# Contrasting constructs or continuum?

More, Kimberly; Hayes, Nicole; Phillips, L. Alison

*Published in:*
Psychology & Health

*DOI:*
10.1080/08870446.2022.2055025

*Publication date:*
2022

Psychology & Health

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/gpsh20

# Contrasting constructs or continuum? Examining the dimensionality of body appreciation and body dissatisfaction

Kimberly R. More, Nicole L. Hayes & L. Alison Phillips

**To cite this article:** Kimberly R. More, Nicole L. Hayes & L. Alison Phillips (2022): Contrasting constructs or continuum? Examining the dimensionality of body appreciation and body dissatisfaction, Psychology & Health, DOI: 10.1080/08870446.2022.2055025

**To link to this article:** https://doi.org/10.1080/08870446.2022.2055025



Published online: 01 Apr 2022.

PSYCHOLOGY & HEALTH
https://doi.org/10.1080/08870446.2022.2055025



# Contrasting constructs or continuum? Examining the dimensionality of body appreciation and body dissatisfaction

Kimberly R. More[a], Nicole L. Hayes[b] and L. Alison Phillips[b]

[a]Department of Psychology, University of Dundee, Dundee, Scotland; [b]Department of Psychology, Iowa State University, Ames, IA, USA

**ABSTRACT**

Individuals experiencing body dissatisfaction have poorer health outcomes in part due to engaging in less physical activity. Body appreciation is protective of health behaviors and proposed to be conceptually different from body dissatisfaction. Two studies evaluated whether body appreciation and dissatisfaction represented two distinct dimensions, and whether body appreciation and dissatisfaction would interact in their effect on activity-related motivation and behavior. Study 1 (n = 313) was prospective and utilized a self-report measure of physical activity whereas Study 2 (n = 123) was prospective and used an objective measure. All hypotheses and analyses were pre-registered. A multiverse approach was taken to demonstrate the robustness of results. In exploratory factor analyses, body appreciation and dissatisfaction did not represent two distinct dimensions of body image as both loaded onto the same factor. This result was largely supported by latent profile analyses, which revealed that participants scored high, moderate, or low on both body satisfaction and appreciation. Additionally, body appreciation did not buffer the negative impact of body dissatisfaction on activity-related motivation and behavior. This study provides the first statistical evaluation of the theoretical proposition that body appreciation and dissatisfaction may be distinct constructs with distinct relationships to outcomes.

**ARTICLE HISTORY**
Received 3 May 2021
Accepted 11 March 2022

## Introduction

Individuals who are dissatisfied with their bodies (i.e., who perceive an unfavorable discrepancy between their actual and ideal body) have poorer health outcomes irrespective of obesity indicators (Černelič-Bizjak & Jenko-Pražnikar, 2014). It is likely that this increased health-risk is partly due to body dissatisfaction being associated with lower quality motivation for, and decreased engagement in, cardiovascular activity (More & Phillips, 2019; Neumark-Sztainer et al., 2006). The present study seeks to inform intervention research by examining whether this risk can be mitigated by co-occurring body appreciation.

**CONTACT** Kimberly R. More kmore001@dundee.ac.uk Department of Psychology, University of Dundee, Dundee, Scotland.

Body appreciation is proposed to be conceptually distinct from the continuum of body dissatisfaction (Tylka & Wood-Barcalow, 2015a) as it is considered a multifaceted construct that encompasses optimism, a broader conceptualization of beauty that extends beyond social ideals, and a tendency to view one's body in terms of functionality rather than appearance. Specifically, a correlational study by Tiggemann and McCourt (2013) found that body appreciation increased with age whereas body dissatisfaction was unrelated to age. Body appreciation has also been shown to be uniquely associated with well-being, independent of body dissatisfaction or negative body image, in observational research (Avalos et al., 2005; Tylka & Wood-Barcalow, 2015b). Thus, unlike body dissatisfaction, body appreciation is thought to be protective of physical health behaviors and outcomes. For example, with regard to physical activity, women who appreciate their bodies are more autonomously motivated to pursue and engage in more regular, moderate-intensity cardiovascular activity (Homan & Tylka, 2014; Wood-Barcalow et al., 2010). This is especially important considering that more autonomous forms of motivation are associated with maintained engagement in health behaviors over time (Buckworth et al., 2007).

Although some research has shown that body appreciation and dissatisfaction can be experienced simultaneously (Tiggemann & McCourt, (2013) and are uniquely related to health-outcomes (Avalos et al., 2005; Tylka & Wood-Barcalow, 2015b), research has yet to empirically test whether they are distinct constructs or whether they have distinct relationships with motivation for, and engagement in, physical activity. The purpose of the present study is to evaluate whether body appreciation is a distinct construct from body dissatisfaction (rather than being opposite ends of a single continuum), and whether these constructs have combined, and potentially interactive, effects on motivation and physical activity. Specifically, it may be that higher levels of body appreciation not only promote engagement in physical activity, but act as a protective factor against body dissatisfaction (i.e., the negative relationship between body dissatisfaction and activity engagement and motivation may be attenuated by body appreciation). A secondary purpose of this research is to test whether individuals fall into distinct and reliable sub-groups on these dimensions such that some individuals may represent a particularly high-risk group in terms of physical inactivity. That is, individuals with low levels of body appreciation and high levels of body dissatisfaction may represent a higher risk group as compared to individuals with high levels of both body appreciation and body dissatisfaction. Considering research on the co-occurrence of body appreciation and dissatisfaction is sparse, this study aims to contribute to the literature by directly examining whether high levels of body appreciation can co-occur with moderate and high levels of body dissatisfaction. These questions are important to address as body appreciation may be malleable with intervention and could, therefore, be targeted by behavior change techniques to help individuals engage in more regular physical activity via more autonomous motivation (Tiggeman & McCourt, 2013; Tylka & Wood-Barcalow, 2015a).

It was hypothesized that (1) body appreciation and body dissatisfaction would represent two distinct dimensions, and (2) body appreciation and dissatisfaction would interact in their effect on motivation to be active and volume of moderate-to-vigorous intensity physical activity such that having higher body appreciation would mitigate the negative relationship between body dissatisfaction and those outcomes. Hypothesis

1 was tested using exploratory factor analysis to assess the theoretical factor structure between body appreciation and dissatisfaction. Hypothesis 2 was tested using an appropriate methodology that allows evaluating moderation effects with continuous dimensions (rather than evaluating relationships between a predictor and outcome at only certain levels of the moderator) —polynomial regression and response surface methodology (Phillips, 2013). It was further hypothesized that (3) individuals would be classified into profiles (i.e., higher versus lower risk groups) regarding body appreciation and dissatisfaction, and that group membership would differ in their motivation for, and engagement in, physical activity. Latent profile analysis was used to identify these groups and allow for a determination of the prevalence and demographic composition of these groups (i.e., gender, ethnicity, and age) providing insight into which types of people are likely to fall within higher-risk categories. Finally, it was hypothesized that (4) individuals with higher levels of body appreciation would engage in more physical activity due to their higher levels of intrinsic motivation and lower levels of external motivation. Mediation was used to test hypothesis 4 to assess mechanisms of action. Hypotheses and associated analyses were pre-registered (https://osf.io/kyrdw). Although both studies described below use secondary data collected by the first and third author, the initial study (i.e., Study 1) was pre-registered prior to analyses and was followed up with a confirmatory analysis with secondary data using objectively measured activity data from accelerometer-based devices and a prospective approach, which used the same pre-registered hypotheses and analytic technique. Data are available upon request.

## Study 1 method

### Participants and procedure

Participants consisted of 334 undergraduates who took part for course credit. Young adults represent an especially important population regarding the negative impacts of body dissatisfaction on health behaviors, as dissatisfaction tends to increase during the transition to young adulthood, among both females and males (Bucchianeri et al., 2013).

Demographics, body appreciation, body dissatisfaction, and motivation were reported at baseline. Physical activity was reported at a two-week follow-up session. All data were collected in person. Three participants that failed either of two random response checks were removed from all analyses ($n = 331$). On average, after removal of random responders, participants were 19.13 ($SD = 2.05$) years of age. The majority of participants reported being female (71%) and Caucasian (80%).

