16, *p*=.30 (6 months), *r*=.37, *p*=.02 (12 months)) and to the fourth item (*r*=.12, *p*=.48 (baseline), *r*=.02, *p*=.89 (6 months), *r*=.46, *p*=.002 (12 months)). However, the third item was more strongly and consistently related to the fourth item at each time point ((*r*=.69 (baseline), *r*=.76 (6 months), *r*=.65 (12 months), all *p*s<.001). Accordingly, the third and fourth items were averaged to assess *social overweight identification*. The first

and second items were retained as single-items reflecting *personal overweight identification* and *affective overweight identification*, respectively.

Dieting behaviours (15 items; Neumark-Sztainer et al., 2006). Items related to diet were taken from the Eating Attitudes Test (EAT). Participants ticked off (yes=1, no=0) whether they exercised, fasted, ate very little, took diet pills, vomited, used laxatives, used diuretics, used food substitutes, skipped meals, ate more fruit and veg, ate less high fat food, ate less sweets, smoked more cigarettes, ate a restricted diet (i.e., high protein/low carbs), or limited fast food in the last year. At each time (i.e., baseline, 6m, 12m) responses were parsed into two indices of dieting behaviours: 'Eat Less, Move More' strategies (i.e., fasted, ate very little, used food substitutes, skipped meals, ate a restricted diet, exercised) and 'Healthy' strategies (i.e., ate more fruit and veg, ate less high fat food, ate less sweets, limit fast food) for comparisons[3,4].

Body measurements included weight (lbs converted to kg), which was assessed using a digital scale (Tanita) and used in combination with height (cm converted to m) to compute Body Mass Index (BMI; $\frac{Weight_{Kg}}{Height_{m}^{2}}$). Body fat (%) assessed through bio-electrical impedence. Waist circumference was measured with a measuring tape (cm). Each body measurement was taken twice by one of the experimenters and averaged for accuracy.

Self-concept clarity (12 items; Campbell et al., 1996) captures whether participants' sense of self is clearly defined, consistent and stable. Sample items include: "I seldom experience conflict between the different aspects of my personality". Items were recoded so that higher score indicated higher self-concept clarity. Cronbach's alphas were .89, .86 and .88 at baseline, 6 months and 12 months, respectively.

Self-esteem (10 items; Rosenberg, 1965) captures how individuals generally feel about and evaluate themselves. Sample items include: "On the whole, I am satisfied with myself" and "I wish I could have more respect for myself." Items were recoded so that higher scores

indicated higher self-esteem. Cronbach's alphas were .91, .87 and .86 at baseline, 6 months and 12 months, respectively.

Weight bias (11 items; Durso & Latner, 2008) measures the degree to which individuals internalize the negative stereotypes about overweight and obesity. Sample items include: "I am less attractive than most other people because of my weight", "My weight is a major way that I judge and value myself as a person". Items were recoded so that higher scores indicated higher weight bias internalization. Cronbach's alphas were .88, .85 and .90 at baseline, 6 months and 12 months, respectively.

Weight dissatisfaction was assessed with one item from the Eating Disorder Examination Questionnaire (EDE-Q; Fairburn and Beglin, 1994): Over the past 28 days, how dissatisfied have you been with your weight? This item was rated from 1 (Not at all) to 7 (Markedly).

Power Analyses

Drawing from Ketturat et al. (2016), and using online calculators provided by Soper (2006/2017), power for this multilevel design was approximated using post-hoc hierarchical regression calculators with a sample size of 160 for the within-person effects (i.e., sample size (i.e., n=80) multiplied by the number of measurement times per person minus one (i.e., 3–1=2)) and a sample size of 80 for the between person effects. Power for small, medium, and large effects (Cohen's f^2) were calculated accounting for 4 control variables (self-esteem, self-concept-clarity, weight bias, weight dissatisfaction) and 3 predictor variables (time, IV, time*IV). Within-person power was 99% for a large effect of f^2=.35, 98% for a medium effect f^2=.15, and 28% for a small effect of f^2=.02. Between-person power was 99% for a large effect of f^2=.35, 80% for a medium effect of f^2=.15, and 15% for a small effect of f^2=.02. This suggests that medium and large sized within-person effects and medium and large sized between-person effects can be detected with the present sample size.

Statistical Analysis

Descriptive statistics and linear mixed modelling (LMM; see Dong & Peng, 2013; Shek & Ma, 2011; West, Welch, & Galecki, 2014) were conducted using SPSS v.21. Statistical significance was set at .05 for two-tailed hypothesis testing. Expectation-Maximization (EM) estimation was used to estimate missing data (Dong & Peng, 2013). LMM was used to account for the dependency of repeated observations and to enable the modelling of random individual time trajectories along with time-varying covariates. Random effects were specified for individuals' intercepts and slopes over time with restricted maximum likelihood estimation (REML) and an unstructured covariance pattern model (UN). That is, rather than assuming an average intercept and slope across all participants, these models allow individuals to have differing initial values of the dependent variables and allows these values to change at a different rate for each individual over time when determining if it predicts the outcome variable. Between-person effects (i.e., the individual's mean score collapsed across time (person-mean)) and within-person effects (i.e., the person-mean subtracted from the individual's mean scores at each time) for each index of overweight identification were computed following Curran and Bauer (2011; also see Wang & Maxwell, 2015) and were specified in separate models as fixed effects to enable us to disaggregate their contributions to dieting behaviours, BMI, body fat, and waist circumference (personal overweight identity, *Model A;* social overweight identification, *Model B*; affective overweight identification, *Model C*). The Akaike Information Criterion (AIC) was used as an index of model fit. The AIC reflects the best trade-off between model fit and model complexity with lower numbers indicating a better fit. For each model, the AICs were compared to the AIC for the intercept only model to assess whether adding the different effects resulted in a better fit. Linear time and the interactions of the between-person and within-person effects with linear time were also included as fixed effects in all models. Interactions were probed using online calculation utilities (Preacher, Curran, & Bauer, 2006) and values at +1SD above

the mean and -1SD below the mean for the between-person or within-person effects were plotted at conditional values of time (0, 1, 2 to represent baseline, 6 months, and 12 months). All analyses adjusted for the mean-centred between-person effects of psychological factors related to self-perceptions (i.e., self-esteem, self-concept clarity) and weight perceptions (i.e., weight bias, weight dissatisfaction).

