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Development of Body Image and Eating Disorder Psychopathology: Normative and Pathological Trajectories

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Development of Body Image and Eating Disorder Psychopathology: Normative and Pathological Trajectories

by

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Abstract

Introduction: Body image is a critical area of wellbeing that predicts many important outcomes, including eating pathology. Unfortunately, there is no consensus about what constitutes normative body image development, or how people come to develop negative body image. The objective of this project was to advance understanding of both normative and pathological trajectories of body image and eating pathology development. **Method:** This dissertation includes a systematic review and meta-analysis (Chapter 2), and two primary longitudinal studies (Chapters 3 and 4). The meta-analysis summarized longitudinal data from 142 samples to characterize normative mean-level change in body image among females and males between ages 6 and 54. The two primary longitudinal studies took a person-centred approach to identify the most common trajectories of body image and eating pathology, and examine their predictors in two samples: a U.S. sample of 760 female twins assessed between ages 11 and 29; and a U.K. sample of 328 girls and 429 boys assessed between ages 11 and 15. **Results:** The meta-analysis identified gender-moderated patterns of normative body image development: boys showed small fluctuations in overall body image with net-improvements between ages 10 and 24, whereas girls showed worsening body image between ages 10 and 16, but improvements between ages 16 and 24. Mean-level changes were largest between ages 10 and 14, and stabilized by age 24. The two primary studies identified subgroups of boys and girls who deviated considerably from normative patterns of development; pathological subgroups showed greater proneness to stress, anxiety, and negative emotionality, social difficulties, dietary restraint, and lower global self-esteem. **Conclusion:** These studies advance theories of body image development. First, a critical period may occur slightly earlier than previously believed. Second, girls and boys may both, on average, experience improvements in body image during emerging adulthood. Third, pluripotent

transdiagnostic risk factors such as personality characteristics merit increased attention alongside sociocultural variables that specifically increase risk for eating pathology.

Keywords: body image, eating pathology, personality, longitudinal, meta-analysis, development

Preface

Chapter 2 of this dissertation presents a manuscript that I conceptualized under the supervision and guidance of Dr. Kristin von Ranson. I was responsible for creating the research question, search strategy, and data analytic strategy. I completed the literature searches, and screened abstracts, and Alyssa Smith and I both reviewed full texts. I extracted data and completed the data analyses with statistical consultation from Dr. Ulrich Orth and Dr. Daniel A. Briley, who lent their expertise and coding examples from prior multilevel longitudinal meta-analyses. I prepared the manuscript, and Dr. von Ranson contributed to editing several iterations of it.

Chapter 3 of this dissertation presents a manuscript that I conceptualized under the supervision and guidance of Dr. Kristin von Ranson, with support from the Minnesota Twin Family Study team, most notably Dr. Sylia Wilson, who facilitated acquisition of archival data. I proposed the research question, designed the study, analyzed the data, and was responsible for preparing the manuscript. Dr. von Ranson contributed to editing several iterations of the manuscript. Use of the data was approved under the University of Calgary Conjoint Faculties Research Ethics Board (CFREB): REB20-0235.

Chapter 4 of this dissertation presents a manuscript that I conceptualized with guidance and input from three important collaborators: Dr. Phillippa Diedrichs, Dr. Melissa J. Atkinson, and Kirsty M. Garbett. For this project, I analyzed archival data, which were non-identifiable and collected by collaborators at the Centre for Appearance Research at the University of West England in Bristol, U.K, under approval from the University of West England ethics review board (#RCTN16782819). I was responsible for creating the research question, analyzing the data, and preparing the manuscript, with input and guidance from these collaborators, who also

supported data management. I am corresponding author for the peer-reviewed journal article, published by Cambridge University Press as:

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Chapter 1: General Introduction

Body image is a multifaceted construct that includes an affective and evaluative dimension, and a cognitive-behavioral investment dimension (Cash, 1994). The affective/evaluative dimension includes appraisals of one's body, and the extent of satisfaction or dissatisfaction with its various characteristics; and the investment dimension refers to the salience, centrality, and (over)valuation associated with one's appearance or body (Cash, 1994). In other words, these two dimensions capture how much one *likes* their appearance or body, and its *importance* to their overall self-worth. The field of body image research has grown considerably since these two dimensions were defined, and an even wider array of body image constructs has now been articulated (Kling et al., 2019). In particular, with conceptual foundations in the strengths-based discipline of positive psychology, positive body image scholarship has emerged to recognize positively valanced constructs such as body appreciation and body acceptance, distinct from negative body image (Tylka & Wood-Barcalow, 2015).

There is much individual variation in subjective experiences along the many dimensions of body image, and how people come to develop negative or positive body image. Negative body image is so common among women (Fiske et al., 2014; A. S. Hartmann et al., 2019; Romito et al., 2021) that the term "normative discontent" was coined to reflect that it is the rule, rather than the exception (Rodin et al., 1984). Nonetheless, research has also identified subgroups who feel quite positively about their bodies and appearances (Frisen & Holmqvist, 2010). Unfortunately, interventions designed to promote positive body image and prevent the development of eating pathology have met with only modest success, and their effectiveness rapidly deteriorates when assessed over the long term (Alleva et al., 2015; Kusina & Exline, 2019). Given the high prevalence and intractability of negative body image and eating pathology (Halmi, 2013), it is

critical to improve our understanding of how these issues develop, so that we may prevent them before they arise.

Normative Developmental Patterns and Pathological Trajectories

What constitutes normative body image development? The term "normative" refers to the average or expected behavior patterns of a group (Barker, 2003; Colman, 2009), and to states in which intervention is not indicated (Costello & Angold, 2006). Negative body image, however, may be normative, yet also require intervention. Indeed, many interventions take a *universal* approach, i.e., one that addresses risk factors in an entire population without taking into account who is at elevated risk (Kusina & Exline, 2019).

To examine normative body image development, previous longitudinal studies have followed cohorts over time to examine changes in average levels of body image constructs, for the most part during childhood, adolescence, and emerging adulthood. These studies have yielded conflicting findings regarding average trajectories of body image, for example: linear increases in body dissatisfaction between ages 15 and 25, followed by a decrease by age 31, in both males and females (Neumark-Sztainer et al., 2018); steady increases in body dissatisfaction among girls from age 11 to age 29 (Lowe et al., 2019); and body dissatisfaction that plateaued around age 14 for boys, but continued to increase through age 18 for girls (Calzo et al., 2012). Disparate findings may reflect a combination of factors, including differences in sample characteristics and study methodology. Only examining averages across entire samples may further mask individual variation in body image development: certain subgroups may differ considerably in the magnitude and direction of change in body image constructs over time, for example, showing worsening body image during age periods when most of their same-aged peers show improvements or stability.

Overview of Dissertation Chapters

To improve understanding of body image development, it is critical to understand normative patterns of development, as well as how and why some people diverge from such patterns. To this end, the overarching goal of the current dissertation work was to describe both normative and pathological trajectories of body image development.

In Chapter 2, a meta-analysis was performed to synthesize longitudinal evidence on normative body image development, depicting age-based trends in body image development and identifying moderators of average mean-level change. Meta-analysis of longitudinal data is an approach that has been applied to study the normative development of other constructs, such as personality (Bleidorn et al., In Press; Roberts et al., 2006) and global self-esteem (Orth et al., 2018). This approach enables researchers to model average trajectories and moderators of mean-level change across multiple longitudinal samples, yielding better coverage of the lifespan, as well as greater statistical power and precision than any single primary study. Representing the most comprehensive and precise synthesis of longitudinal body image research to date, this meta-analysis advances the field by summarizing average developmental trends for male and female samples separately, clarifying potential sensitive periods (i.e., age ranges during which the largest magnitude of change in mean-level body image takes place), and comparing patterns of change in different body image constructs.

Chapters 3 and 4 describe two primary longitudinal studies that apply a person-centered approach—latent class growth modelling—to studying body image development. These studies replicate recent longitudinal research that has identified multiple trajectories of body image development (e.g., Rodgers et al., 2016; Verschueren et al., 2020; S. B. Wang et al., 2019), and

extend this research by identifying personality traits and other individual differences that differentiate individuals who demonstrate healthier, versus more pathological trajectories.

In this way, this dissertation exploited the complementary advantages of longitudinal meta-analysis and person-centered approaches to improve understanding of both normative and pathological patterns of body image development. Identifying normative patterns of body image development, as well as early predictors of pathological trajectories, may provide insights that can advance timely and effective interventions to promote positive body image and prevent the development of disturbances in body image and eating.

Chapter 2: What Constitutes Normative Body Image Development? A Longitudinal Meta-Analysis of Mean-Level Change

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Abstract

This meta-analysis synthesized available longitudinal data on mean-level change in body image among men and women. We searched five databases and accessed unpublished data to identify studies that assessed body image at two or more time points over six months or longer. Analyses were based on data from 142 samples representing a total of 128,254 participants, examining seven body image constructs: body satisfaction, perceived attractiveness, body esteem, body dissatisfaction, valuation (i.e., the degree of importance and concern that one places on their appearance and/or body), self-objectification, and body shame. The mean age associated with the midpoint of measurement intervals ranged from 6 to 54 years. We employed random-effects multilevel meta-regression models to examine standardized yearly mean change, and the potential moderators of body image construct, gender, birth cohort, and attrition rate. Trajectories of mean-level change varied by gender: boys and men showed small fluctuations in overall body image with net-improvements between ages 10 and 24; whereas girls and women showed worsening body image between ages 10 and 16, but improvements between ages 16 and 24. Mean-level change was of greatest magnitude between ages 10 and 14, and stabilized around age 24, with little subsequent change for samples of either of these genders. We found no discernable effect of construct, birth cohort, or attrition rate on mean-level change in body image. Results of the current meta-analysis suggest a need to revise current understandings of normative body image development: sensitive periods may occur somewhat earlier than previously believed, and body image generally improves among girls and women during the transition from adolescence to adulthood.

Introduction

Body image encompasses thoughts, beliefs, feelings, and behaviors related to one's physical appearance, weight, and other body characteristics (Cash, 1994; Cash et al., 2002). It is a multidimensional psychological construct that includes an evaluative component centered on appraisals of one's body parts, shape, weight, and/or appearance, frequently operationalized by measures of body satisfaction (e.g., Wright, 1988) and dissatisfaction (e.g., Garner et al., 1983), as well as the centrality of body and appearance to one's self-evaluation or self-concept, and the extent to which one is concerned by deviations from internalized body ideals– i.e., the importance placed on appearance, termed *valuation* or *over*valuation (e.g., Cash & Smolak, 2011). Body image also encompasses more specific constructs such as body shame, the emotional experience of worthlessness that stems from perceived failure to meet internalized beauty ideals (Claudat et al., 2012); and self-objectification, a process which occurs when one views oneself through the lens of an objectifying observer (Adams et al., 2017). Recently, there has also been increased focus on *positive* body image, which is distinct from negative body image, and includes constructs such as body appreciation, body functionality, and body acceptance (Tylka & Wood-Barcalow, 2015). Past decades have seen a proliferation of research on body image, resulting in a large variety of measures available to assess these numerous and overlapping constructs of body image (Kling et al., 2019).

Disturbances in body image have been established as "the most consistent and robust causal risk factor for all forms of eating disorders (EDs) in both genders" (Antonios Dakanalis et al., 2015, p. 87). In addition to eating disorders, negative body image predicts many other adverse outcomes including poorer overall physical and mental health (Muennig et al., 2008); depressive symptoms (Murray et al., 2018) and lower self-esteem (Blashill et al., 2016; Susan J

Paxton et al., 2006; Sharpe et al., 2018); avoidance of social interactions (Mills et al., 2014); cigarette smoking initiation (Howe et al., 2017), and negative sexual health outcomes (Blashill et al., 2016). Unfortunately, negative body image is so prevalent that it has come to be understood as the norm rather than the exception, which led to the coining of the term "normative discontent" (Rodin et al., 1984). Indeed, negative body image is common in most regions and populations where it has been studied (Fiske et al., 2014). Body image concerns have been found to emerge in children as young as age 6 (Lowes & Tiggemann, 2003; McCabe & Ricciardelli, 2004; Schur et al., 2000), and although estimates have varied depending on study sample and methodology, 40-50% of school-age children (6-12 years) typically report dissatisfaction with at least one aspect of their body size or shape (Smolak, 2011). By adolescence, over 70% of girls may report a desire to change their weight or shape (Wertheim & Paxton, 2011). Estimates of the prevalence of body dissatisfaction among adults have varied widely, from 11% to 72% among U.S. adult women, and 8% to 61% among men (Fiske et al., 2014).