### Measures

#### Body appreciation

Body appreciation was measured using the 13-item Body Appreciation Scale (e.g., 'I take a positive attitude toward my body'; Avalos et al., 2005). Items were rated on a five-point Likert-type scale ranging from '*Never*' to '*Always*' with higher scores corresponding to higher body appreciation ($\alpha = .93$, $M = 3.52$, $SD = 0.77$).

### Body dissatisfaction

Body dissatisfaction was measured using the 10-item Body Shape Satisfaction Scale (Pingitore et al., 1997). Items were rated on a five-point Likert-type scale ranging from '*Very satisfied*' to '*Very dissatisfied*' with higher scores corresponding to higher levels of body dissatisfaction (α = .88, $M = 2.73$, $SD = 0.79$).

### Motivation

Intrinsic motivation was measured using the four-item subscale for Intrinsic Motivation from the Behavioral Motivation in Exercise Questionnaire-2 (e.g., 'I enjoy my exercise sessions'; Markland & Tobin, 2004). Items were rated on a five-point Likert-type scale ranging from '*Not true for me*' to '*Very true for me*' with higher scores corresponding to higher levels of intrinsic motivation (α = .91, $M = 3.31$, $SD = 0.98$). External motivation was also measured using a subscale from the Behavioral Motivation in Exercise Questionnaire-2 (e.g., 'I exercise because other people say I should') with higher scores corresponding to higher levels of external motivation (α = .78, $M = 1.93$, $SD = 0.78$).

### Physical activity volume

Physical activity was assessed using the International Physical Activity Questionnaire (Booth, 2000), which asks participants to recall the previous seven days and report how many days and for how many minutes during each of those days they engaged in light, moderate, or vigorous intensity activity. Due to the behavior of interest being moderate-to-vigorous physical activity (MVPA; what could count towards guidelines for cardiovascular health), the variable used in the present study was a total of reported minutes of moderate and vigorous activity on days participants reported being active over the previous seven days ($M = 264.24$, $SD = 288.58$).

## Statistical analyses

The appropriateness of the sample size of the dataset used in Study 1 was examined first for exploratory factor analysis—as hypothesis 1 is of primary interest. The appropriateness of exploratory factor analysis as a statistical technique relies on many parameters including communalities, number of factors extracted, number of items utilized, and sample size (de Winter et al., 2009). In the present data, the average extracted communality score was .47, the number of factors hypothesized were two, and the number of items utilized was 23.

Thus, to test the hypothesis, 134 participants would be needed. This condition was met for Study 1. Since the data were secondary in nature and power analyses were done post-hoc, analyses were based on a range of effect sizes rather than the effect size found in the results as this has been shown to be problematic (Gelman, 2019). Second, for polynomial regression, power to detect a fixed model $R^2$ increase with two tested predictors (two linear) and five total predictors (3 quadratic and two linear) was assessed in G*Power (Faul et al., 2007). Using .80 power and an alpha of .05 revealed that 485 participants would be needed to detect a small effect ($f^2$ = .02), 117 participants to detect a small-medium effect $f^2$ = .085), 68 to detect a medium effect ($f^2$ = .15), and 32 to detect a large effect ($f^2$ = .35). Thus, Study 1 is well powered to test polynomial regression with small-medium to large effects for two linear predictors and five total predictors. Third, power to detect the correct number of latent classes in a latent profile model depends on the interclass distance between classes, sample size, and number of indicators (Tein et al., 2013). Therefore, the power to detect the correct number of classes was estimated using Monte Carlo simulation in Mplus software. Using an alpha of .05, sample sizes of 100, 300, and 500, with the distance between classes representing medium (.5), large (.8), and very large (2) effects were evaluated using the adjusted Lo-Mendell Rubin test and bootstrap likelihood ratio test. To achieve power (.80) of correctly identifying a three-class model, with two indicators, with medium, large, and very large effects required a sample size of greater than 500, 300, and 100, respectively. Study 1 has sufficient power to correctly identify the correct number of classes, with both large and very large distances between classes. Finally, the statistical power to detect indirect effects in mediation analysis was examined using Monte Carlo simulation in Mplus. The statistical power needed to detect small/medium (.2), medium (.3), and large (.5) in simple and complex models using sample sizes of 100, 300, and 500 with alpha set at .05 was evaluated. Using .80 power and and alpha of .05 revealed that a sample size greater than 500 was needed to detect small/medium effects (.2), 380 to detect medium effects (.3), and 200 to detect large effects (.5). Power to detect a medium indirect effect in a sample of 300 was .68, which indicated that Study 1 was slightly underpowered for mediation analyses.

Data were evaluated for random responding, missing values, multivariate and univariate outliers, and assumptions of regression. Random responders were eliminated from the dataset ($n = 3$) as their inclusion can greatly affect results in observational research (Credé, 2010). There was one value missing on both the Body Appreciation Scale and the Body Shape Satisfaction Scale; a value was imputed for this case using person-centered imputation. Eleven participants were missing a value for total physical activity volume. Missing data were not imputed for total physical activity volume, as missing data represented ≥50% of each individual's activity-related data (Garson, 2015). No participants scored beyond the accepted range of active hours per day (>16 hours per day), according to the International Physical Activity Questionnaire Guidelines ($n = 0$; International Physical Activity Questionnaire, n.d.). The maximum amount of time engaging in MVPA was 8.57 hours per day.

Data for multivariate outliers were then examined using Mahalanobis distance values ($p < .001$). Outliers were examined for the combination of the following variables: body dissatisfaction, body appreciation, intrinsic motivation, and physical activity (Critical value: $\chi^2 = 18.47$). Identified multivariate outliers ($n = 6$) were removed. These results did not vary with the inclusion of person-centered mean imputation. Univariate outliers were examined using the $z > 3.33$ cut-off ($p < .001$). For the dataset including multivariate outliers, univariate outliers were examined for physical activity ($n = 3$), body appreciation ($n = 0$), body dissatisfaction ($n = 0$), and intrinsic motivation ($n = 0$). For the dataset excluding multivariate outliers, univariate outliers remained the same. Neither of these results vary with the inclusion of person-centered mean imputation.

Considering the presence of missing data, multivariate, and univariate outliers, the analyses were conducted eight ways, which is in line with a multiverse analysis approach (Steegen et al., 2016). Specifically, the dataset with person-centered mean imputation and the dataset without person-centered mean imputation were analyzed (1) with the inclusion of both multivariate and univariate outliers, (2) with the exclusion of multivariate outliers only, (3) with the exclusion of univariate outliers only, and (4) with the exclusion of both multivariate and univariate outliers. It was predetermined that if the results did not differ, then they would be reported for the model that best fits the data in terms of assumptions. Conversely, if the results did differ, then variations from the aforementioned analysis would be reported.

Finally, regression assumptions were tested for each multiverse variation including (1) multicollinearity (variance inflation factor <10 and tolerance scores >.2 represent an absence of multicollinearity), (2) auto-correlation, which was examined using the Durbin-Watson test (scores >1 and <3 indicate no concerning auto-correlation), (3) homoscedasticity (standardized residuals were plotted against standardized predicted values and an absence of a funnel or fan shape represented homoscedasticity), (4) linearity (standardized residuals were plotted against standardized predicted values and an absence of a curvilinear shape represented linearity), and (5) normality (P-P plot examined for violations). The data with the inclusion of person-centered mean imputation with the exclusion of multivariate outliers met all of the regression assumptions and, therefore, is reported in subsequent analyses. Correlations between variables are presented in Table 1.

Hypothesis 1 was tested using exploratory factor analysis alongside parallel analysis to determine the number of factors to extract (Zwick & Velicer, 1986). Parallel analysis has been shown to be more accurate in comparison with other methods such as scree tests, Bartlett's chi-square test, and Kaiser's method. The Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test of sphericity were used to determine whether the data were suitable for factor analysis. Hypothesis 2 was tested using polynomial regression. Polynomial regression is a hierarchical linear regression that includes both predictors (body dissatisfaction = X and body appreciation = Y) and their polynomial terms (e.g., quadratic terms that can capture curvilinear effects on the outcomes, $X^2$, $Y^2$, and the interaction term, XY) in separate steps to predict the outcomes (intrinsic motivation for the first analysis, physical activity volume for the second analysis = Z). Polynomial regression allows researchers to more fully evaluate interaction effects between two predictors on an outcome (Phillips, 2013) as it shows the relationships of interest in three dimensions and is not limited to the more standard way of evaluating interactions, which evaluates the relationship between one predictor and the outcome at two values (typically +/− 1 SD) of the moderator (i.e., the second predictor). In addition to evaluating full interaction effects, polynomial regression can detect curvilinear effects—for example, if body dissatisfaction has particularly strong relationships with physical activity volume when it is very high and/or very low (versus towards the center of the scale or average levels of dissatisfaction).