Results

Estimates (*b*), standard errors (SE_b), confidence intervals (*CI*), and the Akaike Information Criterion (*AIC*) for time, between-person and within-person effects of overweight identification, and their interactions on dieting behaviours and body measurements are reported in *Tables 2* and *3* respectively.

Personal identification, dieting behaviours and body measurements (Model A)

'Eat Less, Move More' Behaviours. No significant effects.

'Healthy' Behaviours. No significant effects.

BMI. Supporting H1, the significant between-person effect indicated that every unit increase of personal overweight identification corresponded with a .98 kg/m^2 increase in BMI.

Body fat. Supporting H1, the significant between-person effect indicated that every unit increase of personal overweight identification corresponded with a 1.95% increase in body fat.

Waist circumference. Supporting H1, the significant between-person effect indicated that every unit increase in personal overweight identification was associated with a 3.33 cm increase in waist circumference.

Social overweight identification, dieting behaviours and body measurements (Model B)

'Eat Less, Move More' Behaviours. The significant effect for time indicated that there was an increase of dieting behaviours over time. This was qualified by a time by within-person interaction: At 6 months and 12 months the simple slopes were significant (6 months: b=-.169 SE_b=.0785; z=-2.1522, p=.0314; 12 months: b=-.5299 SE_b=.1664; z=-3.1842, p=.0015). In both

instances decreases in social overweight identification were associated with increases in 'eat less, move more' behaviours. At baseline there was no relationship between social overweight identification and dieting behaviours (b=.192, SE_b=.1208; z=1.59, p=.1119).

'Healthy' Behaviours. No significant effects.

BMI. Supporting H1, the significant between-person effect indicated that every unit increase of social overweight identification was associated with a .72 kg/m^2 increase in BMI. This effect was qualified by a time by between-person interaction: At baseline, 6 months, and 12 months, the simple slopes were all significant (Baseline: b=.7165, SE_b=.3424, z=2.0927, p=.0364; 6 months: b=.8627, SE_b=.3412, z=2.5283, p=.0115; 12 months: b=1.0089, SE_b=.3466, z=2.9105, p=.0036) indicating that increases in overall social overweight identification were associated with increases in BMI. Differences emerged when plotting at conditional values of identification. Here, high overall social overweight identification was associated with increases in BMI over time (b=.3305, SE_b=.0871; z=3.7962, p=.0001) but at low overall social overweight identification there was a non-significant decrease in BMI over time (b=-.0439, SE_b=.0874; z=-.5022, p=.6155).

Body fat. No significant effects.

Waist circumference. No significant effects.

Affective overweight identification, dieting behaviours and body measurements (Model C)

'Eat Less, Move More' Behaviours. There was a significant time by within-person interaction: At 12 months the simple slope was significant (b=-.4215, SE_b=.1518; z=-2.7771, p=.0055) indicating that decreases in affective overweight identification were associated with increases in 'eat less, move more' behaviours. At 6 months the simple slope was marginal suggesting that decreases in affective overweight identification were associated with increases in 'eat less, move more' behaviours (b=-.144 SE_b=.0774; z=-1.8595, p=.063). At baseline there

was no relationship between affective overweight identification and 'eat less, move more' behaviours (b=.1335 SE_b=.1479; z=.903, p=.3666).

'Healthy' Behaviours. No significant effects.

BMI. No significant effects.

Body fat. In line with H2, a significant time by within-person interaction was observed. At 6 months and 12 months the simple slopes were significant indicating that decreases in affective overweight identification corresponded with decreases in body fat (6 months: b=.552, SE_b=.2488; z=2.0978, p=.0359; 12 months: b=1.4685, SE_b=.5003; z=2.935, p=.0033). There were no observed relationships at baseline (b=.4246, SE_b=.4917; z=.8634, p=.3879).

Waist circumference. No significant effects.

Discussion

In a longitudinal study we found evidence that overweight identification offers novel insights into people's dieting behaviours and body measurements. Supporting our first hypothesis, higher between-person *personal* overweight identification was associated with higher BMI, body fat and waist circumference and higher between-person *social* overweight identification was associated with higher BMI over time. This suggests that people who see themselves as overweight, or who identify with other overweight people, are more likely to possess the physical characteristics associated with the group overall (i.e., higher weight). These findings replicate and extend recent work demonstrating that people's feelings about themselves and their weight are related to their measurements (e.g., Robinson et al., 2015) by showing that both people's perceptions of themselves as overweight and their affiliation with other overweight people are related to higher BMI over time. Between-person overweight identification was unrelated to dieting behaviours, suggesting that dieting behaviours are not explicitly dictated by this group membership: Individuals who highly identify with overweight or obesity overall are not less likely to engage in dieting behaviours. In the context of the present

research this finding, although unexpected, makes sense given that all individuals were attempting to lose weight, and a range of dieting behaviours typically characterise these efforts irrespective of overweight identification.

Supporting our second hypothesis, within-person decreases in social and affective overweight identity were associated with increases in dieting behaviours (i.e., 'eat less, move more' behaviours). Decreases in within-person affective overweight identity were also associated with decreases in body fat over time. These findings provide first evidence that changes on the inside (i.e., decreases in psychological identification with other overweight people) may precipitate changes on the outside (i.e., behaviours, body fat). These findings align with an identity-based framework where individuals' understanding of themselves in relation to similar others ('who we are') influences the norms and behaviours that they adhere to ('what we do'; Oyserman et al., 2014; Oyserman, 2015; Tajfel, 1981; Turner et al., 1994). As social and affective aspects of overweight identity decrease, individuals may see themselves as less similar to other people with overweight and obesity, and may be less pleased to be overweight, respectively. As a consequence of decreases in these aspects of overweight identification, individuals may be more motivated to engage in identity-incongruent behaviours, such as increasing restrictive dieting behaviours, which may, in turn be associated with decreases in body measurements such as body fat (see *Supplement* for associations between dieting behaviours and body measurements).

Although these findings are intriguing, we recognize that they come with at least three limitations. First, as these data are correlational there are limits in our ability to discern causality. Whilst we have argued that individuals are changing from the inside out, with identification and changes in identification associated with behaviours and body measurements over time, it is equally plausible that individuals might be changing from the outside in, with body measurements and/or dieting behaviours, and changes in body measurements and/or

dieting behaviours accounting for overweight identification over time. Indeed, we suspect that the relationships between identification, dieting behaviours, and body measurements might be dynamic, where the factors influence each other in reciprocal ways, in light of qualitative research that supports both the identity to behaviour (and body measurements) pathway (Leske, Strodl, & Hou, 2012) and the behaviour (and body measurements) to identity pathway (Epiphaniou & Ogden, 2010), and given recent empirical research on smoking-related identities and behaviours that found that behaviour predicts identity changes and that identity (as a quitter) predicts behaviour change (smoking cessation) over time (Meijer et al., 2018). Future research should examine how this dynamic relationship unfolds in contexts where identity changes are possible such as successful and unsuccessful attempts at weight loss.