Gender Differences in Body Image

A well-established finding is that body image is impacted by both sex (biological constructs) and gender (social constructs; Mauvais-Jarvis et al., 2020) such that people assigned female sex at birth, and people who identify as women, tend to have more negative body image than cisgender men (A. S. Hartmann et al., 2019). Boys and men tend to display more positive body image than girls and women at every age (Hilbert et al., 2012; Murnen, 2011), though this gap may be narrowing in younger generations (Hockey et al., 2021). Gender differences also influence the *types* of body image concerns reported: boys and men are more likely to desire an increase in weight or muscle mass, whereas girls and women more typically report concerns oriented toward thinness (McCabe & Ricciardelli, 2004). Though research on body image has

historically focused predominantly on girls and women, there is increasing recognition that people of *all* genders can and do experience negative body image; this includes not only boys and men, but also people who identify as transgender, and other gender minorities (A. S. Hartmann et al., 2019; Matsumoto & Rodgers, 2020; Romito et al., 2021). Compared to cisgender women, people who identify as transgender may be at even higher risk for eating pathology and negative body image, though gender-affirming hormone therapy may at least partially alleviate these concerns (Sequeira et al., 2017).

Longitudinal Research on Body Image Development

How does body image typically change over the lifespan? Previous literature has characterized adolescence, specifically the ages of 12 to 18 years, as a sensitive period in body image development for boys and girls (Voelker et al., 2015), during which body image tends to worsen most severely, and when risk and protective factors may have the greatest impact. In addition to gender differences in absolute levels and types of body image concerns endorsed, there may also exist gender differences in how body image changes over time across the lifespan. Though men appear to experience lower absolute levels of body dissatisfaction and valuation of appearance, they may show stable or increasingly negative body image later in life (Brown et al., 2020). Contrastingly, it is commonly believed that women attach less importance to their bodies and appearances as they age, despite moving further away from internalized beauty ideals, and potentially reporting increasing dissatisfaction with their aging bodies over time (Grogan, 2011).

Unfortunately, no longitudinal studies have yet spanned the entire lifespan. As such, current understandings of body image development stem from longitudinal studies that have followed cohorts over particular age periods, as well as cross-sectional research comparing people of different ages. When longitudinal studies are compared closely, their findings are

somewhat conflicting with regards to mean-level patterns of body image change across the life span. For example, Project Eating and Activity in Teens and Young Adults (Project EAT), one of the largest and longest longitudinal studies of body image to date, has followed several large cohorts of boys and girls, assessing body dissatisfaction at regular intervals between ages 12 to 31 (University of Minnesota Division of Epidemiology and Community Health, 2020). In Project EAT cohorts, body dissatisfaction increased consistently between ages 15 and 25, then showed a slight decrease by age 31, in both males and females (Neumark-Sztainer et al., 2018). Contrastingly, the Minnesota Twin Family Study found steady increases in body dissatisfaction among girls from age 11 to age 29 (Lowe et al., 2019). The Growing Up Today Study found that mean-level body dissatisfaction plateaued around age 14 for boys, but continued to increase through age 18 for girls (Calzo et al., 2012). Another large-scale cohort study is the Norwegian Longitudinal Health Behavior Study, which has followed population-based cohorts from approximately age 14 to 30 (Winpenny et al., 2018) and measured body *satisfaction*, rather than dissatisfaction. The observed pattern of mean-level body satisfaction development paralleled what was observed for body dissatisfaction in Project EAT: among boys, body satisfaction increased from adolescence to age 21, and then leveled off by age 30; girls showed a similar trend, with a small decrease at age 15 (Holsen et al., 2012). If body satisfaction and dissatisfaction measure opposite ends of a single continuum, or are at least negatively related, this result is surprising. Do body satisfaction and dissatisfaction change in distinct and unrelated ways across the lifespan, or might these disparate findings reflect the unique methods of these studies, as well as individual and cultural differences among the different populations sampled?

Even when considering only the reductive constructs of body satisfaction and dissatisfaction, and attempting to describe normative development during the most well-studied

portions of the lifespan (i.e., adolescence and young adulthood), no clear picture of normative development emerges. When we begin to consider the "plethora" of ways in which body image has been defined and operationalized (Kling et al., 2019), and to take stock of the paucity of longitudinal research examining change in body image among older adults (Roy & Payette, 2012) and men in particular (Matsumoto & Rodgers, 2020), it becomes clear that there is no simple answer to the deceptively simple question of what constitutes normative body image development.

Moderators of Body Image Development

In addition to gender differences, several other methodological factors and sample characteristics may help explain disparate findings regarding normative body image development. First, patterns of change in body image may depend on the particular body image construct assessed. For example, do body dissatisfaction and valuation change in distinct ways across the lifespan? With a growing array of positively and negatively valanced body image constructs being studied (Kling et al., 2019), it is important to understand the extent to which these constructs change in parallel, or evolve differently, over the lifespan.

Second, birth cohort membership may also explain differences in patterns of body image development. Participants who are similar in age at the time of data collection for a given study have lived through shared social, cultural, and historical changes (Trzesniewski & Donnellan, 2010), which may contribute to producing patterns of body image development distinct from other generations. Indeed, birth cohort effects have been shown to modulate absolute levels of body satisfaction among women (Hockey et al., 2021), as well as levels of global self-esteem (Gentile et al., 2010) such that younger generations have reported higher body satisfaction and self-esteem. Paradoxically, the age of onset of eating disorders may be decreasing in younger

generations (Favaro et al., 2019). In cross-sectional studies that have compared levels of body image constructs among people of different age groups, age and cohort effects are confounded (e.g., Watt & Konnert, 2020), and we cannot be sure whether group differences are due to age-related development or generational differences.

Third, to the extent that participants who drop out of longitudinal studies differ meaningfully from those who remain in these studies, sample attrition can bias results, threatening the representativeness of samples and consequently the external validity of the findings (Barry, 2005). For example, if participants with worsening *or* improving body satisfaction selectively drop out of longitudinal studies at higher rates, the emerging picture of normative body image development would be biased in one of these directions. Accordingly, it is important to investigate the potential influence of attrition in the longitudinal studies upon which we base our understandings of how body image develops over long time periods.

Fourth, when considering mean-level change in a variable over time, the magnitude of this change is partly dependent on the time lag, or amount of time that elapses between measurement intervals. Developmental scientists have considered time lag important enough to warrant proposing an entire methodological framework for modeling its influence on primary studies within meta-analyses: the Lag as Moderator Meta-analysis (LAMMA) approach (Card, 2018). Examining the potential moderating roles of birth cohort, attrition rates, and time lag is critical to disentangle these factors from true age-related development of body image.

Current Study

The current study represents the most comprehensive meta-analytic synthesis of longitudinal studies on body image to date. Our aim was to provide as complete as possible a picture of normative body image development across the lifespan, using meta-analytic techniques to synthesize mean-level change in body image over time, and to model the influences of age, gender, construct, birth cohort, attrition, and time lag.

Meta-analysis affords many advantages over any single longitudinal study (Roberts et al., 2001). First, synthesizing studies to estimate average developmental trends, weighted by sample size, effectively controls for the particularities of individual samples, and provides greater statistical power and precision. To the extent that mean-level change is consistent across studies, normative developmental trends may emerge, with greater potential for generalizability beyond any single primary study. Second, a meta-analysis can describe all parts of the lifespan for which primary data are available, exceeding the time span of any primary longitudinal study. To the extent that primary studies cover the lifespan, compiling this data can address important questions, such as whether body image changes more during specific time periods (e.g., early vs. late adolescence), and whether and when mean-level body image stabilizes. Third, exploring potential moderators of body image development can capture some of the complexities of this research topic and potentially clarify contradictory results. Providing a precise and evidence-based representation of normative body image development across the lifespan may inform developmental theory, as well as the timing and delivery of interventions designed to promote positive body image and prevent eating disorders.

Research Question 1: Normative Body Image Development

How does mean-level body image change across the lifespan? We sought to paint a comprehensive, broad-strokes picture of mean-level change in body image for every part of the lifespan for which sufficient data were available, across all constructs of body image. We described normative age-related development of overall body image, providing estimates of mean-level change per year pooled across all samples, as well as separately based on sample gender. In line with prior research and theoretical understandings (Voelker et al., 2015; Wertheim & Paxton, 2011), we hypothesized that the greatest magnitude of change in mean-level body image would occur between the ages of 12 and 18, representing a critical period for typically developing girls and boys. Given the conflicting findings of primary longitudinal studies, we made no hypotheses regarding when body image would stabilize.

Research Question 2: Moderators of Mean-level Change in Body Image

We simultaneously examined the impact of several potential moderators (gender, construct, birth cohort, age, and time lag) to determine to what extent they influenced the magnitude and direction of mean-level change in body image. The null hypothesis was that all regression coefficients (i.e., betas) would be equal to zero.

In meta-analysis, one value represents the entire sample for each moderator variable at each time point. Thus, meta-analysis is appropriate for testing the effects of moderators at the sample level, but not at the individual participant level. We acknowledge that many other factors (e.g., BMI, pubertal status) influence body image development at an individual level; primary studies are better positioned to examine the effects of such moderators, for which there is substantial within-study heterogeneity.

Gender. Though there are well-established gender differences in the type and absolute levels of body image concerns endorsed, evidence is mixed regarding how gender influences the magnitude and direction of change in body image over time. Given the results of a previous longitudinal study where we found that girls were more likely than boys to demonstrate trajectories of low body esteem (Lacroix et al., 2022), we expected to find a less favourable normative pattern of body image development for girls and women than for boys and men, characterized to a greater extent by worsening body image over time.

Construct. Do different constructs of body image show different trajectories of normative development across the lifespan? We examined whether the specific body image constructs assessed showed different developmental trajectories, by including these constructs as moderators in a multilevel meta-analytic regression model. Wherever sufficient data were available, we also plotted mean-level change separately for each body image construct for the aggregate meta-analytic sample, as well as separately for all-male and all-female samples.

We hypothesized that the construct of valuation would show significantly different patterns of mean-level change across the lifespan, compared to other body image constructs. Consistent with a prior scoping review of body image development among adults older than college age (Marika Tiggemann, 2004), we expected to find relative stability in evaluative constructs such as body satisfaction, dissatisfaction, body esteem, and perceived attractiveness from the mid-twenties, at minimum. Conversely, based on the same review, we expected that valuation would show a decline over the lifespan, beginning in the early twenties.

Cohort. Prior studies have shown cohort differences in the absolute levels of body image concerns endorsed, but little is known about the impact of birth cohort on patterns of change over

time. Thus, we made no hypotheses with regards to the impact of cohort on mean-level change over time.

Attrition and Time Lag. Attrition may impact study findings, to the extent that systematic attrition occurs. Similarly, it is important to model the impact of time lag to accurately represent age-related patterns of development. Thus, we examined attrition rate and time lag to increase confidence in the results of the current study.

Method

The present study was performed according to a pre-registered systematic review protocol (PROSPERO ID: CRD42020171926, registered April 28, 2020) and in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement (Moher et al., 2009).

Search Strategy

Based on recommendations for database choice optimization in systematic reviews (Bramer et al., 2017), we systematically searched the databases EMBASE, Medline, Web of Science, PsycINFO, and ProQuest Dissertation & Theses in January 2020. No language or date range restrictions were applied to the search. Keywords related to body image and development were identified by reviewing relevant known studies. After testing a preliminary search strategy, search terms were modified to ensure retrieval of known relevant studies. In the final search, electronic databases were searched with comprehensive themes surrounding body image (using keywords such as "body image" and "body dissatisfaction") and longitudinal design or development over the lifespan (using keywords such as "longitudinal," "development," and "lifespan"). Appendix B presents the full search strategy. To minimize the impact of publication bias, we considered full text articles, dissertations, theses, conference abstracts, and unpublished

data for inclusion. In addition to our systematic search, we circulated calls for unpublished data through Dr. Michael Levine's Body Image Prevention/Sociocultural Factors email newsletter, and through the Academy for Eating Disorders discussion communities (Main Discussion, and Body Image and Prevention).

In cases where we retrieved records but could not access full text copies of the research through academic databases or interlibrary loan, we contacted authors to request copies of full texts and sent a second follow-up email if there was no response. We identified many articles describing studies that could possibly meet inclusion criteria, but which were missing information that we required for this meta-analysis (e.g., sample size, gender composition, participant age at each wave of data collection, body image outcomes at each wave of data collection). In these cases, authors were also contacted and reminded once. In total, 110 authors were contacted, and 31 of these contacts led to authors providing data that allowed us to include their studies in the meta-analysis. To test the sensitivity of our search strategy, we reviewed the reference lists from seven chapters of a widely-used handbook on body image (Cash & Smolak, 2011); our database searches retrieved 100% of relevant articles from these reference lists.