Hypothesis 3 was tested using latent profile analysis (LPA). LPA is a person-centered approach that identifies groups within a heterogeneous sample by estimating the probability that individuals belong to different groups. LPA models were estimated in Mplus version 7.2 (Muthén & Muthén, 2017), with maximum likelihood estimation. As there is no single criterion for deciding on the number of classes, model selection requires

**Table 1.** Zero-order correlations.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. Body appreciation | | −.75 | .29 | −.13 | .02 |
| 2. Body dissatisfaction | −.78 | | −.29 | .22 | −.05 |
| 3. Intrinsic motivation | .28 | −.27 | | −.17 | .29 |
| 4. External motivation | −.27 | .28 | −.08 | | −.14 |
| 5. Physical activity | .16 | −.20 | .28 | .03 | |

*Note*. Correlations are below the diagonal for Study 1 and above the diagonal for Study 2.

consideration of theory, model class sizes, parsimony, as well as statistical support. Multiple models were evaluated using Akaike information criteria (AIC), Bayesian information criteria (BIC), Adjusted BIC, entropy values, the Lo-Mendel-Rubin Adjusted Likelihood Test (LMRT), and the Bootstrap Likelihood Ratio Test (BLRT). Models with different numbers of profiles are compared using information criteria including AIC, BIC, and Adjusted BIC. Lower values on these fit indices indicate better model fit. The accuracy of the model classification is examined with entropy and posterior probabilities, with values ranging from 0 to 1. Higher scores represent greater classification accuracy. The LMRT and the BLRT test whether a model with $k$ profiles provides a significant ($p < .05$) improvement in model fit compared with a model with $k-1$ profiles. A significant $p$-value indicates that there is an improvement in the fit of the model to the data.

Finally, hypothesis 4 was tested using Hayes (2013) PROCESS model 4 for mediation with 5000 bootstrapped samples.

## Study 1 results

### *Hypothesis 1*

The first hypothesis—that body appreciation and body dissatisfaction would represent two distinct dimensions—(see Table 2) was tested using maximum likelihood exploratory factor analysis with a direct oblimin (i.e., correlated) rotation to evaluate the distinctness of theoretical dimensions (Hurley et al., 1997). The data were determined to be suitable for factor analysis based on both the Kaiser-Meyer-Olkin measure of sampling adequacy (.96) and Bartlett's test of sphericity ($\chi^2 = 4965.26$, $p < .001$). A parallel analysis (Zwick & Velicer, 1986) revealed that only one factor should be extracted. This factor accounted for 48.95% of the variance and represented a general body image factor with both

**Table 2.** Exploratory factor analysis for Study 1.

| Item | Factor loading | Extraction communality |
|---|---|---|
| On the whole, I am satisfied with my body | .90 | .81 |
| I feel good about my body | .88 | .77 |
| My feelings towards my body are positive for the most part | .88 | .77 |
| I take a positive attitude toward my body | .88 | .77 |
| Despite its imperfections, I still like my body | .87 | .76 |
| Despite its flaws, I accept my body for what it is | .84 | .70 |
| Body Shape | −.76 | .58 |
| I feel that my body has at least some good qualities | .76 | .58 |
| Weight | −.72 | .52 |
| Stomach | −.72 | .52 |
| I respect my body | .71 | .51 |
| Body build | −.66 | .43 |
| Waist | −.66 | .44 |
| I am attentive to my body's needs | .62 | .39 |
| Hips | −.62 | .38 |
| Thighs | −.56 | .32 |
| Face | −.53 | .28 |
| My self-worth is independent of my body shape or weight | .51 | .26 |
| I do not allow unrealistic images of women/men presented in the media to affect my attitude toward my body | .50 | .25 |
| I engage in healthy behaviors to take care of my body | .49 | .24 |
| I do not focus a lot of energy on being concerned about my body shape or weight | .47 | .22 |
| Shoulders | −.46 | .22 |
| Height | −.17 | .03 |

body dissatisfaction and body appreciation items loading at ≥.46 (except for the first body dissatisfaction item 'Height' loading at −.17). Thus, the first hypothesis that body appreciation and body dissatisfaction would represent two distinct dimensions was rejected as body appreciation and body dissatisfaction both loaded onto one factor. This pattern of results was the case for the entirety of the multiverse analysis pertaining to Hypothesis 1, which highlights the robustness of results to researcher degrees of freedom. The bivariate correlation between the two constructs was $r = -.78$.

## Hypothesis 2

Although Hypothesis 1 was not supported, all analyses of all hypotheses are presented in accordance with the pre-registration of this study. The second hypothesis—that body appreciation and dissatisfaction would interact in their effect on motivation to be active and volume of moderate-to-vigorous intensity physical activity, such that having higher body appreciation would mitigate the negative relationship between body dissatisfaction and those outcomes, was tested with exploratory polynomial regression.

In the test of the second hypothesis, only the linear model was significant for both intrinsic motivation ($R^2$ = .09, $p$ < .001) and physical activity ($R^2$ = .04, $p$ = .001; see Table 3). Intrinsic motivation was predicted by body appreciation but not by body dissatisfaction. Specifically, individuals who had higher levels of body appreciation also had higher levels of intrinsic motivation. Conversely, physical activity was predicted by body dissatisfaction but not by body appreciation. Specifically, individuals who had higher levels of body dissatisfaction engaged in less moderate and vigorous activity. The multiverse analysis was consistent for the polynomial regression models with intrinsic motivation specified as the outcome variable, which highlights the robustness of these results. When physical activity was specified as an outcome, the linear model was not significant in 25% of the models ($p$ > .05) and in an additional 25% of the models, body dissatisfaction did not predict physical activity engagement ($p$ > .05). In light of these results, Hypothesis

**Table 3.** Polynomial regression results for Studies 1 and 2.

| | Unstandardized coefficients | | Standardized coefficients | | |
|---|---|---|---|---|---|
| Variable | *b* | *SE* | *β* | *t* | *p* |
| **Study 1** | | | | | |
| Intrinsic motivation | | | | | |
| Constant | 3.15 | .07 | | 48.51 | <.001 |
| Body dissatisfaction | −.14 | .11 | −.11 | −1.30 | .196 |
| Body appreciation | .25 | .11 | .20 | 2.30 | .023 |
| Physical activity | | | | | |
| Constant | 224.72 | 11.80 | | 19.05 | <.001 |
| Body dissatisfaction | −43.01 | 19.26 | −.20 | −2.23 | .026 |
| Body appreciation | 1.59 | 19.64 | .01 | 0.08 | .936 |
| **Study 2** | | | | | |
| Intrinsic motivation | | | | | |
| Constant | 3.77 | 14 | | 27.25 | <.001 |
| Body dissatisfaction | −.28 | .18 | −.22 | −1.53 | .130 |
| Body appreciation | .08 | .19 | .06 | 0.42 | .676 |
| Physical activity | | | | | |
| Constant | 668.31 | 36.87 | | 18.12 | <.001 |
| Body dissatisfaction | −31.82 | 45.94 | −.11 | −0.69 | .490 |
| Body appreciation | −27.76 | 50.53 | −.08 | −0.55 | .584 |