Second, the overall measure of overweight identification was unreliable, with the four items reflecting personal, social, and affective identification failing to hang together. Although the measure by Doosje et al. (1995) has figured prominently in the literature, there have been several advances in the measurement of identification. In fact, the personal, social and affective components that this scale was divided into loosely mimic distinctions between centrality, solidarity, and satisfaction developed in more recent and comprehensive iterations of group identification scales (e.g., Leach et al., 2008) and newer short-forms of these scales (e.g., Postmes, Haslam & Jans, 2013). Given that our findings suggest that there is value to considering different aspects of identification, future research would benefit from using comprehensive measures of identification which explicitly assess these components to determine whether they better capture individuals' perceptions of, affiliation with, and feelings toward, overweight and obesity, and whether these more comprehensive measures, in turn, replicate the present findings.

Participants' ratings of the overweight identification items in the present research point to another issue with overweight and obesity as a group membership, and the third limitation

of the present findings: Overall, there was low endorsement of the social and affective identification items relative to the personal identification item. This suggests that while the present sample saw themselves as overweight, they did not necessarily feel a bond between themselves and other overweight people, nor were they necessarily pleased with being overweight. This echoes ideas put forth by Hunger and his colleagues (2015) who proposed that categorisation of one's self as overweight might not always translate into other aspects of identification with this group, and supports the assertion that the psychological internalization of overweight and obesity as an identity might differ relative to other types of stigmatized group memberships (e.g., race, gender) where the components of existing scales are usually endorsed in similar ways. Additional research considering identification among individuals with overweight and obesity as well as other group memberships where the identities might be similarly devalued yet deemed controllable (e.g., individuals with drug, alcohol, or nicotine dependency) is also needed to extend the present findings and to confirm whether, for some groups, it might be necessary to focus on separate components, rather than on the average of components, to understand how identification and changes in identification might shape behaviours and influence outcomes.

Clinical implications

With the present findings we have first evidence that considering different components of overweight identification may be a viable way to understand behaviours and measurements. Critically, it appears that shifts in overweight identification are associated with behaviour change. This implies that assessing and attempting to shift different components of overweight identity may support behaviour change among some individuals with overweight and obesity. To our knowledge, personal, social, and affective components of overweight identification are not currently addressed as part of behaviour change or weight-related interventions. However, we know that interventions that promote positive body image, which is linked to the personal

component of overweight identity, have been associated with weight loss maintenance (see Dalle Grave, Centis, Marzocchi, El Ghoch & Marchesini, 2013 for a review), that weight stigma, which is linked to a negative evaluation of the social component of overweight identity, can have a negative impact on behaviours (see Nolan & Eshleman, 2016 for a review), and that among smokers, a similarly devalued identity, endorsement of a quitter identity rather than an smoker identity, that is associated with a positive impact on smoking cessation behaviours (Meijer et al., 2018). This evidence suggests that the content of identities matters, and that existing identities might be modified, new identities might be adopted, and/or discrepancies between existing and new identities might have to be negotiated to facilitate specific outcomes (see also Jones & Hynie, 2017; Leske et al., 2012; Oyserman et al. 2014).

How might identity modification and/or adoption be achieved? As health-tracking via smartphone applications (e.g., step counters, calories counting) has been associated with facilitating behaviour change (via goal setting, feedback, and support; Tang, Abraham, Stamp & Greaves, 2015) and the maintenance of weight loss (Goldstein, Thomas, Wing & Bond, 2017) and, one possibility would be to create an application for online or offline 'identity tracking' where, much like fitness tracking, individuals are encouraged to record and monitor the positive (and negative) aspects of their existing overweight identity and their new identities (e.g., noting instances of positive and negative self-talk about overweight and obesity). Once quantified, individuals could be encouraged to cultivate positive views of themselves, their relationships with others, and their satisfaction with their identities by engaging in behaviours that reflect the positive aspects of their existing and new identities (e.g., goals may be set to reduce instances of negative self-talk; in-app data can be analysed to show how tracked identity, and changes in identity, are associated with working out or making healthy food choices). Moreover, an identity tracking application could help individuals to build links with similar others (e.g., other identity trackers) to gain encouragement for the changes being made, and to

provide a forum where they can challenge the erroneous negative stereotypes and limiting beliefs that tend to be associated with overweight and obesity (e.g., individuals with overweight and obesity do not exercise; Puhl & Brownell, 2001; Seacat & Mickelson, 2009; Meadows & Bombak, 2018). Focusing on identities and identity change, and building links that reinforce these changes, may be important ways to facilitate the behavioural changes that can support health, even if weight loss is not achieved (e.g., Jetten, Haslam, Haslam, Dingle, & Jones, 2014; Meijer et al., 2018). Indeed, whether individuals change from the inside out or from the outside in, what they think about their identities matters.

Footnotes

[1] Significant outliers (> +/- 3SD from the mean) identified on BMI (i.e., two scores of 49 or over) and BMI change (two participants lost or gained significantly more weight than the rest of the sample: -10.09 kg/m^2, +5.34 kg/m^2) were excluded. This left a data set of 80 participants at time one (from 84 participants).

[2]At baseline, month 6 and month 12 participants also completed measures of social support, fit identity, average weight identity, figure ratings, and had their body water measure taken by one of the experimenters. At months 3 and 9, participants completed an online questionnaire where they rated their overweight, fit, and average weight identification and described perceived successes and setbacks associated with their weight loss efforts. These variables were not considered in the present analyses.

[3] Although we recognize that the 'Eat Less, Move More' dieting behaviours might be classified as restrictive, and acknowledge that restrictive dieting behaviours have been associated with weight gain in some samples (e.g., Neumark-Sztainer, Wall, Haines, Story, Sherwood, & van den Berg, 2007), it is important to note that these associations are typically among individuals with average weight who are attempting to diet rather than individuals with overweight or obesity (see Lowe, Doshi, Katterman & Feig, 2013). In support of our assertion that restrictive dieting behaviours can have different outcomes in different samples, the present data suggest that 'Eat less, Move more' dieting behaviours do not influence BMI or waist circumference over time for individuals with overweight and obesity. There was some suggestion that increases in between-person 'Eat Less, Move More' dieting behaviours were associated with decreases in body fat and that increases in within-person 'Eat Less, Move More' dieting behaviours were associated with higher body fat at baseline and 6 months but not at 12 months (see Additional Analyses in the Supplemental Information).