Selection Procedures and Inclusion Criteria

In the first phase of screening, EL examined titles and abstracts for eligibility using purposefully liberal inclusion/exclusion criteria. At this stage, only studies that clearly did not assess body image or employ a longitudinal design were excluded. In the second phase of screening, EL and AS both independently reviewed all full texts to determine whether records met the following criteria:

1. Scores were reported on at least one measure of body image, based on reports by participants themselves (rather than a parent or other informant). Measures of body

satisfaction, esteem, perceived attractiveness, dissatisfaction (incl. visual ratings of actual vs. ideal figures), valuation (incl. weight and shape concern), self-objectification, and body shame were considered for inclusion. We excluded studies that only assessed related constructs such as eating pathology, or more narrow constructs such as drive for thinness, thin-ideal internalization, muscularity concerns, and perceptions of weight status. [1]

2. Body image scores were reported for at least one sample, on at least two measurement occasions spanning at least six months. We excluded studies where body image was reported retrospectively (i.e., where participants were asked to estimate their body image at earlier points in time).
3. Samples were nonclinical and drawn from normative populations, including students and twins. We excluded samples of individuals diagnosed with specific mental or physical health conditions (incl. eating disorders), samples drawn from specific population subgroups (e.g., gymnasts), or samples selected based on body image or eating pathology (e.g., people with high or low body dissatisfaction to begin with).

[1] We initially considered including studies that assessed the constructs of muscularity concerns, body functionality, and body appreciation. However, the number of longitudinal studies that reported on these constructs was insufficient to generate meta-analytic estimates, and thus these studies were excluded. Conversely, there was a great deal of literature on weight esteem, weight concerns and weight satisfaction, as well as more global body image measures that included items on weight; we included those studies in the current review to maximize statistical power and our ability to represent the lifespan.

4. Studies were observational or, if reporting the results of an intervention trial, body image changes were described separately for a no-intervention control group. We excluded samples that received an intervention or experimental manipulation.
5. The age range of the sample was sufficiently homogenous. We excluded samples that had a participant age range larger than 5 years, unless data were reported separately for smaller samples with more homogenous ages. We also excluded studies where selective attrition led to participants of a certain age more frequently dropping out of the study, resulting in a mean age that decreased across study waves (due to the developmentally sensitive nature of our research question, such studies would have introduced error to the variables of age and time lag).
6. At minimum, data were available on mean-level body image (mean and standard deviation), sample size, and age of the sample at each time point.
7. The study abstract, at minimum, was written in English, French, German, or Portuguese (the first author was sufficiently proficient in those languages to extract data for the current meta-analysis).

Our choices of inclusion and exclusion criteria were driven by theory and pragmatic considerations. Rapid expansion of body image research over the past decades has resulted in a plethora of available measures to assess positively and negatively valanced constructs of body image (Kling et al., 2019), and there are no consensus boundaries delineating precisely what is and is not body image. Consistent with Cash's definition of body image (Cash, 1994; Cash et al., 2002), we wanted to capture both negative and positive aspects of the evaluative component of body image, as well as the extent of valuation (i.e., investment, emphasis, and concern placed one one's body and appearance).

In many cases, multiple articles reported on data from the same sample. In such cases, we included the study that included the largest number of participants from the sample, covered the longest total time span, and/or contained the most precise information about subgroups (e.g. separate data by gender).

For AS to become familiar with screening procedures, she was able to view EL's decisions and consult her when screening the first 50 records during full-text review. Except for these first 50 articles, AS and EL were blind to each other's decisions during screening. Excluding non-English-language articles (k = 16) and articles that could not be located (k = 13), as well as the first 50 articles, Kappa for the 567 full texts screened in Phase 2 was .85 (considered in the "almost perfect agreement" range; McHugh, 2012). Disagreements were resolved by consensus.

Data Extraction and Coding

Sample Size and Attrition

Studies handled attrition in various ways. In cases where attrition was reported but data were only provided for participants who had complete data at all time points, we extracted these data as well as attrition rates for the total sample (between each wave, where available), and reported the *N* as the number of participants with complete data (i.e. the smaller number). In cases where imputed data were reported, we extracted imputed data and attrition rates for the total sample and reported the *N* as the number of participants without missing data. In cases where only complete data were reported, with no imputation, we computed attrition rates based on the number of participants for whom data were available at each wave. When only one attrition rate was reported across three or more study waves, this rate was divided by n-1, where n = the number of study waves, to spread attrition out equally over the study waves. For

example, if a sample size of 200 was reported at Time 1, and overall retention was reported as 80%, but sample size was not reported at Times 2 or 3, we estimated that 6.66% of participants were lost between each wave– in this case, the *n* would be extracted as 200 for Time 1, 187 at Time 2, 173 at Time 3, and 160 at Time 4.

Gender

Although we recognize the distinction between sex and gender, many empirical research studies tend to conflate these constructs. For example, studies often phrase questions to ask about biological sex, but only include response options that reflect subjective gender identity (i.e., man, woman; e.g., Sullivan, 2020), and at that, only these two gender identities. Constrained by the information reported in primary studies, many of which collected data decades earlier, when there was less awareness of best practices for collecting sex and gender data, we coded effect sizes based on whether they represented "all-male," "all-female," or mixed samples.

Age and Measurement Interval

For each study, we recorded the mean age of participants at each wave of data collection. In cases where precise ages were not given at each wave of data collection, we estimated ages at follow-up data collections by adding the follow-up interval to the mean age reported at baseline (e.g., if a study reported mean age at baseline was 14.5 years, and there were three waves of data collection spaced one year apart, age would be recorded as 15.5 at Time 2 and 16.5 at Time 3). Some studies only provided the age range of participants at baseline; in such cases, if we were unable to successfully contact the study authors, we kept the studies in our dataset, and assigned age values for each time point based on the midpoint of the age range reported for that time point.

Some studies did not report sample age, but provided descriptive information linked to age, and in some cases, the time of year that data were collected. In such cases, we assigned ages to the samples based on the typical age of individuals from that group. For example, American college freshmen who completed surveys in the middle of the Fall and Winter academic semesters would be assigned age values of 18.33 and 18.66 for each respective wave of data collection.

Given that our goal was to describe mean-level change in body image constructs across the lifespan, we conducted effect size analyses within age group. As in Orth et al. (2021) and Hoff et al. (2018), we assigned age categories (or age "bins") to each effect size estimate based on the midpoint of the sample's age between the times at which mean-level body image data were collected. Each measurement interval within each study (e.g. Time 2 to Time 3 within a study) was categorized into an age bin by taking the midpoint of the measurement interval. Our choice of age bins was driven by the pool of included studies. Below age 10 and above age 24, few studies were available for most body image constructs; no measurement intervals had a midpoint between age 30 and age 38. We constructed a single age bin from age 6 (i.e., the lowest age midpoint) to age 10; 2-year age bins between ages 10.1 and 24; a single bin from age 24.1 to age 30; and a final bin from age 38 to 54 years. Three effect size estimates from a single sample were based on an age midpoint that fell on the cusp of two bins; these effect sizes were assigned to the lower age bin (in this case, 16.1-18), because over 50% of the measurement interval fell within that age bin.

The time lag between assessments was coded separately for each interval within each sample. This variable reflected the time lag (in years) between each wave of data collection; for example, if age was 15.5 at Time 2 and 16.5 for Time 3, the measurement interval would be

coded as 1. In cases where time interval was reported in months, the corresponding fraction of a year was coded.

Body Image Constructs

The first author extracted the names of body image measures from individual studies. In many cases, body image was assessed using purpose-built measures: rather than using previously validated measures, a question or series of questions was written to assess body image. Assessment methods were examined closely and we coded the type of body image construct they assessed.

We created a nominal variable reflecting the construct of body image that was assessed. Rather than categorizing these assessment methods based on an a priori taxonomy of body image constructs, we coded constructs in a data-driven manner, reflecting the ways in which body image was most commonly measured in our meta-analytic sample. Seven constructs captured the domains of body image for which the most longitudinal data are available, but not necessarily the most important constructs of body image.

Body image has been measured in terms of positively valanced constructs, for which it would be considered desirable or healthy to have a higher absolute score and show increases over time (e.g., body satisfaction); or negatively valanced constructs, for which higher and/or increasing scores would be considered undesirable, pathological, or indicative of disturbances in body image (e.g., body dissatisfaction). The three positively valanced body image constructs represented in our dataset were: (a) Body Satisfaction, defined as the degree of satisfaction with specific areas or other characteristics of the body, including weight and appearance (as in the Body Image Questionnaire, Penelo et al., 2012); (b) Perceived Attractiveness, defined as self-perceptions about the attractiveness of one's body or appearance (as in the Body Attractiveness

subscale of the Physical Self-Perception Profile for Children; Whitehead, 1995); and (c) Body Esteem, defined as the broader attitudes, evaluations, and feelings an individual holds about their body (as in the Body Esteem Scale; Franzoi & Shields, 1984). The four negatively valanced body image constructs represented in our dataset were: (d) Body Dissatisfaction, defined as dissatisfaction with specific areas or characteristics of the body (as in the Body Dissatisfaction subscale of the Minnesota Eating Behavior Survey; von Ranson et al., 2005); (e) Valuation, defined as the importance that someone places on their body, weight, and/or appearance, including distress and concern about body, weight, and/or shape (as in the Stanford Weight Concerns Scale; Killen et al., 1994); (f) Self-objectification, defined as viewing one's body as an outside observer, often in a critical or sexualizing way that reduces one's personhood and other aspects of their identity (as in the Body Surveillance subscale of the Objectified Body Consciousness Scale; McKinley & Hyde, 1996); and (g) Body Shame, capturing the emotional experience that may arise when the body does not conform to internalized ideals (as in the Body Shame subscale of the Objectified Body Consciousness Scale; McKinley & Hyde, 1996). Some studies reported data for multiple body image measures; in such cases, data for all body image measures were extracted. In addition to coding the specific construct assessed, we also coded whether the construct was positively or negatively valanced.

Mean Body Image Change

To compute mean-level change in body image, we first extracted the mean and standard deviation of each body image measure at each wave of data collection. If studies provided body image data separately for independent subsamples (e.g., girls and boys), we extracted this data separately.

Cohort

Generational cohort reflected the estimated year of birth of each sample. Few studies reported birth year, and thus we approximated this value using the calculation provided by Hoff et al. (2018): for each study, we subtracted the age of participants at final data collection from the year of publication, minus 2 years (to account for the delay prior to publication). A similar formula was also used by Jin and Rounds (2012).

Data Analysis

Effect Size & Sampling Variance

Mean-level change between each wave of data collection was quantified using the standardized mean difference (Cohen's *d*), a single-group, pretest-posttest raw score effect size (Morris & DeShon, 2002). This metric is standardized in the units of the original scale and facilitates comparisons across independent samples with different assessment methods. We calculated standardized mean difference effect size using the formula provided by Morris and DeShon (2002), and also used by many others (e.g., Hoff et al., 2018; Orth et al., 2021; Roberts et al., 2006): for each data collection interval (e.g. Time 3 to Time 4), we subtracted the mean of the body image scores at the earlier time point (Time 3) from the mean at the later time point (Time 4) and divided this raw mean difference by the standard deviation of the raw scores at the earlier time point. We then standardized this variable as mean change per year (d_{year}) by dividing it by the time interval between Time 1 and Time 2. Accordingly, the effect size measure used in the present meta-analysis is expressed as a change-to-time ratio in *d* per year units (as in Orth et al., 2021; Orth et al., 2018), reflecting the magnitude of yearly change in standard deviation units of original scales. When meta-analyzed across many studies using diverse assessment methods, d_{year} can be said to represent the average yearly change that could be expected in standard

deviation units of any given body image measure. Negative effect sizes denote a decrease, and positive effect sizes denote an increase, in the construct over time. For analyses that pooled all body image constructs (i.e., Research Question 1), we used inverse scores for effect sizes based on negatively valanced body image measures, to ensure that positive effect sizes (e.g., d_{year} = .140) consistently indicated improvements in body image and negative effect sizes (e.g., d_{year} = -.140) indicated worsening body image. For example, a d_{year} value of 0.140 for the age range of 14 to 16 would suggest that during this period, the average adolescent, all else being equal, could be expected to improve by 0.140 standard deviations per year on whatever measure of body image is used. From age 14 to 16, we would expect a cumulative improvement of 0.240 standard deviations.

For studies which reported data at three or more time points, effect sizes were computed for each sequential pair of measurements. For example, a study with three waves of data collection would have two effect sizes: one effect size representing change between the first and second waves, and a second effect size representing change between the second and third waves of data collection. Effect sizes were computed separately by gender, whenever studies provided sufficient data to do so. Some studies reported on separate subsamples, e.g., ethnic subgroups, or the body dissatisfaction of parents and children; in these cases, we extracted these data separately and retained any data that met our inclusion criteria.