**Table 4.** Fit statistics for the latent profile analysis of body appreciation and body dissatisfaction.

| Number of groups | AIC | BIC | SSA BIC | Entropy | LMRT | *p* | BLRT | *p* | Group sample sizes 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Study 1** | | | | | | | | | | | | | |
| 1 | 1525.37 | 1540.50 | 1527.81 | 1.00 | | | | | 325 | | | | |
| 2 | 1344.98 | 1371.46 | 1349.26 | 0.73 | 176.24 | <.001 | 186.39 | <.001 | 150 | 175 | | | |
| 3 | 1252.04 | 1289.88 | 1258.16 | 0.80 | 93.55 | <.001 | 98.94 | <.001 | 37 | 129 | 159 | | |
| 4 | 1212.37 | 1261.56 | 1229.32 | 0.81 | 43.18 | .001 | 45.67 | <.001 | 123 | 33 | 40 | 129 | |
| 5 | 1201.38 | 1261.92 | 1211.17 | 0.83 | 16.07 | .076 | 16.99 | <.001 | 119 | 58 | 101 | 14 | 33 |
| **Study 2** | | | | | | | | | | | | | |
| 1 | 494.70 | 505.46 | 492.82 | 1.00 | | | | | 109 | | | | |
| 2 | 442.57 | 461.41 | 439.29 | 0.76 | 54.27 | .004 | 58.13 | <.001 | 70 | 39 | | | |
| 3 | 421.03 | 447.95 | 416.35 | 0.83 | 25.71 | .019 | 27.54 | <.001 | 63 | 35 | 11 | | |
| 4 | 413.16 | 448.15 | 407.07 | 0.85 | 12.95 | .016 | 13.87 | <.001 | 26 | 16 | 10 | 57 | |
| 5 | 409.10 | 452.16 | 401.60 | 0.86 | 9.40 | .109 | 10.07 | .115 | 6 | 26 | 46 | 30 | 1 |

2, that body appreciation and dissatisfaction would interact in their effect on motivation and engagement in physical activity, was rejected. That is, body appreciation does not buffer the negative effect of body dissatisfaction on physical activity-related outcomes.

## *Hypothesis 3*

To determine whether participants belong to different profiles, or groups, based on their body appreciation and dissatisfaction, latent profile analysis (LPA) was conducted. LPA models ranging from two to five groups were examined to identify the optimal number of groups to retain (see Table 4 for fit indices). The IC indices (AIC, BIC, and SSA-BIC) all suggested that four or more classes are preferred. It is important to note that as additional classes are added the model fit tends to improve with all else being equal. The LMRT suggested that the two-class model provides significantly better fit than a one-class model, that a three-class model provides better fit than the two-class model, and that a four-class model provides better fit than a three-class model. The BLRT was significant for all solutions.

Both the three-class model and the four-class models were examined further. Upon examining group classification on the indicators (body appreciation and body dissatisfaction), it appeared that the four-class model included a group that was moderately-high in body appreciation and average in body dissatisfaction scores. This group does not emerge with the three-class model, those classified as high in body appreciation and low in body dissatisfaction in the three-class model were classified as moderately-high in body appreciation and average in body dissatisfaction in the four-class model. Based on parsimony, model fit, and class size, a three-class model appears to represent the best solution. This pattern of results was the case for the entirety of the multiverse analysis pertaining to Hypothesis 3, which highlights the robustness of results to researcher degrees of freedom. Similar to the first two hypotheses, the data are reported with the inclusion of person-centered mean imputation and with the removal of multivariate outliers only since these data best met the assumptions of linear regression (i.e., all the assumptions were met). The three-group model also classified individuals with a high degree of accuracy with classification


**Figure 1.** Study 1: Three-class model of body appreciation and body dissatisfaction.

**Table 5.** Mean (SD) group differences in intrinsic motivation and physical activity.

| | High BA/Low BD (*n* = 129; 35) | AVG BA/BD (*n* = 159; 63) | Low BA/High BD (*n* = 37; 11) | *F* | *p* |
|---|---|---|---|---|---|
| **Study 1** | | | | | |
| Intrinsic motivation | $3.66_a$ (0.87) | $3.13_b$ (0.97) | $2.90_b$ (1.09) | 5.572 | <.01 |
| Physical activity | $268.25_a$ (181.34) | $207.55_b$ (167.58) | $190.07_b$ (151.45) | 14.915 | <.001 |
| **Study 2** | | | | | |
| Intrinsic motivation | $4.31_a$ (0.72) | $3.76_b$ (0.96) | $3.45_b$ (0.98) | 5.245 | <.01 |
| Physical activity | $585.76_a$ (386.90) | $606.40_a$ (240.43) | $646.44_a$ (376.53) | 0.167 | >.05 |

*Note*. Values with different notations differ significant.

accuracy ranging from 0.872 to 0.921 (Figure 1 displays the three classes and means for endorsing body appreciation and body dissatisfaction indicators).

As indicated in Table 5, class 1 (11.3%, $n = 37$) was characterized by low body appreciation and high body dissatisfaction whereas class 2 (39.6%, $n = 129$) was characterized by high body appreciation and low body dissatisfaction. Finally, class 3 (48.9%, $n = 159$) was characterized by average body appreciation and average body dissatisfaction. Whether the latent profile groups differed from one another on motivation and physical activity was examined using multivariate analysis of variance (MANOVA) and post hoc Games-Howell pairwise comparisons, adjusting for familywise error. This pattern of results was the case for the entirety of the multiverse analysis pertaining to hypothesis 3. The data are reported with the inclusion of person-centered mean imputation and with the removal of multivariate outliers only as these data best met the assumptions of linear regression (i.e., all the assumptions were met). Overall, groups significantly differed on intrinsic motivation and physical activity ($F(4, 642) = 8.382$, $p < .001$, Wilks $\Lambda = .903$, partial $\eta^2 = 0.50$). Univariate testing indicated that intrinsic motivation and physical activity significantly differed among the three groups ($F(2, 322) = 14.915$, $p < .001$, partial $\eta^2 = 0.033$; $F(2, 322) = 5.572$, $p < 0.01$, partial $\eta^2 = 0.085$; respectively). The high body appreciation/low body dissatisfaction group ($M = 3.66$, $SD = 0.87$), compared to both the average body appreciation/average body dissatisfaction group ($M = 3.13$, $SD = 0.97$, $g = 0.57$), and the low body appreciation/high body dissatisfaction group ($M = 2.90$, $SD = 1.09$, $g = 0.82$), reported significantly higher levels of intrinsic motivation. The high body appreciation/low body dissatisfaction group ($M = 268.25$, $SD = 181.34$), compared to both the average body appreciation/average body dissatisfaction group ($M = 207.55$, $SD = 167.58$, $g = 0.35$), and the low body appreciation/high body dissatisfaction group ($M = 190.07$ $SD = 151.45$, $g = 0.45$), reported significantly higher levels of physical activity engagement.

Whether groups differed in terms of gender, age, and ethnicity was also examined. For gender, significant differences emerged ($\chi^2$ (4) = 18.03, $p$ < .001) such that the high body appreciation/low body dissatisfaction group had the lowest percentage of females (68.2%), compared to the average body appreciation/body dissatisfaction group (76.1% female) and the low body appreciation/high body dissatisfaction group (83.8% female). Conversely, the groups did not significantly differ in terms of ethnicity ($\chi^2$ (14) = 22.367, $p$ = .070) or age ($F$(2, 322) = 1.576, $p$ = .208).

## *Hypothesis 4*

The fourth hypothesis examining whether the relationship between body appreciation and physical activity as mediated by external and intrinsic motivation was examined using Hayes (2013) PROCESS model 4 for mediation with 5000 bootstrapped samples. There was one univariate outlier for external motivation, three univariate outliers for physical activity, and nine multivariate outliers for the combination of variables used in this analysis. Once multivariate outliers were removed, there were only two univariate outliers for the physical activity variable. These results did not vary with the inclusion of person-centered mean imputation on the body appreciation variable. Similar to the first three hypotheses, the data are reported with the inclusion of person-centered mean imputation and with the removal of multivariate outliers only as these data best met the assumptions of linear regression (i.e., all the assumptions were met). First, higher levels of body appreciation predicted higher levels of intrinsic motivation ($b$ = .40 ($SE$ = .07) [95% CI: .22, .49]) and lower levels of external motivation ($b = -.26$ ($SE$ = .05) [95% CI: −.36, −.15]). Second, higher levels of intrinsic motivation predicted higher levels of physical activity engagement ($b = 47.38$ ($SE = 9.60$) [95% CI: 28.49, 66.28]). The mediated effect of body appreciation on physical activity engagement through intrinsic motivation was significant (Completely standardized indirect effect: $\beta$ = .08 [95% CI: .04, .12]) meaning that individuals who had higher levels of body appreciation engaged in more physical activity because they had higher levels of intrinsic motivation. External motivation did not predict physical activity engagement ($b = 6.11$ ($SE = 12.22$) [95% CI: −17.93, 30.15]), nor did it mediate the relationship between body appreciation and physical activity engagement (Completely standardized indirect effect: $\beta$ = −.01 [95% CI: −.04, .02]). Finally, there was no direct effect of body appreciation on physical activity engagement when the mediators were accounted for ($b = 22.93$ ($SE = 12.57$) [95% CI: −1.80, 47.67]). The total effect was significant ($b = 38.14$ ($SE = 12.12$) [95% CI: 14.28, 61.99]), except for in two iterations (25%). This pattern of results was the case for the entirety of the multiverse analysis pertaining to the exploratory hypothesis, which highlights the robustness of the results to researcher degrees of freedom.