[4] Although the EAT is a validated measure of dieting behaviours, it asks participants to recall the number of behaviours engaged in during the last year. This is likely to capture changes in dieting behaviours at baseline (i.e., the year before the weight loss attempt was started), and 12 months (i.e., the entire year period of the weight loss attempt), but leads to overlapping time periods in the measurement at 6 months that might minimises our ability to capture change at this measurement point due to the time frame. This is a limitation of the present research.

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Table 1. Means and standard deviations for measures of self-perceptions, weight-perceptions, overweight identification, dieting behaviours, and body measurements (*n*=80)

	Baseline	**6 months**	**12 months**
Variables	Mean *(SD)*	Mean *(SD)*	Mean *(SD)*
Self-Esteem	4.966 *(1.194)*	5.108 *(.928)*	5.285 *(.853)*
Self-Concept Clarity	4.466 *(1.240)*	4.350 *(.893)*	4.573 *(.910)*
Weight Bias	3.902 *(1.238)*	3.822 *(1.107)*	3.756 *(1.127)*
Weight Dissatisfaction	5.175 *(1.792)*	4.748 *(1.536)*	4.579 *(1.866)*
Personal Overweight Identification	5.863 *(1.549)*	5.770 *(1.110)*	5.464 *(1.424)*
Social Overweight Identification	2.694 *(1.472)*	3.042 *(1.457)*	3.056 *(1.353)*
Affective Overweight Identification	1.838 *(1.096)*	2.172 *(1.328)*	2.145 *(1.049)*
All Dieting Behaviours	5.350 *(2.007)*	6.024 *(1.862)*	5.847 *(1.507)*
'Eat Less, Move More' Behaviours	2.125 *(1.257)*	2.580 *(1.364)*	2.511 *(1.241)*
'Healthy' Behaviours	3.050 *(1.272)*	3.274 *(.955)*	3.165 *(.830)*
Body Mass Index (BMI)	30.242 *(3.790)*	30.063 *(3.727)*	30.490 *(3.993)*
Body Fat (%)	34.441 *(8.559)*	34.398 *(8.007)*	34.270 *(8.800)*
Waist Circumference (cm)	101.193 *(10.791)*	101.984 *(10.780)*	100.325 *(11.887)*

Table 2. Disaggregation of between and within effects of overweight identification on dieting behaviours

	'Eat Less Move More' Behaviours			'Healthy' Diet Behaviours		
	Estimate *(SE)*	CI_L	CI_U	Estimate *(SE)*	CI_L	CI_U
Model A: Personal Overweight Identification						
Intercept	2.57 *(.74)****	1.10	4.03	2.81 *(.72)****	1.39	4.24
Self-Concept Clarity	-.32 *(.18)*^{l}	-.67	.02	-.03 *(.13)*	-.23	.30
Self-Esteem	.17 *(.18)*	-.19	.52	.17 *(.13)*	-.10	.43
Weight Dissatisfaction	.19 *(.11)*	-.02	.41	.04 *(.08)*	-.12	.21
Weight Bias	.18 *(.17)*	-.16	.52	.06 *(.13)*	-.20	.32
Time (Linear)	.36 *(.30)*	-.24	.97	.21 *(.34)*	-.47	.88
Between-person	-.06 *(.13)*	-.32	.19	.05 *(.12)*	-.19	.30
Within-person	-.06 *(.12)*	-.30	.19	-.08 *(.12)*	-.32	.17
Time*Between-person	-.02 *(.05)*	-.13	.08	-.03 *(.06)*	-.14	.09
Time*Within-person	.20 *(.12)*	-.04	.44	.06 *(.12)*	-.17	.29
Model B: Social Overweight Identification						
Intercept	2.64 *(.33)****	1.99	3.30	3.12 *(.34)****	2.44	3.80
Self-Concept Clarity	-.39 *(.17)**	-.72	-.06	.04 *(.13)*	-.22	.31
Self-Esteem	.11 *(.17)*	-.23	.45	.17 *(.14)*	-.11	.44
Weight Dissatisfaction	.15 *(.09)*	-.04	.34	.05 *(.08)*	-.10	.21
Weight Bias	.15 *(.16)*	-.17	.34	.06 *(.13)*	-.20	.32
Time (Linear)	.40 *(.14)***	.11	.68	.02 *(.17)*	-.31	.36
Between-person	-.14 *(.10)*	-.34	.07	.00 *(.11)*	-.21	.22
Within-person	.19 *(.12)*	-.05	.43	.16 *(.12)*	-.08	.39
Time*Between-person	-.07 *(.04)*	-.15	.02	.01 *(.05)*	-.10	.11
Time*Within-person	-.36 *(.12)***	-.60	-.12	-.11 *(.11)*	-.33	.12
Model C: Affective Overweight Identification						
Intercept	2.51 *(.31)****	1.90	3.12	3.02 *(.32)****	2.38	3.66
Self-Concept Clarity	-.36 *(.16)**	-.68	-.03	.04 *(.13)*	-.22	.31
Self-Esteem	.15 *(.17)*	-.18	.49	.17 *(.13)*	-.09	.44
Weight Dissatisfaction	.15 *(.10)*	-.04	.34	.06 *(.08)*	-.10	.21
Weight Bias	.12 *(.17)*	-.23	.46	.09 *(.14)*	-.19	.36
Time (Linear)	.16 *(.13)*	-.11	.42	.04 *(.15)*	-.27	.35
Between-person	-.13 *(.14)*	-.41	.14	.03 *(.14)*	-.25	.31
Within-person	.13 *(.15)*	-.16	.43	-.14 *(.15)*	-.43	.15
Time*Between-person	.02 *(.06)*	-.10	.14	.02 *(.07)*	-.12	.15
Time*Within-person	-.28 *(.13)**	-.53	-.02	.03 *(.13)*	-.22	.28
Model Comparisons						
Model A AIC	705.58			660.90		
Model B AIC	*696.90*			659.97		
Model C AIC	701.34			657.79		
Intercept Only AIC	706.40			*649.84*		