We calculated within-study variance using a formula provided by Morris and DeShon (2002). This formula incorporates information about test-retest reliability to adjust the standard errors of the effect size estimates such that, all else being equal, effect sizes with higher test-retest reliability would have smaller standard errors (Roberts et al., 2006). Unfortunately, few studies in our sample reported test-retest reliability coefficients for body image measures. A

previous review of body image measures (Kling et al., 2019) reported test-retest reliability coefficients for some of the measures represented in our review, however, the test-retest intervals were much shorter than the measurement intervals of studies included our meta-analytic dataset (i.e., typically 6 weeks at most, compared to our average time lag of approximately two years). To avoid inflating confidence in the results of the current meta-analysis, we assumed a conservative test-retest reliability estimate of .50 across studies in our variance calculations, as in Orth et al. (2021), based on meta-analytic estimates of the longer-term test-retest reliability of measures of global self-esteem (Trzesniewski et al., 2003). To evaluate the impact of this choice, we compared estimates of d_{year} for overall body image calculated using within-study variance based on test-retest reliabilities of r = .25, .50, and .75. The influence of different test-retest reliability values was negligible, resulting in a maximum difference in d_{year} of .013 (M = .003; see Appendix C), indicating this choice had little impact on our results. As with d_{year}, we adjusted the variance for time lag, in this case dividing it by the squared time lag.

Evaluation of Publication Bias

We used two methods to assess whether publication bias impacted our data. First, we examined funnel plots for each body image construct. Funnel plots show the relationship between effect size and the precision of estimates; in the absence of publication bias, effect sizes can be expected to concentrate in a symmetrical funnel around the true population effect size. Second, we employed Egger's regression test (Egger et al., 1997) of funnel graph asymmetry.

Meta-analytic Structural Equation Modeling

Meta-analytic structural equation modeling enabled us to examine aggregate effect sizes, representing mean-level change during the different age periods across all included samples, for each body image construct. We used the meta-analytic structural equation modeling framework

of Cheung (2008) to fit three-level meta-analytic models, estimating effect sizes of mean-level change in body image. To model within- and between-study variance, we followed multilevel meta-analytic modeling approach outlined by Assink and Wibbelink (2016). We estimated multi-level random-effects metaregression models (for weighted mean effect sizes across each age period) and mixed-effects metaregression models (to test moderators). Data were prepared in SPSS Version 28.0, and statistical analyses were performed in R version 4.2.0 using the rma.mv function of the metafor package (Viechtbauer, 2010). Effect sizes were weighted using the inverse variance method (Nyaga et al., 2014), which is standard practice in contemporary longitudinal meta-analyses (e.g., Briley & Tucker-Drob, 2013; Hoff et al., 2018; Orth et al., 2021; Orth et al., 2018). The inverse variance method weights effect sizes by the inverse of the sampling variance and the number of effect sizes drawn from sample; effect sizes that have greater precision and larger sample sizes are weighted more heavily. This method ensures that samples which contributed many effect sizes do not unduly influence the results, and that samples are not over-represented in the dataset when they reported scores on multiple body image measures, or multiple scores within an age category/body image construct. This approach allowed us to correct for non-independence of estimates wherever multiple effect sizes were drawn from the same sample (Hoff et al., 2018; McNeish et al., 2017).

Research Question 1. To address our first research question (How does mean-level body image change across the lifespan?), we fit metaregression models to aggregate effect sizes (d_{year}) within age categories. These models investigated the average magnitude and direction of change per year across all body image constructs, during each age period. We estimated pooled change across the entire meta-analytic sample, as well as separately for all-male and all-female samples.

Research Question 2. To address our second research question (Do gender, construct, birth cohort, attrition, and time lag moderate mean-level change in body image?), we examined whether mean-level change in body image constructs was moderated by gender, construct, cohort, attrition rate, and time lag, controlling for the linear and quadratic effects of age. To increase statistical power and reduce the possibility of Type I error (Hoff et al., 2018), we conducted an omnibus test to simultaneously investigate the unique impact of each of these potential moderators on overall effect sizes across all body image constructs. For the categorical variables of construct and gender, we used dummy variables to facilitate specific comparisons, following the procedure outlined by Assink and Wibbelink (2016). We created mutually exclusive dummy variables for each body image construct, as well as to denote whether samples were all-male, all-female, or mixed gender, allowing us to examine the mean effect of reference categories tested against all other categories.

We compared each construct separately to the remainder of the meta-analytic sample; and compared female-only samples to the rest of the meta-analytic dataset (i.e., to all-male and mixed-gender samples). The null hypothesis of this omnibus test was that all regression coefficients (i.e., betas) would be equal to zero; we expected at least one regression coefficient would not be equal to zero, and specifically hypothesized that gender and the construct of valuation would have significant effects.

For descriptive purposes, regardless of the significance of potential moderators, we fit models separately for each of the seven specific body image constructs, to depict change in these body image constructs during courses of the lifespan where sufficient data were available. We described developmental patterns across all studies, and for male-only and female-only samples separately.

Results

Study Identification

A PRISMA flow diagram (Figure 2.1) depicts progress through stages of screening. The initial search yielded almost 17,000 results, 646 of which were considered for inclusion at the stage of full-text review. In total, the present meta-analysis included 143 articles and 2 additional datasets, describing 142 unique samples[2] and yielding 717 effect sizes. Table 2.1 presents the basic characteristics of included studies and datasets. The 135 published studies and eight dissertations were published between 1989 and 2020, with a median publication year of 2012; results from two unpublished datasets were included. Total sample sizes ranged from 14 to 21,129 participants (M = 952.65, Median = 410, SD = 2109.64). Fifty-two of the studies only included female samples, 3 were male-only, 70 included separate samples of males and females, and 52 pooled male and female participant data together. The time lag between measurements ranged from .25 years (i.e., 3 months) to 11.69 years (M = 2.13, SD = 2.17).[3] Mean age at the midpoint between testing intervals ranged from 6.35 years to 53.53 years (M = 16.97, SD = 5.91). Mean estimated year of birth ranged from 1946 to 2008 (M = 1991.76, SD = 8.73). The number of effect size estimates per construct was 185 for Body Esteem, 180 for Body Dissatisfaction, 134 for Satisfaction, 146 for Valuation, 32 for Self-objectification, 30 for Perceived Attractiveness, and 10 for Body Shame.

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[2] The number of samples is smaller than the number of included studies because some data were compiled from multiple studies that published on the same sample.

[3] Inclusion criteria required a minimum total study duration of at least 6 months. Shorter time lags were drawn from studies which overall spanned longer than 6 months, but with more frequent collection of data.

Figure 2.1: PRISMA Flowchart of Screening Process to Identify Studies of Body Image Development

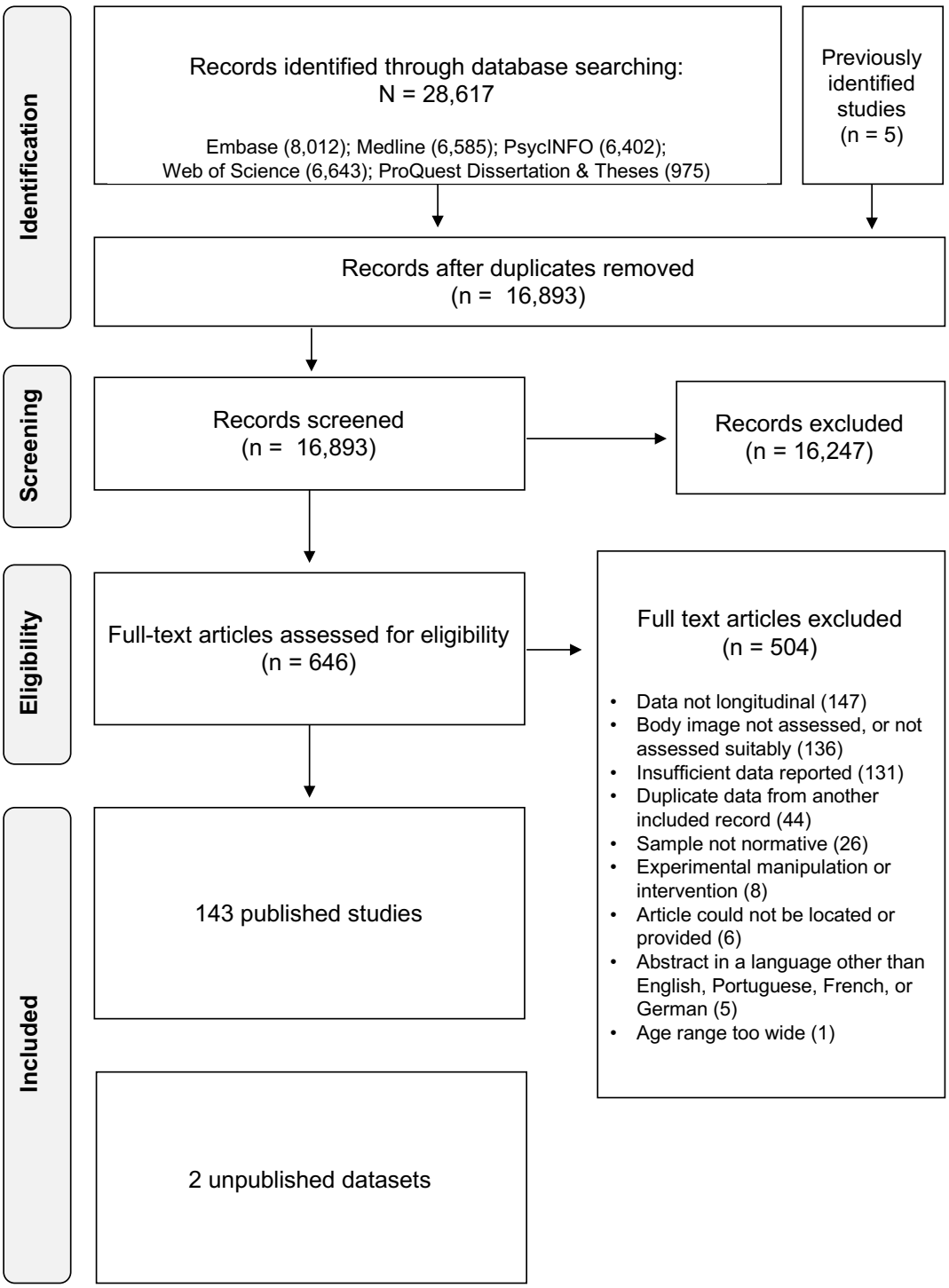


Table 2.1: Longitudinal Studies of Mean-Level Change in Body Image

Study authors (year)	Gender	*n* at T1	Age range	Waves	Construct(s)
Andrew et al. (2016)	F	298	14.03-15.02	2	SO
Archibald et al. (1999)	F	127	12.14-13.15	2	BE
Attie & Brooks-Gunn (1989)	F	193	13.93-16.09	2	BE
Aubrey & Taylor (2009)	M	152	19.70-20.70	2	V, SO
Bearman et al. (2006)	M, F	176; 240	13.57-15.57	2	D
Belanger & Marcotte (2011)	M, F	262; 237	11.22-12.29	2	BE
Benjet & Hernandez-Guzman (2002)	M, F	439; 512	11.67-12.32	2	S
Bird (2013)	F	612	20.24-21.07	2	D
Bookhout (2019)	M&F	924	10.09-13.63	2	D, V
Boone et al. (2011)	M&F	559	13.88-15.88	2	D
Boone et al. (2014)	F	455	13.24-13.74	2	D, V
Bradford & Petrie (2008)	F	236	18.20-18.70	2	S
Brosof & Levinson (2017)	F	190	18.00-18.50	2	V
Bruning Brown (2003)	F	51	14.90-15.40	2	V
Buddeberg-Fischer & Klaghofer (2002)	M, F	325	17.00-20.50	3	S, V
Burrmann (2004)	M&F	403	12.50-16.00	2	D, V
Byely et al. (2000)	F	77	12.21-13.10	2	BE
Calvete et al. (2016)	M, F	371; 523	15.43-15.93	2	S
Calzo et al. (2012)	M, F	3045; 3438	9.90-17.90	3	V
Cantin & Stan (2010)	M, F	288; 306	13.1-14.1	2	D
Carlson Jones (2004)	M, F	139; 165	12.5-16.5	2	D
Chen & Jackson (2009)	M, F	131; 181	13.95-18.7	2	BE
Clark & Tiggemann (2008)	F	150	10.30-11.30	2	D, BE
Craigen (2014)	F	136	18.00-18.75	2	V, SO, BS
Crespo et al. (2010)	M, F	851; 923	12.13-14.13	3	S
Dakanalis et al. (2015)	M, F	324; 361	14.54-16.54	3	SO, BS
Davison et al. (2003)	F	197	5.40-9.40	3	D, V
Davison et al. (2008)	F	163	9.34-13.33	3	BE
De Caro & Di Blas (2016)	M, F	74; 65	15.36-16.32	2	D
de Vries et al. (2016)	M, F	298; 306	14.70-16.20	2	D
Dion et al. (2015)	M, F	258; 152	14.50-18.50	2	D