## Study 2 method

### Participants and procedure

Participants were 87 undergraduates and 36 university staff ($n = 123$). Thirteen participants failed the random response check at baseline and were removed from all analyses ($n = 110$). Demographics, the Body Appreciation Scale (α = .92, $M = 3.76$, $SD = 0.70$), the Body Shape Satisfaction Scale (α = .88, $M = 2.55$, $SD = 0.74$), and intrinsic (α = .91, $M = 3.92$, $SD = 0.95$) and external motivation (α = .80, $M = 1.90$, $SD = 0.85$) using the Behavioral Motivation in Exercise Questionnaire-2 were reported at baseline. All baseline data were collected in person. Objectively measured physical activity was recorded using an accelerometer-based device (i.e., Fitbit Zip) for two weeks. Participants were instructed to wear the device on their bra or waistband during the day and to put the device by their bedside during sleep. Minimum valid wear time per day was set to 10 hours and participants had to wear their device for at least 10 hours on 75% of monitored days to be included in the analyses. Non-wear time and wear time was assessed using the Fitabase data visualization option. Daily minutes of activity by intensity was downloaded for each participant (i.e., light, moderate, and vigorous). Physical activity is reported in terms of total MET minutes of moderate and vigorous activity engagement over the two-week period ($M = 683.91$, $SD = 269.84$). Specifically, physical activity was scored according to metabolic equivalent of task (MET) minutes where one minute of moderate physical activity accounts for four MET minutes and one minute of vigorous physical activity accounts for eight MET minutes. Thus, participants engaged in an average of 42 minutes of vigorous activity or 85 minutes of moderate activity per week in the present sample. On average, participants were 24.58 ($SD = 11.27$) years of age with the majority reporting being female (70.9%) and Caucasian (76.4%) and had an average BMI of 23.70 ($SD = 6.04$), which is considered to be healthy.

### Statistical analyses

Similar to Study 1, whether the sample size was appropriate to test the main hypothesis using exploratory factor analysis was evaluated first. In the present data, the average extracted communality score was .437 with two factors extracted and 23 items total. Therefore, a sample size of 134 would be needed (de Winter et al., 2009). To that end, Study 2 is slightly underpowered to test the initial hypothesized solution but is not underpowered to replicate the one factor solution that was found in Study 1 (required $n = 52$). In Study 1, a small-medium effect ($R^2$ = .04; physical activity) and medium effect ($R^2$ = .09; intrinsic motivation) was found in the polynomial regression. Thus, Study 2 is well-powered to detect a medium effect ($f^2$ = .15; required $n = 68$), and to detect a small-medium effect ($f^2$ = .085; required $n = 115$) using .80 power and an alpha level of .05. Additionally, the sample size needed to correctly identify a three-class model was estimated using latent profile analysis. To correctly identify a three-class model, with very large distances between classes (2) a sample of 100 is required, whereas for large (.8) distances between classes, sample size of 300 is required. The distances between classes in Study 1 and in the present study were very large (2). Thus, Study 2 has sufficient power to identify the correct number of classes. Whether the sample size was appropriate to test indirect effects using mediation analyses was also examined. A sample size of 380 was needed to achieve .80 power to detect medium sized indirect effects, which indicated that Study 2 was underpowered.

For Study 2, the same multiverse approach was taken as in Study 1. In terms of missing data, one participant was missing one item for intrinsic motivation, two participants were missing one item each for body dissatisfaction, four participants were missing one item each for body appreciation, and 11 participants were missing a score on the physical activity variable because they did not receive a Fitbit. Missing values were imputed using person-centered imputation for the self-report measures. Missing data were not imputed for the physical activity variable as these participants did meet the threshold for inclusion. To be consistent with Study 1, participants who engaged in more than 16 hours of physical activity per day on average as per the International Physical Activity Questionnaire Guidelines ($n = 0$) were removed. The maximum amount of time engaging in MVPA in the sample was 135.11 MET minutes per day on average. This corresponds to 33.77 minutes of moderate activity or 16.88 minutes of vigorous activity per day on average.

Next, the data were examined for multivariate outliers. As in Study 1, outliers were examined for the combination of body dissatisfaction, body appreciation, intrinsic motivation, and physical activity (Critical value: $\chi^2$ = 18.467). Multivariate outliers ($n = 1$) were removed and the analysis was re-conducted until there were no remaining outliers. These results did not vary with the inclusion of person-centered mean imputation. Univariate outliers were examined using the $z > 3.33$ cut-off ($p <$ .001). For the dataset including multivariate outliers, univariate outliers were as follows: physical activity ($n = 1$), body appreciation ($n = 0$), body dissatisfaction ($n = 0$), and intrinsic motivation ($n = 0$). For the dataset excluding multivariate outliers, univariate outliers remained the same. For both datasets with person-centered imputation (i.e., multivariate outliers included and excluded) there was one univariate outlier on the physical activity variable and one univariate outlier on the body appreciation variable.

Finally, regression assumptions were checked using the same procedure as in Study 1. For the Study 2 data, the dataset with the removal of both univariate and multivariate outliers without the inclusion of the person-mean centered data met all of the regression assumptions and is reported in the subsequent analyses. The same multiverse approach as in Study 1 was taken and deviations from the aforementioned analysis are reported (Steegen et al., 2016). Correlations between variables are presented in Table 1.

In keeping with Study 1, hypothesis 1 was tested using parallel analysis and exploratory factor analysis. Suitability of the data for exploratory factor analysis was assessed using both the Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test of sphericity. Hypothesis 2 was tested using polynomial linear regression. Hypothesis 3 was tested using latent profile analysis. Finally, hypothesis 4 was tested using parallel mediation with 5000 bootstrapped samples.

## Study 2 results

### Hypothesis 1

The first hypothesis—that body appreciation and dissatisfaction would represent two unique constructs (Table 6) was tested using maximum likelihood exploratory factor analysis with a direct oblimin rotation (Hurley et al., 1997). As was the case in Study 1, a parallel analysis revealed that only one factor should be extracted (Zwick & Velicer, 1986). Similar to Study 1, the data were determined to be suitable for factor analysis based on both the Kaiser-Meyer-Olkin measure of sampling adequacy (.91) and Bartlett's test of sphericity ($\chi^2 = 1547.76$, $p < .001$). This factor represented a general body image construct, which accounted for 46.07% of the variance in scores with both body dissatisfaction and body appreciation items loading at ≥.39. Once again, the only exception was the first body dissatisfaction item 'Height', which had a factor loading of −.23. Confirming the results from Study 1, the first hypothesis that body appreciation and body dissatisfaction would represent two distinct dimensions was rejected. This pattern of results occurred for the entirety of the multiverse analysis, which highlights the robustness of results. The bivariate correlation between the two constructs was $r = -.75$.