Note. $^{l}p<.07$, $^{*}p<.05$, $^{**}p<.01$, $^{***}p<.001$; Akaike Information Criterion (AIC) values in *italics* indicate the best fit relative to the intercept-only

Table 3. Disaggregation of between and within effects of overweight identification on body measurements

	BMI			Body Fat (%)			Waist Circumference (cm)		
	Estimate *(SE)*	CI_L	CI_U	Estimate *(SE)*	CI_L	CI_U	Estimate *(SE)*	CI_L	CI_U
Model A: Personal Overweight Identification									
Intercept	24.51 *(2.32)****	26.80	30.97	23.31 *(5.08)****	13.19	33.42	82.57 *(6.30)****	70.01	95.12
Self-Concept Clarity	.43 *(.57)*	-.71	1.57	1.51 *(1.25)*	-.99	4.01	.69 *(1.55)*	-2.40	3.79
Self-Esteem	-.41 *(.58)*	-1.56	.75	-1.38 *(1.26)*	-3.90	1.14	.20 *(1.56)*	-2.92	3.32
Weight Dissatisfaction	-.02 *(.35)*	-.72	.69	.30 *(.77)*	-1.24	1.84	.24 *(.96)*	-1.67	2.16
Weight Bias	.30 *(.56)*	-.81	1.41	.06 *(1.22)*	-2.38	2.50	.80 *(1.51)*	-2.22	3.82
Time (Linear)	-.46 *(.32)*	-1.09	.17	-.70 *(1.01)*	-2.70	1.29	-1.45 *(1.56)*	-4.53	1.63
Between-person	.98 *(.41)**	.18	1.78	1.95 *(.88)**	.20	3.70	3.33 *(1.09)***	1.16	5.50
Within-person	.16 *(.14)*	-.11	.44	.26 *(.44)*	-.60	1.13	.02 *(.67)*	-1.29	1.34
Time*Between-person	.11 *(.05)*^{l}	-.00	.21	.11 *(.17)*	-.23	.45	.20 *(.27)*	-.33	.72
Time*Within-person	-.05 *(.45)*	-.32	.23	-.21 *(.43)*	-1.07	.64	.47 *(.66)*	-.83	1.78
Model B: Social Overweight Identification									
Intercept	28.01 *(1.08)****	25.86	30.17	31.82 *(2.35)****	27.13	36.51	96.28 *(2.99)****	90.33	102.23
Self-Concept Clarity	.96 *(.58)*	-.19	2.11	2.38 *(1.26)*	-.14	4.89	1.97 *(1.60)*	-1.22	5.16
Self-Esteem	-.33 *(.60)*	-1.52	.86	-1.45 *(1.30)*	-4.05	1.15	.31 *(1.65)*	-2.98	3.60
Weight Dissatisfaction	.45 *(.33)*	-.21	1.10	1.01 *(.72)*	-.43	2.46	1.48 *(.92)*	-.35	3.31
Weight Bias	.47 *(.56)*	-.65	1.60	.48 *(1.24)*	-1.98	2.94	1.39 *(1.57)*	-1.73	4.51
Time (Linear)	-.29 *(.15)*	-.58	.02	-.71 *(.49)*	-1.67	.25	-.07 *(.76)*	-1.56	1.42
Between-person	.72 *(.34)**	.03	1.40	.87 *(.75)*	-.62	2.35	1.76 *(.95)*^{l}	-.13	3.64
Within-person	-.16 *(.14)*	-.43	.12	-.50 *(.42)*	-1.34	.34	-.98 *(.65)*	-2.26	.30
Time*Between-person	.15 *(.05)***	.05	.24	.23 *(.15)*	-.07	.53	-.08 *(.24)*	-.54	.39
Time*Within-person	.07 *(.14)*	-.21	.36	.44 *(.44)*	-.43	1.31	.33 *(.67)*	-1.00	1.66
Model C: Affective Overweight Identification									
Intercept	28.88 *(1.05)****	26.80	30.97	32.36 *(2.26)****	27.85	36.87	97.60 *(2.89)****	91.83	103.38
Self-Concept Clarity	.76 *(.58)*	-.40	1.92	2.17 *(1.26)*	-.34	4.68	1.79 *(1.61)*	-1.42	5.00
Self-Esteem	-.50 *(.60)*	-1.68	.69	-1.52 *(1.29)*	-4.09	1.04	-.20 *(1.65)*	-3.49	3.08
Weight Dissatisfaction	.38 *(.34)*	-.29	1.06	1.02 *(.73)*	-.44	2.48	1.57 *(.94)*	-.30	3.44
Weight Bias	.70 *(.61)*	-.52	1.92	.88 *(1.32)*	-1.76	3.51	2.07 *(1.69)*	-1.30	5.45
Time (Linear)	-.03 *(.14)*	-.31	.25	-.18 *(.43)*	-1.03	.68	-.36 *(.69)*	-1.73	1.02

Between-person	.61 *(.47)*	-.33	1.54	.99 *(1.02)*	-1.04	3.01	2.01 *(1.30)*	-.58	4.61
Within-person	-.09 *(.17)*	-.43	.25	-.42 *(.49)*	-1.40	.55	.81 *(.80)*	-.77	2.39
Time*Between-person	.08 *(.06)*	-.04	.21	.03 *(.19)*	-.34	.41	-.06 *(.31)*	-.66	.55
Time*Within-person	.02 *(.15)*	-.27	.32	.95 *(.43)**	.10	1.79	-.93 *(.70)*	-2.30	.1845
Model Comparisons									
Model A AIC	901.93			1372.36			*1545.51*		
Model B AIC	*898.80*			1374.48			1550.74		
Model C AIC	909.43			*1370.13*			1552.08		
Intercept Only AIC	911.48			1386.61			1577.44		

Note. $^{I}p<.07$, $^{*}p<.05$, $^{**}p<.01$, $^{***}p<.001$; Akaike Information Criterion (AIC) values in *italics* indicate the best fit relative to the intercept-only

Supplementary Information

Data Examination

A. Exclusions

Participants with BMI scores (i.e., raw scores, changes in BMI scores over time (i.e., T5-T1)) that deviated +/- 3 standard deviations from the average scores in the distribution were excluded from the analyses. Two participants were significant outliers on BMI (i.e., scores of 49 or over) and two participants either lost or gained significantly more weight than the rest of the sample (i.e., BMI change = -10.09, +5.34). As such, data sets of 80 participants were included in the final analyses (from 84 participants), with any variation in degrees of freedom reflecting missing values on individual variables or time points.