Study authors (year)	Gender	*n* at T1	Age range	Waves	Construct(s)
Donovan et al. (2006)	F	797	12.83-14.83	3	D
Duarte et al. (2017)	F	290	13.73-15.63	3	BS
Duncan et al. (2007)	M, F	177; 130	12.50-13.60	2	BE
Espinoza et al. (2013)	M, F	75; 126	13.48-15.40	2	S, D
Evans et al. (2017)*	M, F	797; 1042	7.45-18.45	4	D, BE
Fawkner et al. (2014)	F	143	11.80-13.28	4	PA
Fay & Lerner (2013)	M&F	521	14.90-16.90	3	D
Ferreiro et al. (2011)	M, F	404; 399	12.80-14.90	2	D
Ferreiro et al. (2012)	M, F	445; 437	10.83-12.85	2	D
Frisén et al. (2015)	M, F	445; 515	10.00-18.00	5	BE
Gattario et al. (2019)	M, F	316; 394	10.36-18.36	2	BE
Gervais & Jose (2019)	M, F	854; 920	12.11-14.14	3	S
Gestsdottir et al. (2015)	M, F	195; 190	15.00-23.00	2	S
Gilbert & Meyer (2005)	F	143	18.70-19.29	2	D
Gillen & Lefkowitz (2012)	M, F	179; 211	19.44-20.04	2	V
Gillison & Standage (2011)	M, F	169; 176	14.05-14.89	2	S
Girard et al. (2018)	F	192	20.97-21.97	2	D
Gondoli et al. (2011)	F	88	11.60-13.60	3	D
Goossens et al. (2012)	M&F	601	9.05-10.05	2	V
Guerin et al. (2017)	F	102	49.85-54.02	5	BE
Halpern et al. (1999)	F	202	13.80-15.80	5	D
Hochgraf et al. (2019)	M, F	602; 592	10.12-18.88 (children), 38.62-44.54 (parents)	5	V
Hoffmann & Warschburger (2019)	M, F	481; 492	14.09-18.21	3	V
Holsen et al. (2012)	M, F	615; 517	13.30-30.30	6	S
Homan (2010)	F	231	23.30-30.30	2	S
Hunger & Tomiyama (2018)	F	2036	14.00-19.00	2	D
Jackson & Chen (2008)	M, F	217; 376	15.25-16.75	3	V
Jackson et al. (2020)	F	1836	18.69-19.69	2	V
Jackson & Chen (2014)	M, F	1271; 1415	12.66-17.57	2	D
Jackson & Chen (2015)	M, F	1017; 2144	18.87-19.97	2	D, SO, BS
Johnson (2006)	F	219	18.00-18.91	4	D
Jones et al. (2008)	M	154	12.60-13.60	2	D

Study authors (year)	Gender	*n* at T1	Age range	Waves	Construct(s)
Knowles et al. (2009)	F	204	11.83-12.79	2	PA
Kvalem et al. (2011)*	M, F	5407; 5645	12-32	4	BE
Lee & Vaillancourt (2019)	M, F	291; 340	12.91-16.91	3	D
Lemoyne & Girard (2018)	M, F	87; 169	17.60-19.10	6	PA
Linville et al. (2011)	F	444	17.50-20.50	4	D
Low et al. (2003)	F	16	19.00-19.50	2	D, V
Low et al. (2006)	F	14	19.00-19.96	3	D, V
Lowe et al. (2019)	F	762	11.00-29.00	6	D, V
Lunde et al. (2007)	M, F	400; 474	10.36-13.58	2	BE
Luszczynska & Abraham (2012)	M&F	551	16.43-17.45	2	S
Martins & Harrison (2012)	M&F	429	8.72-9.75	2	D
McCabe & Ricciardelli (2005)	M, F	344; 246	13.08-14.49	3	D, V
McKinley (2006)	F	72 (younger); 74 (older)	18.58-28.58, 47.41-57.41	2	BE, SO, BS
McKinley (2006)	M, F	163; 303	18.97-29.40	2	BE, SO, BS
McVey & Davis (2002)	F	113	10.88-11.88	3	BE
Mendelson et al. (1996)	M&F	76 (younger); 85 (older)	8.90-10.80, 11.90-14.00	2	BE
Mendes et al. (2014)	M, F	897; 985	13.67-16.80	2	D
Mills et al. (2012)	F	79	19.60-22.10	6	D
Mora et al. (2015)	M&F	88	13.40-14.48	3	D
Morin et al. (2011)	M&F	1001	12.62-16.04	5	PA
Murdey et al. (2005)	M, F	43; 40	11.00-19.00	3	PA
Murphy et al. (2019)	M, F	442; 479	13.10-13.70	2	BE
Murray et al. (2018)	M, F	245; 251	14.31-15.56	2	V
Nelson et al. (2018)	M&F	967	10.36-24.36	6	BE
O'Dea & Abraham (2000)	M&F	195	12.94-13.94	2	S, D, V
Ohring et al. (2002)	F	120	14.30-16.00	2	D
Olive et al. (2019)	M&F	376	8.16-12.07	3	BE
Patalay et al. (2015)	M, F	4767; 5136	8.70-13.71	3	D
Perkins & Brausch (2019)	M, F	186; 223	13.04-14.19	3	D
Petersen & Hyde (2013)	M, F	196; 207	11.52-15.50	3	SO
Plumed et al. (2019)	M, F	3361; 3711	13.60-15.70	2	D

Study authors (year)	Gender	*n* at T1	Age range	Waves	Construct(s)
Presnell et al. (2004)	F	293	17.00-17.75	2	BE
Rawana & Morgan (2014)	M, F	2237; 2122	12.00-21.00	10	D
Rayner et al. (2013)	F	1094	12.30-14.20	3	D, V
Rehkopf et al. (2011)	F	2198	12.03-19.09	5	D
Ricciardelli et al. (2006)	M	237	9.25-10.57	3	D
Rodgers et al. (2015)	F	230	12.77-13.80	3	D
Rodgers et al. (2019)	M, F	106; 138	7.50-8.50	2	BE
Rollins et al. (2011)	F	177	9.50-11.50	2	V
Rousseau et al. (2017)	M&F	1621	14.76-15.26	2	D
Rousseau et al. (2018)	M, F	1037; 934	11.30-12.30	3	V, SO
Rousseau et al. (2020)	F	1037; 934	11.30-12.30	3	S
Sala & Levinson (2016)	F	299	18.71-19.71	3	D
Schaffhuser et al. (2017)	M, F	120; 126	10.61-12.64	3	BE
Schooler (2013)	F	171	13.30-17.30	3	BE
Schooler & Trinh (2011)	M, F	387; 454	14.70-16.70	2	BE
Sehm & Warschburger (2018)	M, F	516; 523	14.37-16.04	2	V
Seiffge-Krenke et al. (2002)	M, F	51; 64	14.90-17.20	3	S
Seiffge-Krenke et al. (2015)	M, F	114; 144	14.27-16.95	2	S
Shomaker & Furman (2010)	M, F	95; 98	17.90-19.11	2	BE
Shomaker & Furman (2009)	M, F	98; 98	17.90-19.11	2	S
Simmons (1998)	F	239	12.84-17.87	5	D
Sinton (2007)	M, F	192 (girls); 197 (fathers); 197 (mothers)	9.34-13.33 (girls), 37.37-41.58 (parents)	3 (girls), 2 (parents)	V
Slap et al. (1994)	F	54	12.22-13.22	2	BE
Stice & Whitenton (2002)	F	496	13.01-14.01	2	D
Striegel-Moore et al. (2000)	F	2379	11.00-16.00	6	D
Stutts & Blomquist (2020)	M, F	157; 394	18.50-21.50	2	V
Swarr (1998)	F	103	11.50-15.50	3	BE
Tiggemann (2005)	F	242	14.00-16.00	2	S, D
Tiggemann (2004)	M, F	19; 58	25.12-33.12	2	S
Tiggemann & Slater (2017)	F	438	13.60-15.60	2	SO
Trompeter et al. (2019)	M, F	443; 595	14.25-16.25	3	V
Valois et al. (2019)	M&F	1197	13.51-15.62	3	BE

Study authors (year)	Gender	*n* at T1	Age range	Waves	Construct(s)
Vandenbosch & Eggermont (2016)	M&F	1504	15.35-16.35	3	SO
Vangeel et al. (2018)	M&F	355	21.17-27.17	4	SO
Verschueren et al. (2018)	M, F	262; 268	15.00-16.34	3	D
Viborg et al. (2014)	F	445	13.00-14.05	2	BE
Viira & Raudsepp (2003)	M, F	105; 92	13.00-14.00	2	D
Wade et al. (2015)	M, F	160; 257	13.46-14.53	3	V
Wang, Y. et al. (2019)	M&F	767	15.78-16.36	2	D, SO
Wang, S.B. et al. (2019)	M, F	597; 858	12.64-31.96	4	S, V
Warschburger & Zitzmann (2018)	M&F	544	12.90-13.90	2	D
Waszczuk et al. (2019)	M&F	2629	15.20-19.60	3	D
Webb et al. (2016)	M, F	167; 200	12.01-13.01	2	V
Webb & Zimmer-Gembeck (2016)	M, F	172; 215	11.97-13.68	4	BE
Wertheim et al. (2001)	F	316	12.84-16.39	2	D
Wichstrom & von Soest (2016)	M, F	1482; 1769	14.88-28.49	4	BE
Woelders et al. (2010)	M, F	1041; 982	13.80-15.80	3	D, V
Wojtowicz & von Ranson (2012)	F	393	15.80-16.80	2	D
Zimmer-Gembeck et al. (2018)	M, F	175; 212	12.00-14.00	5	BE, V
Unpublished datasets (Atkinson, 2020)	M, F	419; 317	11.46-14.61	5	BE
	M, F	259; 232	13.23-14.25	3	S, BE

Note. "M, F" indicates that data were reported separately for these two genders; "M&F" indicates that data were pooled across genders. S = satisfaction; D = dissatisfaction; PA = perceived attractiveness; BE = body esteem; V = valuation; SO = self-objectification; BS = body shame. In service of conciseness, some subgroups have been pooled in this table, although their data were extracted and analyzed separately. Some data needed to be extracted from multiple publications reporting on a single sample; in these cases, both papers are cited for completeness,

but we assigned the same sample ID number and weighted these studies accordingly. In some cases, authors graciously provided additional data and information about their study samples; the data in this table (as well as the data extracted and analyzed) may accordingly differ somewhat from what has been described in publications.

Publication Bias

Two characteristics of the current meta-analysis reduce the possibility that systematic publication bias influenced our results. First, unpublished data and dissertations were included in the current meta-analytic dataset. Second, most studies included did not focus on body image development but instead happened to report this data in the context of testing other hypotheses. We cannot imagine that the authors of primary studies would have been incentivized to publish research demonstrating greater stability or change in body image.

To assess the possibility of publication bias in our included studies, we created and inspected funnel plots, and performed Egger's regression test of funnel graph asymmetry (Egger et al., 1997) for overall body image, and for each of the seven body image constructs in our dataset. To correct for multiple comparisons (we conducted 8 Egger's tests), we used a Bonferroni-corrected *p* value of .0006 (.05 divided by 8). As reported in Table 2.2, Egger's tests were non-significant when we employed the Bonferroni correction. Funnel graphs are displayed in Figure 2.2. There were several outlier effect sizes in our meta-analytic dataset, but these outliers appeared to represent valid data points. Removing outliers would have resulted in greater *p* values of Egger's tests and would also have made the funnel graphs appear more symmetrical. At the risk of widening the confidence intervals around our estimates, we chose to keep these outliers in the dataset, consistent with literature advising against deletion, in meta-analysis, of outliers with particularly large or small effect sizes (Viechtbauer & Cheung, 2010).