### Hypothesis 2

The second hypothesis—that body appreciation and dissatisfaction would interact in their effect on motivation to be active and volume of moderate-to-vigorous intensity physical activity—was tested using polynomial regression. Only the linear model was significant for intrinsic motivation ($R^2 = .08$, $p = .022$; Table 3). However, intrinsic

**Table 6.** Exploratory factor analysis for Study 2.

| Item | Factor loading | Extraction communality |
|---|---|---|
| I feel good about my body | .91 | .83 |
| On the whole, I am satisfied with my body | .89 | .79 |
| I take a positive attitude toward my body | .83 | .69 |
| My feelings toward my body are positive for the most part | .82 | .67 |
| Despite its imperfections, I still like my body | .80 | .64 |
| Despite its flaws, I accept my body for what it is | .78 | .61 |
| Body Build | −.74 | .56 |
| I respect my body | .69 | .47 |
| Body Shape | −.68 | .47 |
| Waist | −.68 | .47 |
| Weight | −.68 | .47 |
| Hips | −.66 | .44 |
| I feel that my body has at least some good qualities | .66 | .43 |
| Stomach | −.63 | .40 |
| Shoulders | −.63 | .39 |
| I am attentive to my body's needs | .61 | .37 |
| Thighs | −.59 | .35 |
| I engage in healthy behaviors to take care of my body | .56 | .31 |
| My self-worth is independent of my body shape or weight | .44 | .19 |
| Face | −.39 | .15 |
| I do not focus a lot of energy on being concerned with my body shape or weight | .39 | .15 |
| I do not allow unrealistic images of women/men presented in the media to affect my attitudes toward my body | .39 | .15 |
| Height | −.23 | .05 |

motivation was not predicted by body appreciation or body dissatisfaction. The linear model was not significant for physical activity ($R^2$ = .01, $p$ = .785; Table 3), and neither body appreciation nor body dissatisfaction predicted physical activity. For the multiverse analysis, the linear model was significant for all iterations of the polynomial regression that specified intrinsic motivation as the outcome and neither body appreciation nor body dissatisfaction predicted the outcome. For the multiverse analysis using physical activity as the outcome, the results were consistent across all iterations highlighting the robustness of these findings. Body appreciation does not buffer the influence of body dissatisfaction on activity-related outcomes and, therefore, hypothesis 2 was rejected.

## *Hypothesis 3*

LPA models ranging from two to five groups were examined to identify the optimal number of groups to retain (see Table 4 for fit indices). The IC indices (AIC, BIC, and SSA-BIC) all suggested that four or more classes were preferred. The LMRT suggested that the two-class model provides significantly better fit than a one-class model, that a three-class model provides better fit than the two-class model, and that a four-class model provides better fit than a three-class model. The BLRT was significant for all solutions. For the multiverse analysis, this pattern of results was the case for 50% of the models pertaining to hypothesis 3. In the models that did not correct for missing data, a two-class model compared to a three-class model fit the data best. Upon further examination of these models the class sizes in the two-class model ($n=106$, $n=4$) and the three-class model ($n=65$, $n=41$, $n=4$) contained a separate group ($n=4$). This group represented the four participants that were missing data on body appreciation. Thus, these models are untrustworthy.

In the models that corrected for missing data, both a three-class and four-class model fit the data well. This pattern was observed across all models that corrected for missing data. Both the three-class model and the four-class models were examined further. Upon examining group classification on the indicators (body appreciation and body dissatisfaction), it appeared that the four-class model included a group that has moderately high in body appreciation and moderately low in body dissatisfaction scores. This group does not emerge within the three-class model as those classified as high in body appreciation and low in body dissatisfaction in the three-class model were classified as moderately high in body appreciation and low in body dissatisfaction. Based on parsimony, model fit, and class size, a three-class model appears to represent the best solution. Similar to the first two hypotheses, the data are reported with the inclusion of person-centered mean imputation and with the removal of multivariate outliers only as these data best met the assumptions of linear regression (i.e., all the assumptions were met). The three-group model also classified individuals with a high degree of accuracy with classification accuracy ranging from 0.840 to 0.937 (Figure 2 displays the three classes and means for endorsing body appreciation and body dissatisfaction indicators).

As indicated in Table 4, class 1 (31.9%, $n=35$) was characterized by high body appreciation and low body dissatisfaction whereas class 2 (57.6%, $n=63$) was characterized by average appreciation and average body dissatisfaction. Finally, class


**Figure 2.** Study 2: Three-class model of body appreciation and body dissatisfaction.

3 (10.5%, $n = 11$) was characterized by low body appreciation and high body dissatisfaction. Whether the latent profile groups differed from one another on motivation and physical activity was examined using multivariate analysis of variance (MANOVA) and post hoc Games-Howell pairwise comparisons, adjusting for familywise error. This pattern of results was the case for the entirety of the multiverse analysis pertaining to hypothesis 3. The data are reported with the inclusion of person-centered mean imputation and with the removal of multivariate outliers only as these data best met the assumptions of linear regression (i.e., all the assumptions were met).

Overall, groups significantly differed on intrinsic motivation and physical activity ($F(4, 210) = 2.829$, $p = .026$, Wilks $\Lambda = .900$, partial $\eta^2 = 0.51$). Univariate testing indicated that intrinsic motivation significantly differed among the three groups ($F(2, 106) = 5.245$, $p < 0.01$; partial $\eta^2 = 0.09$. Physical activity did not significantly differ among the three groups ($F(2, 106) = 0.167$, $p > 0.05$, partial $\eta^2 = 0.003$). The high body appreciation/low body dissatisfaction group ($M = 4.31$, $SD = 0.72$), reported significantly higher levels of intrinsic motivation compared to the average body appreciation/average body dissatisfaction group ($M = 3.76$, $SD = 0.96$, $g = 0.62$) but not the low body appreciation/high body dissatisfaction group ($M = 3.45$, $SD = 1.43$, $g = 0.92$). The high body appreciation/low body dissatisfaction group ($M = 585.76$, $SD = 386.90$) reported lower levels of physical activity compared to both the average body appreciation/average body dissatisfaction group ($M = 606.40$, $SD = 240.43$, $g = 0.07$) and the low body appreciation/high body dissatisfaction group ($M = 646.44$ $SD = 376.54$, $g = 0.16$), although there were no significant differences between the groups.

Whether groups differed in terms of biological sex, age, and race was also examined. For biological sex, significant differences emerged ($\chi^2(4) = 12.597$, $p = .013$) such that there were more females (62.9%) than males in the high body appreciation/low body dissatisfaction group, average body appreciation/body dissatisfaction group (71.4% female), and in the low body appreciation/high body dissatisfaction group (90.9% female, 9.1% chose not to respond). The groups did not significantly differ in terms of race ($\chi^2(10)$ = 10.239, $p$ = .42). There were more Caucasian participants (68.6%) than all other ethnicities in the high body appreciation/low body dissatisfaction group, the average body appreciation/body dissatisfaction group (82.5%), and in the low body appreciation/high body dissatisfaction group (63.6%). Groups were not significantly different in terms of age ($F$(2, 106) = 1.890, $p$ = .156).

### *Hypothesis 4*

The fourth exploratory hypothesis—that the relationship between body appreciation and physical activity would be mediated by intrinsic and external motivation—was tested using Hayes (2013) PROCESS model 4 for mediation with 5000 bootstrapped samples. Body appreciation was specified as the predictor variable and physical activity was specified as the outcome variable. The two mediators were intrinsic and external motivation. For this hypothesis there was one univariate outlier on the physical activity variable, and one univariate outlier on the external motivation variable. This result did not vary with the exclusion of multivariate outliers ($n$ = 1; Critical Value = 20.52). Correction for missing data—including one missing case on external motivation—did not influence the multivariate outlier analyses, but it did reveal one additional univariate outlier on the body appreciation variable. Similar to the first three hypotheses, the dataset with the removal of both univariate and multivariate outliers without the inclusion of the person-mean centered data met all of the regression assumptions and, therefore, was utilized in the analysis of hypothesis 4. First, higher levels of body appreciation predicted higher levels of intrinsic motivation ($b$ = .49 ($SE$ = .15) [95% CI: .20, .77]), but not lower levels of external motivation ($b$ = −.16 ($SE$ = .13) [95% CI: −.41, .09]). Second, higher levels of intrinsic motivation predicted higher levels of physical activity engagement ($b$ = 67.23 ($SE$ = 24.60) [95% CI: 18.33, 116.12]). The mediated effect of body appreciation on physical activity engagement through intrinsic motivation was significant (Completely Standardized Indirect Effect: $\beta$ = *.09* [95% CI: .02, .20]). Thus, individuals who had higher levels of body appreciation engaged in more physical activity as they also had higher levels of intrinsic motivation. External motivation did not predict physical activity engagement ($b$ = −22.98 ($SE$ = 28.30) [95% CI: −79.22, 33.26]), nor did it mediate the relationship between body appreciation and physical activity engagement (Completely Standardized Indirect Effect: $\beta$ = .01 [95% CI: −.02, .06]). Finally, there was no direct effect of body appreciation on physical activity engagement when the mediators were accounted for ($b$ = −31.01 ($SE$ = 35.29) [95% CI: −101.14, 39.13]). The total effect was not significant ($b$ = 5.22 ($SE$ = 34.59) [95% CI: −63.49, 73.94]). This pattern of results occurred for the entirety of the multiverse analysis pertaining to hypothesis 4 and were largely consistent with the results from Study 1, which highlights the robustness of these results