B. Attrition and Missing Data

At 12 months we had a complete sample of 42 participants (38 participants lost to attrition). This attrition rate is not unlike what is typically reported in weight loss interventions (see Moroshko, Brennan, & O'Brien, 2011 for a review). Differences in the characteristics of participants who completed all times versus participants who were missing data were examined by chi-squared tests for categorical data and independent t-tests for continuous data. Participants lost to attrition did not differ significantly from those who remained in terms of Age, $t(78)=-1.31$, $p=.19$; Gender: Pearson X^2 (1, $N=80$)=.097, $p=.76$; Ethnicity (White/Non-White): Pearson X^2 (1, $N=80$)=2.32, $p=.13$; BMI: $t(78)=-.41$, $p=.68$; Body fat: $t(76)=-.96$, $p=.34$; Waist circumference: $t(76)=-.56$, $p=.58$; All Dieting behaviors: $t(78)=.63$, $p=.53$; 'Eat Less, Move More' Strategies: $t(78)=1.30$, $p=.20$; 'Healthy Diet' Strategies: $t(78)=-.51$, $p=.61$; Social Overweight identification: $t(78)=.70$, $p=.48$; Personal Overweight identification: $t(78)=-1.13$, $p=.26$; Affective Overweight identification: $t(78)=.44$, $p=.66$. Nor were differences detected in Self-Concept Clarity: $t(77)=-1.62$, $p=.11$; Self-esteem: $t(75)=-.16$, $p=.87$; Weight Bias: $t(77)=1.01$, $p=.32$; or Weight Dissatisfaction: $t(78)=.04$, $p=.97$. Overall,

up to 47.5% of data were missing at Time 5. After considering imputation methods, the expectation-maximization (EM) algorithm was used to replace missing values given that single imputation using EM does not appear to unduly bias parameter or error estimates with MCAR data even when missing up to 60% of values (Dong & Peng, 2013). Missing data were imputed using Missing Values Analysis within SPSS v. 21. Little's MCAR test was non-significant, indicating that data was missing completely at random ($\chi^2(731)= 683.141$, $p=.897$). Outlying values were restricted to the respective scale range.

C. Distributions

We investigated whether dieting behaviors might be better explained as count data using a poisson distribution rather than as continuous data using a normal distribution. Poisson distributions are typically positively skewed, have means equal to the variance, and many 0 scores. Support for assumptions underlying a poisson distribution were not found when considering all dieting behaviors or 'healthy diet' strategies (i.e., no or negative skew, mean higher than the variance, few 0 scores), nor was it found for 'eat less, move more' strategies (i.e., positive skew, mean higher than the variance at time 3 only, few 0 scores). This led us to treat this index as continuous data. Transformation did not consistently improve the skew of the dieting behaviors. As such, these scores remained untransformed in the present analyses. We also noted that BMI was positively skewed. Although transformation using the natural logarithm improved the skew, findings were similar using transformed and untransformed scores. As such untransformed scores were used in the present analyses to facilitate interpretation.

Data Processing

A. Preliminary Analyses

Unconditional mean models (i.e., intercept only, null models) were run to obtain the intraclass correlation (ICC) for each of the outcomes variables. ICC values reflect the variation due to

inter-individual differences (i.e., variation in the scores attributable to variation between individuals). Values over .25 (range from 0 to 1) suggest that individual growth curve analyses may be warranted. To test this, fixed and random effects were specified as including the intercept only. To calculate the ICC, the random value for the intercept was divided by the sum of the random residual and random value for the intercept. The ICC for all dieting behaviors was .60, for 'eat less, move more' strategies was .66, for 'healthy diet' strategies was .50, for BMI was .96, for body fat was .92, and for waist circumference was .88. This suggests that body composition measurements were fairly stable over time with most of the variation occurring between people whereas all types of dieting behaviors were less stable and suggested variation within people.

Baseline growth curve models were run to understand the nature of the individual trajectories over time for each of the variables (Shek & Ma, 2013). A linear model with a linear time parameter (Model 1), and a quadratic model with both linear and quadratic time parameters (Model 2) were examined. In the model time was entered as a fixed effect and individuals and linear slopes were allowed to vary randomly across individuals by entering intercept and linear time as random effects. Through these analyses it is possible to determine whether there is a constant increase or decrease (linear model) and the extent to which the linear rate of change accelerates or decelerates (quadratic model) when considering the fixed effect of time.

In testing Model 1, participants varied in their initial ratings of social overweight identification, personal overweight identification, affective overweight identification, number of all dieting behaviors, number of 'eat less, move more' strategies, number of 'healthy diet' strategies, and measures of BMI, body fat (%), and waist circumference (cm). All intercepts were significant (i.e., all ts>14.64, all ps<.001). Linear effects for time were detected for all dieting behaviors (β=.249, SE=.095, t=2.606, p=.011; 95% CI [.059, .439]), 'eat less, move

more' strategies (β=.193, *SE*=.058, *t*=3.349, *p*<.001; 95% CI [.079, .307]), personal overweight identification (β=-.200, *SE*=.064, *t*=-3.111, *p*<.001; 95% CI [-.326, -.073]), social overweight identification (β=.181, *SE*=.064, *t*=2.835, *p*=.006; 95% CI [.054, .308]), affective overweight identification (β=.154, *SE*=.057, *t*=2.664, *p*=.008; 95% CI [.040, .267]), self-esteem (β=.160, *SE*=.047, *t*=3.406, *p*=.001; 95% CI [.067, .252]), and weight dissatisfaction (β=-.298, *SE*=.073, *t*=-4.091, *p*<.001; 95% CI [-.442, -.154]). Linear effects for time were not detected for any of the other variables: 'Healthy diet' strategies (β=.057, *SE*=.067, *t*=.861, *p*=.392; 95% CI [-.075, .190]); Body fat (β=-.085, *SE*=.190, *t*=-.449, *p*=.654; 95% CI [-.461, .290]; Waist circumference (β=-.434, *SE*=.298, *t*=-1.454, *p*=.147; 95% CI [-1.021, .154]); Self-concept clarity (β=.054, *SE*=.057, *t*=.948, *p*=.346; 95% CI [-.059, .166]), and Weight Bias (β=-.073, *SE*=.041, *t*=-1.791, *p*=.077; 95% CI [-.154, .008]).