Figure 2.2: Funnel Graphs Displaying the Association Between Effect Size and Precision

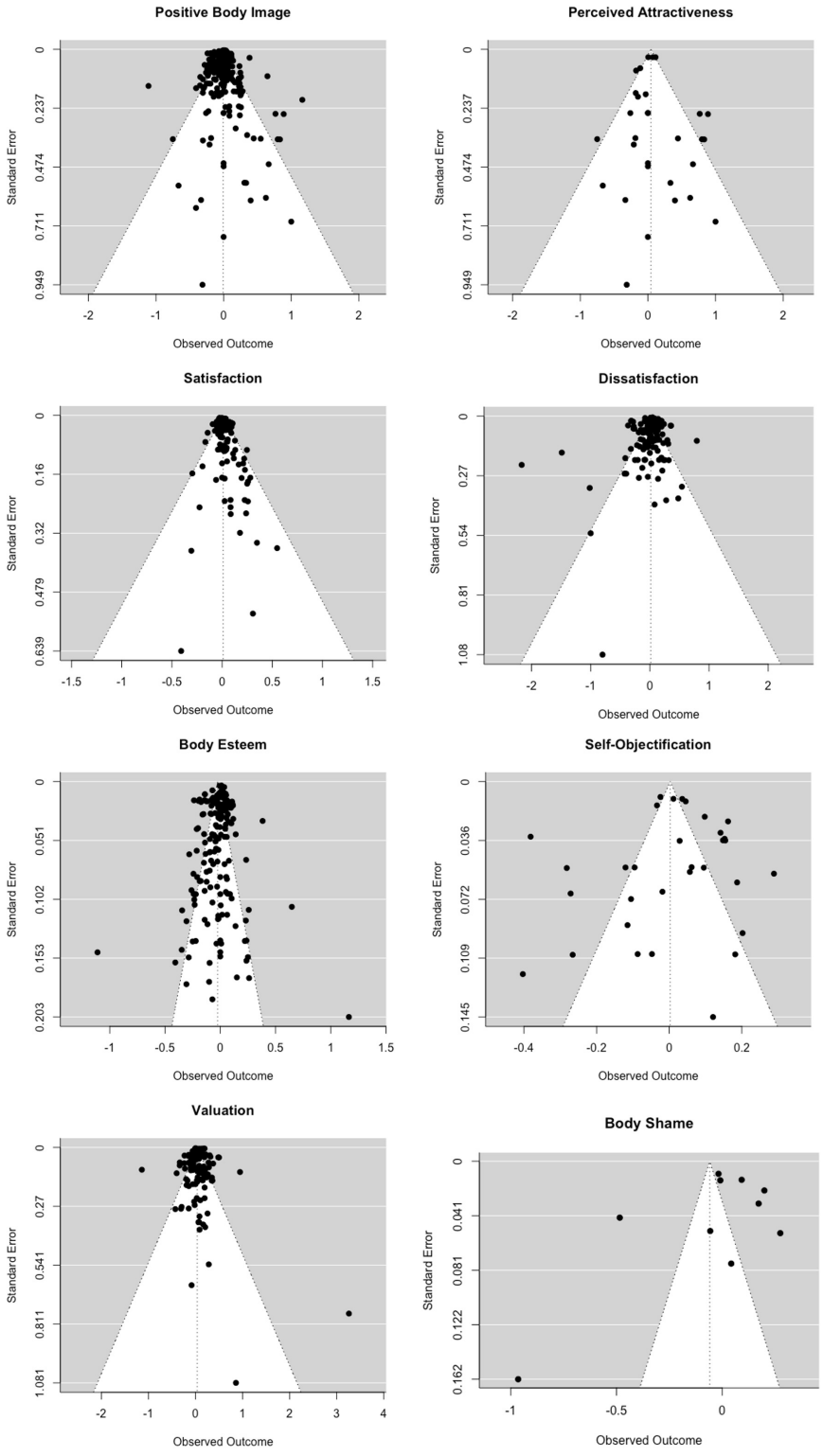


Table 2.2: Results of Egger's Tests Examining Publication Bias in Mean-level Change in Body Image Constructs

Construct	*k*	N_{ES} (M)	N_{ES} (F)	N_{ES} (M&F)	*z*	*p*
Overall Body Image	142	260	396	61	-2.632	.008
Satisfaction	23	62	67	5	2.520	.012
Perceived Attractiveness	5	11	15	4	1.057	.290
Body Esteem	38	69	96	20	-1.302	.193
Dissatisfaction	61	48	118	14	-2.972	.003
Valuation	33	59	80	7	0.985	.325
Self-Objectification	13	9	12	11	-1.177	.239
Body Shame	6	2	8	0	-2.773	.006

Note. Unstandardized regression coefficients.

k = number of samples; N_{ES} = number of effect sizes. M = male samples; F = female samples; M&F = mixed male and female samples.

The sum of the number of studies (*k*) for body image constructs is larger than the total number of included samples (*k* = 142), because some studies reported on multiple body image constructs.

Mean-level Change in Overall Body Image

We fitted multi-level meta-analytic models to estimate effect sizes of mean-level change in overall body image across portions of the lifespan where sufficient data were available. We used the weighted mean-level change per year (d_{year}) to capture the magnitude and direction of change in each age range, regardless of whether these effect sizes were significantly different from zero. These effect size analyses were conducted within age groups, modeling heterogeneity within and between samples.

Table 2.3 describes the meta-analytic findings for mean-level change across all body image constructs, for the entire meta-analytic sample and separately for all-male and all-female samples. Figure 2.3 shows the findings on body image development as a function of age, between ages 6 and 30. Cumulative *d* values are plotted along the vertical axis; the estimate of weighted mean-level change per year (d_{year}) was used for each year included in each age group. No effect sizes were available from measurement intervals with a midpoint between 30 and 38, and only five studies reported on body image between 38 and 54. Thus, we were limited in our ability to draw conclusions about normative patterns of mean-level change in body image past the age of 30. We have not plotted mean-level change past age 30, but have reported these estimated d_{year} values in Table 2.3. These values were based on a small number of studies, and thus have wider confidence intervals; they should be interpreted with caution.

Given the preponderance of all-female (396 effect sizes), versus all-male (260 effect sizes) and mixed (61 effect sizes) samples in our data, aggregate mean-level effect sizes across all samples were skewed heavily towards representing female body image development, which could be misleading. Accordingly, we focus on describing patterns of age-related change in overall body image separately for male and female samples.

Note that all but two d_{year} estimates are non-significant, as indicated by confidence intervals that cross zero. We were primarily interested in the magnitude and direction of estimated yearly change, rather than the significance of these estimates. The power of null-hypothesis significance tests of mean-level change would have been greater if we constructed broader age groups (i.e., compiled meta-analytic effect-size estimates based on larger numbers of samples and effect sizes), but such an approach would have reduced our precision in describing age-related trends in normative body image development. Accordingly, null-hypothesis significance testing of mean-level change was not the focus of the current meta-analysis, but we report these results in service of completeness, as in Orth et al. (2018, 2021).

Male samples showed a pattern of fluctuating, but overall slightly improving, body image with increasing age. Body image worsened slightly between ages 6 and 10 (cumulative d = -0.016, representing total average change during these four years); improved between ages 10 and 16 (cumulative d = 0.260); worsened slightly between ages 16 and 18 (cumulative d = -0.048); improved between age 18 and 22 (cumulative d = 0.166); and worsened again between age 22 and 24 (cumulative d = -0.038). The largest improvements tended to take place between ages 10 and 12 (d_{year} = 0.090), followed by ages 20 to 22 (d_{year} = 0.071). As with female samples, male samples showed a plateau between ages 24 and 30, with negligible worsening between these age midpoints (cumulative d = -.006). The four studies (and four effect sizes) with measurement interval midpoints after age 30 showed a weighted average effect size of d = -.035, suggesting that males may show worsening body image later in adulthood, perhaps to a larger extent than females.

In female samples, changes were larger in magnitude, and in the direction opposite male samples until age 18. Body image tended to improve slightly between ages 6 and 10 (cumulative

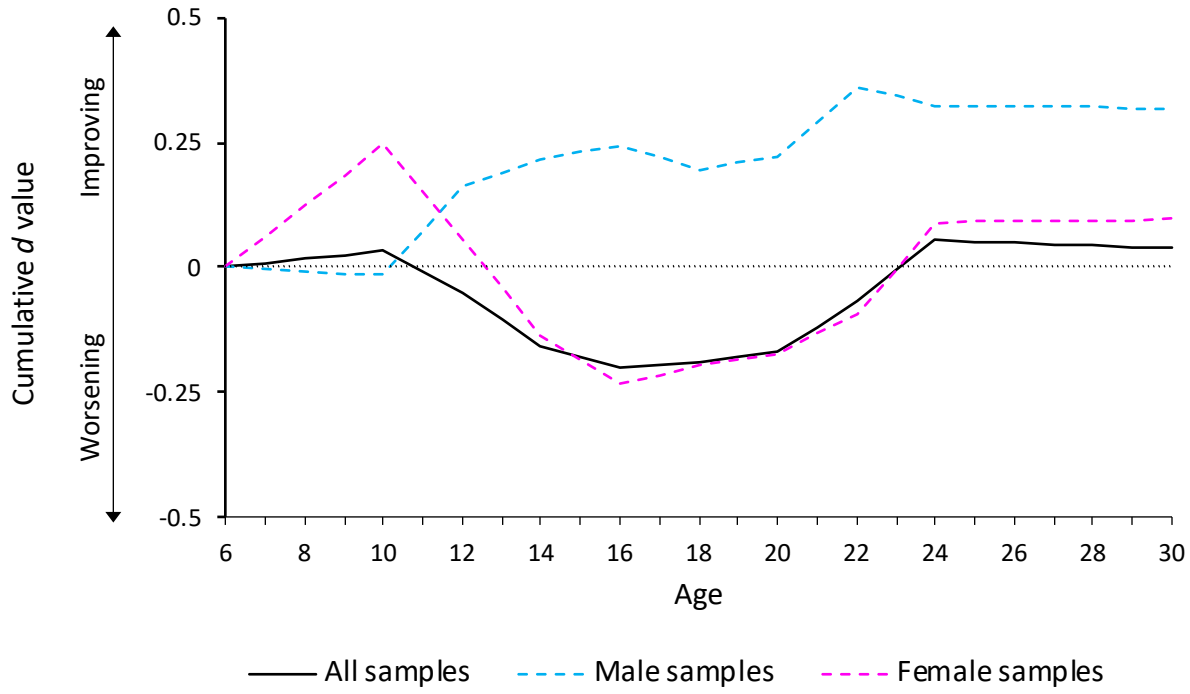
d = 0.248), though notably, this estimate was based on only four studies and eight effect sizes. Body image then worsened between ages 10 and 16 (cumulative d = -0.482), with cumulative mean change culminating in a nadir around age 16. The magnitude of decrement was largest between ages 10 to 12 (d_{year} = -0.097), and 12 to 14 (d_{year} = -.095), but smaller in magnitude between ages 14 and 16 (d_{year} = -.049). Based on relative magnitude of change, age 10 to 14 may represent a sensitive period for body image among typically developing girls. Between age 16 and 24, female samples tended to show improvements in mean-level body image (cumulative d = 0.330). Mean-level body image then appeared to plateau, with very minor improvements between ages 24 and 30 (cumulative d = .006). Only four studies (10 effect sizes) assessing body image in female samples had measurement interval midpoints after age 30. Their weighted average effect size was d = -0.015 per year, suggesting that females may show worsening body image as middle age wears on.

Table 2.3: Yearly Mean-Level Change in Overall Body Image

	All samples					Male samples					Female samples				
Age range	*k*	N_{ES}	d_{year}	95% CI	*Q*	*k*	N_{ES}	d_{year}	95% CI	*Q*	*k*	N_{ES}	d_{year}	95% CI	*Q*
6-10	9	18	0.008	[-0.081, 0.096]	190.36*	4	4	-.004	[-0.074, 0.067]	7.73	4	8	.062	[-0.105, 0.229]	119.28*
10.1-12	23	48	-0.041	[-0.130, 0.047]	1061.78*	12	16	.090	[-0.054, 0.233]	408.99*	19	27	-.097	[-0.199, 0.005]	386.83*
12.1-14	57	167	-0.053	[-0.103, -0.003]	2232.13*	31	60	.026	[-0.064, 0.115]	431.66*	49	96	-.095	[-0.145, -0.046]	1203.73*
14.1-16	61	158	-0.021	[-0.039, -0.004]	1445.43*	35	56	.014	[-0.009, 0.037]	385.87*	50	88	-.049	[-0.071, -0.026]	763.63*
16.1-18	30	90	0.005	[-0.029, 0.039]	694.69*	16	34	-.024	[-0.067, 0.020]	194.32*	23	46	.020	[-0.025, 0.065]	426.46*
18.1-20	31	111	0.009	[-0.018, 0.036]	783.08*	16	40	.012	[-0.035, 0.058]	340.19*	28	64	.010	[-0.024, 0.044]	421.60*
20.1-22	11	37	0.052	[-0.035, 0.139]	379.53*	6	14	.071	[-0.103, 0.244]	40.54*	8	19	.041	[-0.082, 0.164]	326.12*
22.1-24	6	32	0.061	[-0.080, 0.203]	546.67*	3	12	-.019	[-0.040, 0.001]	22.52*	5	18	.091	[-0.077, 0.258]	462.01*
24.1-30	8	43	-0.003	[-0.014, 0.009]	115.77*	6	21	-.001	[-0.018, 0.015]	45.72*	6	20	.001	[-0.011, 0.014]	48.32*
38-54	4	13	-0.026	[-0.063, 0.010]	32.22*	2	3	-.035	[-0.103, 0.034]	2.64	4	10	-.015	[-0.068, 0.038]	29.47*

Note. Effect sizes were meta-analyzed using random-effects multilevel models. The first *k* column does not sum to 142 (i.e., the total number of included samples), because many studies contributed multiple effect sizes in multiple age categories and body image constructs. *k* = number of samples; N_{ES} = number of effect sizes in the *k* samples; d_{year} = Weighted mean effect size expressed as mean-level change per year; CI = confidence interval; *Q* = heterogeneity test statistic. Positive d_{year} values indicate that body image improved during an age period, whereas negative d_{year} values indicate that body image worsened. * $p < .05$.