## Discussion

The present study extended upon previous research by examining whether positive body image (i.e., body appreciation) and negative body image (i.e., body dissatisfaction) represent unique dimensions of body image and whether body appreciation can buffer the negative effects of body dissatisfaction on motivation and physical activity. The first hypothesis that body appreciation and body dissatisfaction would represent two distinct dimensions was rejected. Thus, contrary to theory that suggests positive body image and negative body image are unique dimensions, the present research found that these constructs are not statistically distinct and represent opposite ends of one continuum (Tiggemann & McCourt, 2013; Tylka & Wood-Barcalow, 2015a). This was supported by the results from the third hypothesis examining the latent class profiles of participants on body dissatisfaction measures. Specifically, it was shown that groups have either high levels of body appreciation and low levels of body dissatisfaction, high levels of body dissatisfaction and low levels of body appreciation, or moderate levels of both.

The second hypothesis, that body appreciation would buffer the negative effects of body dissatisfaction on physical activity-related variables (i.e., motivation and behavior) was rejected, which further supports the results from the first and third hypotheses. Finally, the fourth, exploratory, hypothesis examining the relationship between body appreciation and physical activity engagement revealed that intrinsic, but not external, motivation mediated this relationship. Thus, individuals who have higher levels of body appreciation—positive body image—engage in more physical activity because they are more intrinsically motivated to do so. This finding is consistent with literature that has shown that positive body image is associated with more autonomous types of activity-related motivation (Homan & Tylka, 2014; Wood-Barcalow et al., 2010) and with Self-Determination Theory, which proposes that intrinsic motivation is more conducive to physical activity engagement than external motivation (Buckworth et al., 2007). However, this finding may not be unique from the negative relationship between body dissatisfaction and intrinsic motivation found in past research (More & Phillips, 2019).

These results are unexpected, but important. It is assumed within the literature that body appreciation is a distinct construct from body dissatisfaction and that it should not be represented as being on the same continuum as body dissatisfaction (Tylka & Wood-Barcalow, 2015a). Past research has suggested that the unique variance captured by body appreciation for predicting health outcomes independent of body dissatisfaction is indicative of independence (for review please see Tylka & Wood-Barcalow, 2015a). However, multiple regression and dominance analyses are not appropriate to evaluate the theoretical factor structure of constructs. What is more appropriate for testing construct independence is factor analytic techniques (DeCoster, 1998) and utilizing polynomial linear regression analyses to test interaction effects between factors that may be linear or curvilinear in nature (Phillips, 2013). Using an appropriate analytic strategy, the assumption of independence between body appreciation and dissatisfaction was not supported across two samples in the present study, which used a multi-study comprehensive, multiverse, technique suggesting that body appreciation and dissatisfaction can be conceptualized as end points of a single continuum with participants tending to group on the ends or middle of this continuum.

In line with previous research, results from the latent profile analyses across Study 1 and Study 2 revealed that women were more likely to have high levels of body dissatisfaction and low levels of body appreciation in comparison with men (e.g., Lowery et al., 2005). Considering this finding, it is likely that body image may be an especially viable intervention target for comprehensive interventions directed at improving physical activity levels in women. Expansion of intervention paradigms to target body dissatisfaction may include body functionality or self-compassion interventions, both of which have been successful in previous trials (e.g., Alleva et al., 2018; Moffitt et al., 2018).

Psychological measures are observed as approximations for latent variables (Borsboom, 2008). As such, psychological measures are prone to error and are not exact approximations of their underlying latent construct. The measures used in the presented studies were part of secondary datasets and thus were utilized to provide an initial conceptual test of the hypotheses. More research using additional measures of body appreciation and dissatisfaction will be needed to replicate the findings presented here to ensure robustness of results across scales. Similarly, moderate and vigorous physical activity was measured in lieu of moderate and vigorous exercise behavior. Although all exercise is a form of physical activity, not all physical activity is exercise. Specifically, physical activity refers to any movement resulting in energy expenditure, whereas exercise refers to *planned* movement resulting in energy expenditure caused by a physical fitness objective (Caspersen et al., 1985). Thus, the present study provides a holistic picture of the relationship between body image and physical activity but does not assess the relationship between body image and planned exercise sessions. Although both physical activity and exercise have the potential to contribute to overall health and well-being (WHO, 2020), more research is needed to determine the impact of body image on exercise specifically. Moreover, the findings from Study 2 were obtained using a commercial grade accelerometer (i.e., Fitbit Zip) in lieu of a research grade monitor (e.g., Actigraph). A systematic review by Feehan and colleagues (2018) found that Fitbits overestimate time spent in high-intensity activities (i.e., moderate and vigorous) in comparison with research-grade monitors. Thus, future research is warranted using objectively measured activity using research-grade devices.

To ensure population generalizability, the present study will need to be replicated in a sample with a larger variation in age as body appreciation tends to increase with age on average whereas body dissatisfaction seems to be unrelated to age on average (Tiggemann & McCourt, 2013). Similarly, results will need to be replicated outside of a university context as university students are not necessarily representative of the general population (Peterson, 2001). However, it should be noted that Study 2 largely replicated the results found in Study 1 using a sample composed of both university students and university staff, who were older on average. Additionally, although participants in Study 1 were meeting the minimum recommended amount of physical activity, the results were replicated in Study 2, which consisted of a less active sample of participants who did not meet the weekly recommendations. Despite a smaller sample size in Study 2, there was sufficient power to detect these effects, except for indirect effects, and for the most part replicated results from Study 1. Given low statistical power to detect indirect effects in Study 2, these findings will need to be replicated in a larger sample. The replicability of these results will build confidence that these findings reflect true population effects.

As a result of both studies utilizing secondary observational datasets, causal conclusions cannot be drawn for hypotheses 2 and 4. Specifically, it cannot be claimed that either body appreciation or dissatisfaction led to activity-related motivation or behavior. Moreover, it cannot be stated that there is a causal mediated effect between body image and physical activity through motivation quality. Thus, hypotheses 2 and

4 need to be replicated within intervention paradigms that are designed to shift either positive or negative body image. However, an experimental study would have been inappropriate to test both hypothesis 1 and 3, as the main interest was in how these constructs co-occur rather than whether improving positive body image leads to decreased body dissatisfaction.

## Conclusion

This research represents an important first step in assessing the assumed independence of negative and positive body image constructs within the literature. First, evidence that negative and positive body image exist on the same continuum is provided. Second, evidence that positive body image does not buffer the effects of negative body image on health outcomes is provided (i.e., motivation and physical activity measured using self-report and objective data). Although these results were unexpected, they are important as understanding the underlying latent constructs of positive and negative body image will help inform subsequent measurement of these constructs and will direct how these constructs are targeted in intervention studies. Specifically, if the results from the present study are found to be robust through replication, then the theoretical relationship between negative and positive body image will need to be reconsidered in the literature. Although it is possible the theoretical distinction is not adequately captured by current measures and that new measures need to be developed, it is also possible that these constructs are not theoretically or statistically distinct and that separate intervention protocols are not needed to reduce body dissatisfaction or to improve body appreciation, respectively.

## Disclosure statement

No potential conflict of interest was reported by the authors.

## Funding

The authors reported there is no funding associated with the work featured in this article.