In testing Model 2, again participants varied in initial ratings of social overweight identification, personal overweight identification, affective overweight identification, number of all dieting behaviors, number of 'eat less, move more' strategies, number of 'healthy diet' strategies, and measures of BMI, body fat, and waist circumference (i.e., significant intercepts; all *t*s>13.76, all *p*s<.001). Effects for linear and quadratic time were detected for all dieting behaviors (Linear: β=1.10, *SE*=.286, *t*=3.84, *p*<.001; 95% CI [.531, 1.668]; Quadratic: β=-.426, *SE*=.135, *t*=-3.152, *p*=.002; 95% CI [-.694, -.157]), 'eat less, move more' behaviours (Linear: β=.717, *SE*=.203, *t*=3.54, *p*=.001; 95% CI [.315, 1.12]; Quadratic: β=-.262, *SE*=.097, *t*=-2.699, *p*=.009; 95% CI [-.456, -.069]), healthy dieting behaviours (Linear: β=.391, *SE*=.177, *t*=2.12, *p*=.029; 95% CI [.040, .742]; Quadratic: β=-.167, *SE*=.082, *t*=-2.038, *p*=.045; 95% CI [-.330, -.004]), and BMI (Linear: β=-.483, *SE*=.213, *t*=-2.269, *p*=.025; 95% CI [-.903, -.063]; Quadratic: β=.303, *SE*=.102, *t*=2.973, *p*=.003; 95% CI [.102, .505]).

Linear but not quadratic effects for time were detected for social overweight identity (Linear: β=.514, *SE*=.205, *t*=2.51, *p*=.014; 95% CI [.108, .921]; Quadratic: β=-.167, *SE*=.097,

t=-1.712, *p*=.091; 95% CI [-.360, .027]), affective overweight identity (Linear: *β*=.514, *SE*=.205, *t*=2.51, *p*=.013; 95% CI [.110, .919]; Quadratic: *β*=-.180, *SE*=.098, *t*=-1.833, *p*=.069; 95% CI [-.375, .014]), and weight dissatisfaction (Linear: *β*=-.556, *SE*=.260, *t*=-2.140, *p*=.034; 95% CI [-1.069, -.043]; Quadratic: *β*=.129, *SE*=.125, *t*=1.033, *p*=.303; 95% CI [-.117, .375]).

Quadratic but not linear effects for time were detected for waist circumference (Linear: *β*=2.017, *SE*=1.039, *t*=1.941, *p*=.054; 95% CI [-.035, 4.069]; Quadratic: *β*=-1.225, *SE*=.497, *t*=-2.463, *p*=.015; 95% CI [-2.208, -.243]), Self-concept clarity (Linear: *β*=-.286, *SE*=.171, *t*=-1.675, *p*=.097; 95% CI [-.624, .053]; Quadratic: *β*=.170, *SE*=.080, *t*=2.108, *p*=.038; 95% CI [.009, .330]).

Neither linear nor quadratic effects for time were found for body fat (Linear: *β*=-.001, *SE*=.671, *t*=-.001, *p*=.999; 95% CI [-1.326, 1.325]; Quadratic: *β*=-.042, *SE*=.322, *t*=-.132, *p*=.895; 95% CI [-.678, .593]), personal overweight identification (Linear: *β*=.014, *SE*=.230, *t*=.06, *p*=.952; 95% CI [-.440, .467]; Quadratic: *β*=-.107, *SE*=.110, *t*=-.967, *p*=.335; 95% CI [-.325, .111]), self-esteem (Linear: *β*=.124, *SE*=.157, *t*=.792, *p*=.43; 95% CI [-.186, .434]; Quadratic: *β*=.008, *SE*=.114, *t*=.238, *p*=.813; 95% CI [-.130, .166]), Weight bias (Linear: *β*=-.088, *SE*=.146, *t*=-.600, *p*=.550; 95% CI [-.378, .203]; Quadratic: *β*=.007, *SE*=.070, *t*=.104, *p*=.917; 95% CI [-.132, .147]).

Preliminary analyses suggest a linear increase in all dieting behaviors and 'eat less, move more' behaviours over time. As time was central to our hypotheses these variables were not detrended in subsequent analyses (i.e., time was not separated from the between and within effects or from this outcome variable; Wang & Maxwell, 2015). BMI, bodyfat and waist circumference were fairly stable. This stability might be expected as changes in body measurements tend not to be sustained over time. However, these findings do not preclude consideration of individual differences in change. This possibility was examined by focusing

on the between-person and within-person effects of overweight identification on dieting behaviours and body measurements. In light of these preliminary analyses, and because we did not have sufficient time points (i.e., $n < 4$), the quadratic effects for time and associated interactions were not examined.

B. Additional Analyses – Correlations between self-perceptions, weight-perceptions, and overweight identification

Pearsons correlations were computed to understand the relationships between self-perceptions, weight perceptions, and overweight identification over time (see *Table 1 (Supplement)*). Self-perceptions were related to personal and social aspects of overweight identification: Self-esteem was negatively related to PID at 12 months. Self-esteem and self-concept clarity were negatively related to SID at each time point. Self-esteem and self-concept clarity were unrelated to AID at each time point. Weight-perceptions were related to personal and affective overweight identification: Weight bias and weight dissatisfaction were positively related to PID at each time point, and negatively related to AID at each time point. Weight bias and weight dissatisfaction were unrelated to SID. The observed correlations were small to moderate, suggesting that while self-perceptions, weight-perceptions, and overweight identification might be related, they are not equivalent constructs.

C. Additional Analyses – Dieting behaviours and body measurements

Between-person and within-person effects were computed for dieting behaviors to assess whether participants' average number of behaviors overall or changes in the number of behaviors over time might predict body measurements. Separate models were considered for 'eat less, move more' behaviours and 'healthy' behaviours. All models adjusted for self-concept clarity, self-esteem, weight bias, and weight dissatisfaction (see *Table 2 (Supplement)*). For 'eat less, move more' behaviours, there was a significant between-person effect on body fat suggesting that every unit increase in 'Eat Less, Move More' dieting