Figure 2.3: Mean-level Change in Overall Body Image from Age 6 to 30



Note. This figure shows cumulative *d* values; the point of origin (i.e., zero) is arbitrary. The black line (all samples) also included mixed-gender samples.

Moderators of Mean-Level Change in Body Image

We tested whether the categorical variables of sample gender and construct, and the continuous variables of cohort (i.e., sample's estimated birth year), retention rate (an indicator of attrition expressed for each effect size as the proportion of participants from Time 1 who were also assessed at Time 2), and time lag (i.e., time elapsed between Time 1 and Time 2 for each effect size) moderated mean-level change in overall body image development. Categorical variables were dummy coded to examine the main effect of sample gender (all-female vs. all-male or mixed samples), and of each body image construct separately. Continuous variables were mean-centered. To gain information about the unique effects of moderators on effect sizes, we simultaneously entered these moderators into the multilevel model. We also controlled for the linear and quadratic effects of age of the sample at the midpoint of each measurement interval.

Table 2.4 describes the findings of the omnibus moderator analysis. The construct of body shame was determined to be redundant (likely because only seven effect sizes were reported for body shame) and was dropped from the model. None of the body image constructs had significant main effects, failing to support our hypothesis that the construct of valuation would change in ways that differed systematically from other body image constructs. The effects of cohort and retention rate were also non-significant.

Effect sizes were significantly moderated by gender. As hypothesized, the main effect of female sample gender was negative (b = -.033), indicating that at any given time, samples composed entirely of girls and women were more likely than other samples to show worsening body image; this moderator had the largest effect of all those tested.

Time lag had a small negative relationship with change (b = -.013), such that longer data collection intervals were associated with larger negative changes in overall body image. The

linear effect of age was positive (b = .23), such that samples with older mean ages were more likely to show improvements in body image over time. The quadratic effect of age (representing a U-shaped relationship between effect sizes and age), although it was significant, was so negligible in magnitude that it is not worth interpreting.

Table 2.4: Mixed-Effects Meta-Regression Models Examining Moderators of Overall Body Image Development

Moderator	Estimate [CI]	*SE*	*p*
Gender (F)	-0.033 [-0.051, -0.016]	0.009	<.001
Construct			
Satisfaction	0.034 [-0.041, 0.110]	0.039	.110
Perceived attractiveness	0.060[-0.128, 0.249]	0.096	.249
Body esteem	0.044 [-0.030, 0.118]	0.038	.247
Dissatisfaction	0.036 [-0.038, 0.111]	0.038	.340
Valuation	0.037 [-0.038, 0.113]	0.038	.331
Self-objectification	-0.004 [-0.079, 0.071]	0.038	.923
Cohort	0.000 [-0.003, 0.004]	0.002	.785
Retention rate[a]	-0.024 [-0.074, -0.027]	0.026	.364
Age (linear)[b]	0.023 [0.016, 0.031]	0.004	<.001
Age (quadratic)[c]	-0.000 [-0.001, -0.000]	0.000	<.001
Time lag[d]	-0.013 [-0.020, -0.006]	0.004	<.001

Note. Body shame was identified as a redundant predictor and dropped from the model. Regression coefficients are unstandardized, and based on a meta-analytic sample of 717 effect sizes. $Q(570) = 6340.27$, $p < .001$. CI = 95% confidence interval.

[a] The retention rate reflects, for each effect size, the portion of the sample from time 1 that was measured at time 2. Retention rate data were only available for 591 of 717 effect sizes.

[b] Linear effect of the age of the sample at the midpoint of observed data collection interval.

[c] Quadratic effect of the age of the sample at the midpoint of observed data collection interval.

[d] Effect of the duration of the observed data collection interval.

Mean-level Change in Specific Body Image Constructs

Despite construct not being a significant moderator of yearly mean-level body image change, we estimated change across studied portions of the lifespan separately for each construct to maximize the informativeness and utility of the current meta-analysis. Table 2.5 describes meta-analytic effect size estimates stratified based on the construct of body image, across all samples and separately for all-male and all-female samples. These aggregate estimates were based on smaller numbers of samples, and as such, confidence intervals were wider than when d_{year} was aggregated across body image constructs.

In Figure 2.4, we plotted d_{year} separately for each construct, across all samples and separately for all-male and all-female samples, for each age range that had at least two available effect sizes upon which to base meta-analytic estimates. There were missing data for certain constructs and phases of the lifespan, indicated by discontinuities in our plots.

Body Satisfaction (Age 10–30)

In male samples, mean body satisfaction showed incremental increases from age 12 to 20. The largest increases were observed between age 12 and 14 (d_{year} = 0.060), but the magnitude of increases diminished across the adolescent years. At approximately age 20, the direction of change in mean-level body satisfaction reversed in male samples: for age midpoints above 20, mean body satisfaction declined, with the steepest decline occurring between ages 22 and 24 (d_{year} = -0.018).

In female samples, mean body satisfaction declined from age 10 to 16, with the steepest decline occurring from age 10 to 12 (d_{year} = -0.097), a magnitude substantially larger than what was observed among male samples. At approximately age 16, the direction of change in mean-level body satisfaction reversed for female samples; for age midpoints above 16, mean body

satisfaction increased. However, the magnitude of change was small after age 20 ($d_{year} \leq .008$), suggesting that on average, mean-level body satisfaction was stable in samples of adult women.

Perceived Attractiveness (Age 10–20)

In male samples, estimates of yearly mean-level change in perceived attractiveness were positive at every age range for which data were available, suggesting the average adolescent male finds himself better-looking every year (cumulative *d* for ages 10 to 16= 1.592; cumulative *d* for ages 18-20 = 0.664). In female samples, mean-level perceived attractiveness increased between ages 10 and 12 (cumulative *d* = .226), declined from 12 to 16 (cumulative *d* = -0.400), and increased between ages 18 and 20 (cumulative *d* = 0.252).

Body Esteem (Male Samples: Age 10–30; Female Samples: Age 10–54)

In male samples, mean-level body esteem was relatively stable, with small fluctuations: it increased slightly between ages 10 and 16 (cumulative *d* = 0.092), decreased between age 16 and 18 (cumulative *d* = -0.052), increased from 18 to 22 (cumulative *d* = 0.056), and then increased from age 24 to 30 (cumulative *d* = 0.018). In female samples, mean-level body esteem declined from age 10 to 16 (cumulative *d* = -0.452) but increased from age 16 to 30 (cumulative *d* = .488). Two longitudinal studies examined body esteem in female samples between ages 38 and 54, yielding a pooled effect size of d_{year} = -0.028; this value suggests women may, on average, experience declines in body esteem later in adulthood.

Body Dissatisfaction (Male Samples: Age 6–20; Female Samples: Age 6–22)

In male samples, mean body dissatisfaction increased between ages 6 and 10 (cumulative *d* = 0.048), decreased between ages 10 and 16 (cumulative *d* = -0.466), increased very slightly between ages 16 to 18 (cumulative *d* = 0.016), and decreased from age 18 to 20 (cumulative *d* = -0.136). In female samples, change occurred in the opposite direction: mean body dissatisfaction

decreased between ages 6 and 10 (cumulative d = -0.284), increased between ages 10 and 16 (cumulative d = 0.364), decreased slightly between ages 16 and 18 (cumulative d = -0.120), increased between ages 18 and 20 (cumulative d = 0.078), and decreased between ages 20 and 22 (cumulative d = -0.096).

Valuation (Male Samples: Age 10–30 and 38–54; Female Samples: Age 6–30 and 38–54)

In male samples, mean-level valuation decreased between ages 10 and 16 (cumulative d = -0.368), increased slightly between ages 16 and 18 (cumulative d = 0.034), decreased between ages 18 and 22 (cumulative d = -0.242), and increased between ages 22 and 30 (cumulative d = 0.164). Two studies reported on change later in adulthood; these studies were pooled to yield an effect size of d_{year} = 0.035, suggesting that for men, valuation may increase later in adulthood.

In female samples, mean valuation decreased between ages 6 and 10 (cumulative d = -0.772), increased between ages 10 and 18 (cumulative d = 0.870), decreased slightly between ages 18 and 20 (cumulative d = -0.016), and increased between ages 20 and 30 (cumulative d = 0.204). Two studies reported on change later in adulthood; these studies were pooled to yield an effect size of d_{year} = -0.015, suggesting that for women, valuation may decrease later in adulthood.

Self-objectification (Incomplete Data)

Few longitudinal studies examined self-objectification. When pooled across all samples, mean levels of self-objectification decreased between ages 10 and 12 (cumulative d = -0.380), increased between ages 12 and 20 (cumulative d = 0.750), and decreased between ages 20 and 30 (cumulative d = -0.800). Available data suggested increases in self-objectification between the ages of 12 and 16 for both male (cumulative d = 0.132) and female (cumulative d = 0.532) samples. For female samples, data were also available for ages 18-20, and suggested an increase

in mean-level self-objectification during this age range (cumulative d = 0.196). Available data suggested that female samples decreased in mean self-objectification between ages 22 and 24 (cumulative d = -0.404).

Body Shame (Incomplete Data)

Only five longitudinal studies examined body shame, and none of these studies reported mean-level change separately for male samples (one effect size was based on a mixed sample, and six effect sizes were based on female-only samples). On average, body shame decreased in the predominantly female samples at all age ranges during which data were available: cumulative d values were -0.023 for age 14 to 16, -0.752 for age 18 to 20, and -0.498 for age 22 to 24. Given the scant and discontinuous nature of available data on body shame, and the wide confidence intervals of resulting yearly change estimates, we were not confident in these change estimates, and thus we did not plot the development of body shame.

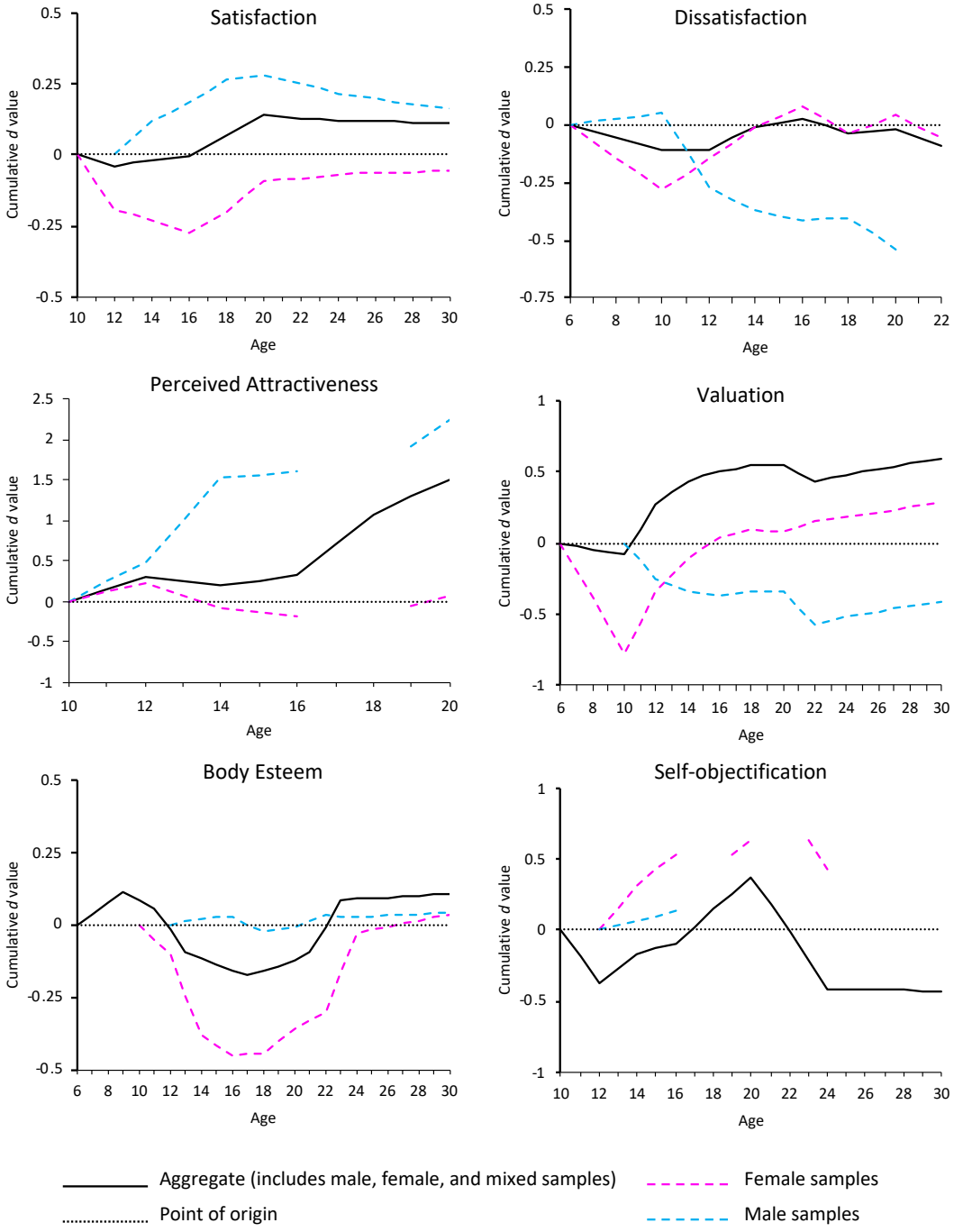
Table 2.5: Yearly Mean-Level Change in Body Image Constructs