## ORCID

Kimberly R. More http://orcid.org/0000-0003-4122-7191
Nicole L. Hayes http://orcid.org/0000-0001-8431-7109
L. Alison Phillips http://orcid.org/0000-0003-1126-1559

## References

Alleva, J., Diedrichs, P., Halliwell, E., Martijn, C., Stuijfzand, B., Treneman-Evans, G., & Rumsey, N. (2018). A randomised-controlled trial investigating potential underlying mechanisms of a functionality-based approach to improving women's body image. *Body Image*, *25*, 85–96. https://doi.org/10.1016/j.bodyim.2018.02.009

Avalos, L., Tylka, T. L., & Wood-Barcalow, N. (2005). The body appreciation scale: Development and psychometric evaluation. *Body Image*, *2*(3), 285–297. https://doi.org/10.1016/j.bodyim.2005.06.002

Booth, M. (2000). Assessment of physical activity: An international perspective. *Research Quarterly for Exercise and Sport*, *71*(sup2), 114–120. https://doi.org/10.1080/02701367.2000.11082794

Borsboom, D. (2008). Latent variable theory. *Measurement: Interdisciplinary Research & Perspective*, *6*(1–2), 25–53. https://doi.org/10.1080/15366360802035497

Bucchianeri, M. M., Arikian, A. J., Hannan, P. J., Eisenberg, M. E., & Neumark-Sztainer, D. N. (2013). Body dissatisfaction from adolescence to young adulthood: Findings from a 10-year longitudinal study. *Body Image*, *10*(1), 1–7. https://doi.org/10.1016/j.bodyim.2012.09.001

Buckworth, J., Lee, R. E., Regan, G., Schneider, L. K., & DiClemente, C. C. (2007). Decomposing intrinsic and extrinsic motivation for exercise: Application to stages of motivational readiness. *Psychology of Sport and Exercise*, *8*(4), 441–461. https://doi.org/10.1016/j.psychsport.2006.06.007

Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: Definitions and distinctions for health-related research. *Public Health Reports (Washington, DC: 1974)*, *100*(2), 126–131. https://www.google.com/search?client=safari&rls=en&q=Public+Health+Reports&ie=UTF-8&oe=UTF-8

Černelič-Bizjak, M., & Jenko-Pražnikar, Z. (2014). Impact of negative cognitions about body image on inflammatory status in relation to health. *Psychology & Health*, *29*(3), 264–278. https://doi.org/10.1080/08870446.2013.844807

Credé, M. (2010). Random responding as a threat to the validity of effect size estimates in correlational research. *Educational and Psychological Measurement*, *70*(4), 596–612. https://doi.org/10.1177/0013164410366686

DeCoster, J. (1998). Overview of factor analysis. Retrieved March 25, 2021, from http://www.stat-help.com/notes.html

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191.

Feehan, L. M., Geldman, J., Sayre, E. C., Park, C., Ezzat, A. M., Yoo, J. Y., Hamilton, C. B., & Li, L. C. (2018). Accuracy of Fitbit devices: Systematic review and narrative syntheses of quantitative data. *JMIR mHealth and uHealth*, *6*(8), e10527. https://doi.org/10.2196/10527

Garson, D. G. (2015). *Missing values analysis & data imputation*. Statistical Publishing Associates.

Gelman, A. (2019). Don't calculate post-hoc power using observed estimate of effect size. *Annals of Surgery*, *269*(1), e9–e10. https://doi.org/10.1097/SLA.0000000000002908

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guildford Press.

Homan, K. J., & Tylka, T. L. (2014). Appearance-based exercise motivation moderates the relationship between exercise frequency and positive body image. *Body Image*, *11*(2), 101–108. https://doi.org/10.1016/j.bodyim.2014.01.003

Hurley, A. E., Scandura, T. A., Schriesheim, C. A., Brannick, M. T., Seers, A., Vandenberg, R. J., & Williams, L. J. (1997). Exploratory and confirmatory factor analysis: Guidelines, issues, and alternatives. *Journal of Organizational Behavior*, *18*(6), 667–683. https://doi.org/10.1002/(SICI)1099-1379(199711)18:63.0.CO;2-T https://doi.org/10.1002/(SICI)1099-1379(199711)18:6<667::AID-JOB874>3.0.CO;2-T

International Physical Activity Questionnaire. (n.d.). Home. https://sites.google.com/site/theipaq/home

Lowery, S. E., Kurpius, S. E. R., Befort, C., Blanks, E. H., Sollenberger, S., Nicpon, M. F., & Huser, L. (2005). Body image, self-esteem, and health-related behaviors among male and female first year college students. *Journal of College Student Development*, *46*(6), 612–623. https://doi.org/10.1353/csd.2005.0062

Markland, D., & Tobin, V. (2004). A modification to the behavioral regulation in exercise questionnaire to include an assessment of amotivation. *Journal of Sport and Exercise Psychology*, *26*(2), 191–196. https://doi.org/10.1123/jsep.26.2.191

Moffitt, R. L., Neumann, D. L., & Williamson, S. P. (2018). Comparing the efficacy of a brief self-esteem and self-compassion intervention for state body dissatisfaction and self-improvement motivation. *Body Image*, *27*, 67–76. https://doi.org/10.1016/j.bodyim.2018.08.008

More, K. R., & Phillips, L. A. (2019). The influence of body dissatisfaction on cardiovascular and strength-based physical activity by gender: A self-determination theory approach. *Psychology & Health*, *34*(12), 1437–1450. https://doi.org/10.1080/08870446.2019.1614587
Muthén, L. K., & Muthén, B. O. (2017). *Mplus: Statistical Analysis with Latent Variables: User's Guide (Version 8)*. Los Angeles, CA: Authors.
Neumark-Sztainer, D., Paxton, S. J., Hannan, P. J., Haines, J., & Story, M. (2006). Does body satisfaction matter? Five-year longitudinal associations between body satisfaction and health behaviors in adolescent females and males. *The Journal of Adolescent Health*, *39*(2), 244–251. https://doi.org/10.1016/j.jadohealth.2005.12.001
Peterson, R. A. (2001). On the use of college students in social science research: Insights from a second-order meta-analysis. *Journal of Consumer Research*, *28*(3), 450–461. https://doi.org/10.1086/323732
Phillips, L. A. (2013). Congruence research in behavioral medicine: Methodological review and demonstration of alternative methodology. *Journal of Behavioral Medicine*, *36*(1), 61–74. https://doi.org/10.1007/s10865-012-9401-9
Pingitore, R., Spring, B., & Garfield, D. (1997). Gender differences in body satisfaction. *Obesity Research*, *5*(5), 402–409. https://doi.org/10.1002/j.1550-8528.1997.tb00662.x
Steegen, S., Tuerlinckx, F., Gelman, A., & Vanpaemel, W. (2016). Increasing transparency through a multiverse analysis. *Perspectives on Psychological Science*, *11*(5), 702–712. https://doi.org/10.1177/1745691616658637
Tein, J., Coxe, S., & Cham, H. (2013). Statistical power to detect the correct number of classes in latent profile analysis. *Structural Equation Modeling: A Multidisciplinary Journal*, *4*, 640–757. https://doi.org/10.1080/10705511.2013.824781
Tiggemann, M., & McCourt, A. (2013). Body appreciation in adult women: Relationships with age and body satisfaction. *Body Image*, *10*(4), 624–627. https://doi.org/10.1016/j.bodyim.2013.07.003
Tylka, T. L., & Wood-Barcalow, N. L. (2015a). What is and what is not positive body image? Conceptual foundations and construct definition. *Body Image*, *14*, 118–129. https://doi.org/10.1016/j.bodyim.2015.04.001
Tylka, T. L., & Wood-Barcalow, N. L. (2015b). The Body Appreciation Scale-2: Item refinement and psychometric evaluation. *Body Image*, *12*, 53–67. https://doi.org/10.1016/j.bodyim.2014.09.006
de Winter, J. C. F., Dodou, D., & Wieringa, P. A. (2009). Exploratory factor analysis with small sample sizes. *Multivariate Behavioral Research*, *44*(2), 147–181. https://doi.org/10.1080/00273170902794206
Wood-Barcalow, N. L., Tylka, T. L., & Augustus-Horvath, C. L. (2010). "But I Like My Body": Positive body image characteristics and a holistic model for young-adult women. *Body Image*, *7*(2), 106–116. https://doi.org/10.1016/j.bodyim.2010.01.001
World Health Organization. (2020, November). *Physical activity*. World Health Organization International. https://www.who.int/news-room/fact-sheets/detail/physical-activity
Zwick, W., & Velicer, W. (1986). Comparison of five rules for determining the number of components to retain. *Psychological Bulletin*, *99*(3), 432–442. https:/.doi.org/10.1037/0033-2909.99.3.432 https://doi.org/10.1037/0033-2909.99.3.432