behaviors was associated with a -1.82% decrease in bodyfat. There was also a significant within-person effect on body fat suggesting that within-person increases in 'Eat Less, Move More' dieting behaviors were associated with an 1.15% increase in body fat. A time by within-person interaction on body fat also emerged: At baseline and 6 months the simple slopes were significant (Baseline: b=1.1504, SE_b=.4502, z=-2.554, p=.0106; 6 months: b=.7982, SE_b=.2693, z=2.964, p=.003) indicating that as 'Eat Less, Move More' dieting behaviours increased, body fat increased. At 12 months the simple slope was not significant (b=.446, SE_b=.5977, z=.7462, p=.4555) suggesting that there was no relationship between 'Eat Less, Move More' dieting behaviours and body fat. There were no effects on BMI or waist circumference. For 'Healthy' dieting behaviours there was a significant time by within-person interaction on body fat: At baseline increases in healthy dieting behaviours were associated with decreases in body fat, b=-.8339, SE_b=.4253, z=1.9606, p=.05. At 6 months and 12 months, increases in healthy dieting behaviours were associated with increases in body fat (6 months: b=1.3545, SE_b=.2878, z=4.7067, p<.0001; 12 months: b=3.543, SE_b=.6683, z=5.3016, p<.0001). The marginal effect for time suggested that body fat decreased from baseline to 12 months. The marginal between-person effect for 'Healthy' dieting behaviours suggested that every unit increase in 'Healthy dieting behaviours was associated with a 1.73% increase in body fat. The marginal within-person effect for healthy behaviours suggested that increases in healthy behaviours were marginally associated with a -.834% decrease in body fat.

Table 1 (Supplement). Relationships between self-perceptions (between-person), weight-perceptions (between-person), and overweight identification variables over time.

	2	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***	***13***
1 Self-Esteem	.537***	-.532***	-.268*	-.203	-.163	-.249*	-.255*	-.320**	-.313**	.136	-.042	.108
2 Self-Concept Clarity		-.438***	-.10	.022	-.021	.033	-.227*	-.292**	-.315*	.062	.041	-.002
3 Weight Bias			.604***	.311**	.307*	.369**	.014	.122	.077	-.432**	-.252*	-.466***
4 Weight Dissatisfaction				.459***	.395**	.546***	-.132	-.027	-.053	-.368**	-.273*	-.359**
5 PID (baseline)					.532***	.783***	.145	.224*	.092	-.200	-.013	-.115
6 PID (6 months)						.665***	.133	.149	.152	-.120	-.178	-.035
7 PID (12 months)							.071	.234*	.205	-.153	-.037	-.056
8 SID (baseline)								.673***	.676***	.157	.063	.261*
9 SID (6 months)									.808***	.025	.168	.187
10 SID (12 months)										.073	.137	.374**
11 AID (baseline)											.613***	.698***
12 AID (6 months)												.578***
13 AID (12 months)												-

Table 2 (Supplement). Disaggregation of between and within effects of dieting behaviours on body composition

	BMI			Body Fat			Waist Circumference		
	Estimate *(SE)*	CI_L	CI_U	Estimate *(SE)*	CI_L	CI_U	Estimate *(SE)*	CI_L	CI_U
Model D: Eat Less, Move More Dieting Behaviours									
Intercept	30.26 *(1.03)****	28.21	32.31	39.09 *(2.13)****	34.84	43.34	102.01 *(2.82)****	96.40	107.61
Self-Concept Clarity	.65 *(.60)*	-.54	1.84	1.87 *(1.25)*	-.61	4.35	1.57 *(1.65)*	-1.71	4.84
Self-Esteem	-.61 *(.60)*	-1.80	.59	-1.35 *(1.24)*	-3.83	1.13	-.35 *(1.65)*	-3.63	2.93
Weight Dissatisfaction	.33 *(.35)*	-.36	1.02	1.14 *(.72)*	-.29	2.57	1.30 *(.95)*	-.59	3.19
Weight Bias	.44 (.59)	-.73	1.61	.87 *(1.22)*	-1.56	3.29	1.24 *(1.61)*	-1.96	4.44
Time (Linear)	.19 *(.15)*	-.22	.48	-.23 *(.45)*	-1.13	.66	-.63 *(.71)*	-2.02	.77
Between-person	-.06 *(.39)*	-.84	.72	-1.82 *(.81)**	-3.44	-.20	-.07 *(1.07)*	-2.20	2.07
Within-person	-.12 *(.15)*	-.42	.18	1.15 *(.45)**	.26	2.04	1.20 *(.70)*	-.18	2.58
Time*Between-person	-.02 *(.05)*	-.13	.09	.03 *(.17)*	-.31	.36	.02 *(.27)*	-.51	.54
Time*Within-person	.13 *(.15)*	-.17	.43	-1.35 *(.46)***	-2.25	-.45	-.74 *(.71)*	-2.14	.65
Model E: Healthy Dieting Behaviours									
Intercept	30.66 *(1.62)****	27.43	33.89	28.87 *(3.58)****	26.56	37.53	106.25 *(4.51)****	97.27	115.23
Self-Concept Clarity	.66 *(.58)*	-.50	1.82	1.68 *(1.22)*	-.74	4.10	1.62 *(1.61)*	-1.59	4.83
Self-Esteem	-.51 *(.59)*	-1.70	.67	-2.20 *(1.24)*	-4.68	.27	-.27 *(1.65)*	-3.55	3.01
Weight Dissatisfaction	.30 *(.25)*	-.37	.97	1.10 *(.70)*	-.31	2.50	1.46 *(.93)*	-.40	3.31
Weight Bias	.46 (.58)	-.69	1.62	-.36 *(1.21)*	-2.76	2.05	1.30 *(1.60)*	-1.89	4.49
Time (Linear)	-.31 *(.34)*	-.80	.19	-1.38 *(.73)*^{I}	-4.26	.02	-.05 *(1.23)*	-2.47	2.36
Between-person	-.16 *(.50)*	-1.15	.83	1.73 *(1.09)*	-.93	2.42	-1.46 *(1.38)*	-4.21	1.29
Within-person	.24 *(.14)*	-.04	.53	-.83 *(.43)*^{I}	-2.35	.07	.25 *(.68)*	-1.10	1.59
Time*Between-person	.13 *(.08)*	-.02	.28	.42 *(.22)*^{I}	.05	1.35	-.12 *(.37)*	-.86	.61
Time*Within-person	-.18 *(.17)*	-.51	.15	2.19 *(.48)****	1.35	3.92	-.58 *(.79)*	-2.14	.99
Model Comparisons									
Model D AIC	916.54			1377.66			1557.58		
Model E AIC	913.01			1365.17			*1553.94*		
Model F AIC	*907.48*			*1348.46*			*1553.58*		
Intercept Only AIC	911.48			1386.61			1577.44		

Note. $^{I}p<.07$, $^{*}p<.05$, $^{**}p<.01$, $^{***}p<.001$; Akaike Information Criterion (AIC) values in *italics* indicate the best fit relative to the intercept-only