Construct and age	All samples				Male samples				Female samples			
	k	N_{ES}	d_{year} [95% CI]	*Q*	*k*	N_{ES}	d_{year} [95% CI]	*Q*	*k*	N_{ES}	d_{year} [95% CI]	*Q*
Satisfaction												
10.1-12	2	3	-0.019 [-0.392, 0.354]	8.74*					2	2	-0.097 [-1.023, 0.829]	1.86
12.1-14	7	19	0.011 [-0.019, 0.042]	42.45*	6	9	0.060 [-0.022, 0.142]	23.07*	5	9	-0.017 [-0.046, 0.012]	8.78
14.1-16	9	19	0.005 [-0.030, 0.040]	92.52*	8	9	0.031 [-0.031, 0.093]	41.94*	9	10	-0.024 [-0.076, 0.028]	31.79*
16.1-18	6	21	0.038 [0.016, 0.060]	58.40*	4	9	0.041 [-0.004, 0.087]	28.15*	5	10	0.037 [0.005, 0.069]	27.94*
18.1-20	9	31	0.034 [0.013, 0.055]	66.80*	7	13	0.008 [-0.015, 0.032]	21.77*	8	16	0.055 [0.029, 0.082]	20.21
20.1-22	4	11	-0.004 [-0.027, 0.019]	29.92*	4	6	-0.014 [-0.033, 0.006]	2.59	3	5	0.004 [-0.054, 0.062]	21.53*
22.1-24	3	12	-0.004 [-0.036, -0.028]	64.70*	3	6	-0.018 [-0.033, -0.003]	5.07	3	6	0.008 [-0.047, 0.063]	46.03*
24.1-30	4	18	-0.002 [-0.015, 0.011]	27.47*	4	9	-0.009 [-0.032, 0.014]	16.92*	4	9	0.002 [-0.006, 0.011]	5.52
Perceived attractiveness												
10.1-12	1	4	0.156 [-0.925, 1.238]	4.44	1	2	0.239 [-4.466, 4.944]	0.67	1	2	0.113 [-10.454, 10.679]	3.54
12.1-14	4	9	-0.054 [-0.185, 0.077]	15.58*	1	2	0.525 [-3.934, 4.984]	0.22	3	5	-0.154 [-0.336, 0.028]	0.55
14.1-16	2	7	0.057 [-0.067, 0.180]	6.61*	1	2	0.032 [-5.431, 5.496]	0.73	1	3	-0.046 [-1.605, 1.514]	0.09
16.1-18	1	2	0.380 [-6.435, 7.170]	5.89*								
18.1-20	1	8	0.218 [-0.243, 0.679]	22.31	1	4	0.332 [-0.849, 1.512]	12.61*	1	4	0.126 [-0.578, 0.829]	8.82*
Body esteem												
6-10	3	5	0.037 [-0.127, 0.201]	11.78*								
10.1-12	11	22	-0.027 [-0.170, 0.116]	233.06*	5	7	0.033 [-0.322, 0.388]	70.03*	9	12	-0.053 [-0.262, 0.156]	107.40*
12.1-14	18	49	-0.076 [-0.130, 0.022]	263.73*	9	18	0.010 [-0.072, 0.092]	61.98*	16	27	-0.139 [-.0216, -0.063]	98.20*
14.1-16	13	30	-0.022 [-0.061, 0.016]	321.18*	8	11	0.003 [-0.059, 0.066]	142.95*	10	15	-0.034 [-0.093, 0.025]	138.71*
16.1-18	6	21	-0.019 [-0.073, 0.035]	188.37*	4	8	-0.026 [-0.145, 0.093]	88.78*	5	11	0.004 [-0.056, 0.065]	57.78*
18.1-20	6	22	0.014 [-0.014, 0.042]	66.37*	5	10	0.010 [-0.010, 0.030]	12.53	5	10	0.041 [0.003, 0.079]	21.04*
20.1-22	1	6	0.026 [0.000, 0.052]	11.26*	1	3	0.018 [-0.022, 0.058]	1.15	1	3	0.029 [-0.059, 0.116]	6.78*
22.1-24	4	12	0.091 [-0.120, 0.302]	156.53*	1	4	-0.003 [-0.024, 0.018]	2.49	3	6	0.137 [-0.174, 0.448]	120.34*
24.1-30	3	13	0.003 [-0.007, 0.014]	28.62*	3	7	0.003 [-0.029, 0.036]	12.50	2	6	0.011 [0.003, 0.019]	2.69
38-54	2	5	-0.028 [-0.006, 0.004]	1.63					2	5	-0.028 [-0.060, 0.004]	1.63
Dissatisfaction												
6-10	5	9	-0.027 [-0.170, 0.120]	99.00*	3	3	0.012 [-0.074, 0.098]	2.05	3	5	-0.071 [-0.345, 0.204]	90.98*
10.1-12	6	9	0.001 [-0.128, 0.129]	185.96*	3	3	-0.161 [-0.486, 0.164]	41.66*	4	5	0.069 [-0.070, 0.209]	41.36*
12.1-14	27	55	0.046 [-0.056, 0.148]	645.84*	12	17	-0.047 [-0.341, 0.247]	228.78*	23	35	0.067 [-0.017, 0.152]	394.52*
14.1-16	26	54	0.021 [-0.005, 0.048]	414.77*	11	15	-0.025 [-0.062, 0.011]	64.26*	20	34	0.046 [0.007, 0.084]	209.68*
16.1-18	14	22	-0.035 [-0.092, 0.021]	172.07*	5	6	0.008 [-0.057, 0.073]	31.26*	10	13	-0.060 [-0.138, 0.018]	121.99*
18.1-20	11	21	0.010 [-0.059, 0.079]	317.60*	2	3	-0.068 [-0.592, 0.455]	170.80*	10	17	0.039 [-0.019, 0.096]	77.43*
20.1-22	5	9	-0.037 [-0.203, 0.130]	245.40*								

Construct and age	All samples				Male samples				Female samples			
	k	N_{ES}	d_{year} [95% CI]	*Q*	*k*	N_{ES}	d_{year} [95% CI]	*Q*	*k*	N_{ES}	d_{year} [95% CI]	*Q*
Valuation												
6-10	2	4	-0.021 [-0.569, 0.527]	78.68*					1	2	-0.193 [-0.706, 0.320]	2.25
10.1-12	6	8	0.176 [-0.104, 0.456]	321.85*	2	2	-0.124 [-0.271, 2.463]	34.54*	5	5	0.218 [-0.149, 0.586]	133.24*
12.1-14	12	31	0.086 [-0.032, 0.203]	1104.70*	7	12	-0.043 [-0.186, 0.100]	36.93*	11	18	0.114 [-0.076, 0.304]	540.73*
14.1-16	14	38	0.030 [-0.016, 0.077]	439.25*	11	17	-0.017 [0.070, 0.035]	61.66*	12	20	0.076 [0.018, 0.134]	159.10*
16.1-18	6	19	0.027 [0.004, 0.049]	47.45*	5	9	0.017 [-0.005, 0.039]	3.42	6	10	0.027 [-0.025, 0.080]	40.65*
18.1-20	10	23	0.000 [-0.035, 0.034]	54.70*	4	8	-0.001 [-0.069, 0.066]	9.68	8	13	-0.008 [-0.056, 0.040]	36.73*
20.1-22	4	6	-0.059 [-0.348, 0.229]	15.65*	3	3	-0.120 [-0.930, 0.690]	13.52*	3	3	0.036 [-0.007, 0.079]	1.99
22.1-24	1	4	0.022 [-0.005, 0.050]	19.52*	1	2	0.031 [-0.145, 0.206]	6.55*	1	2	0.015 [-0.143, 0.173]	7.92
24.1-30	2	7	0.020 [-0.016, 0.055]	28.66*	1	3	0.017 [-0.014, 0.048]	4.74	2	4	0.017 [-0.041, 0.075]	21.44*
38-54	2	6	0.007 [-0.041, 0.054]	8.23*	2	3	0.035 [-0.034, 0.103]	2.64	2	3	-0.015 [-0.095, 0.066]	1.20
Self-objectification												
10.1-12	1	2	-0.190 [-1.247, 0.867]	2.77								
12.1-14	2	4	0.108 [-0.079, 0.295]	8.89*	2	2	0.029 [-1.633, 1.691]	7.58*	2	2	0.159 [-0.260, 0.577]	0.25
14.1-16	5	8	0.036 [-0.082, 0.153]	66.18*	2	2	0.037 [-0.350, 0.425]	0.18	4	4	0.107 [-0.015, 0.228]	8.57*
16.1-18	3	4	0.119 [-0.265, 0.503]	40.49*								
18.1-20	2	3	0.112 [0.036, 0.188]	1.30					2	2	0.098 [-0.174, 0.370]	0.02
20.1-22	2	5	-0.189 [-0.659, 0.282]	16.18*								
22.1-24	2	2	-0.202 [-2.474, 2.071]	103.09*					2	2	-0.202 [-2.474, 2.071]	103.09*
24.1-30	2	3	-0.003 [-0.126, 0.120]	14.67*								
Body shame												
14.1-16	1	2	-0.023 [-0.621, -0.567]	1.16					1	2	-0.023 [-0.621, 0.576]	1.16
18.1-20	2	3	-0.376 [-0.283, 2.111]	50.53*					2	2	-0.372 [-7.771, 7.028]	50.50*
22.1-24	2	2	-0.249 [-3.218, 2.719]	117.52*					2	2	-0.249 [-3.218, 2.719]	117.52*

Note. To create a meta-analytic effect size estimate, each age range and construct required a minimum of two effect sizes, from at least one study; empty age range rows were omitted, and columns were left blank where data were insufficient. Effect sizes were meta-analyzed using random-effects multilevel models. *k* = number of samples; N_{ES} = total number of effect sizes in the *k* samples; d_{year} = Weighted mean effect size expressed as mean-level change per year; CI = confidence interval; *Q* = heterogeneity test statistic. Many studies contributed multiple effect sizes in multiple age categories and body image constructs. * $p < .05$.

Figure 2.4: Mean-level Change in Body Image Constructs During Represented Age Ranges



Note. These figures show cumulative *d* values relative to the starting ages, which differ based on the represented age ranges for each construct. The point of origin (i.e., zero) is arbitrary.

Discussion

The primary goal of the current meta-analysis was to describe normative body image development across the lifespan. We also examined the impact of construct, gender, cohort, attrition, and time lag on the magnitude and direction of mean-level change in overall body image. We synthesized available longitudinal data on mean-level change across the most studied constructs of body image, and provided separate estimates of mean-level change for the specific constructs of body satisfaction, body esteem, perceived attractiveness, body dissatisfaction, valuation, self-objectification, and body shame. The meta-analytic dataset included 142 samples, 717 effect sizes, and a total of 128,254 participants. Although sample mean age between testing intervals ranged from 6.35 to 53.53 years, ages younger than 10 and older than 24 were not well-represented in primary studies. Analyses were based on mean effect size of change in body image per year, providing a description of yearly change in the average sample across represented age ranges. We used a multilevel meta-analytic approach to model dependency of effect size estimates within samples.

This study provided a comprehensive and evidence-based description of normative body image development during phases of the lifespan where this development has been studied. Age significantly moderated mean-level change in body image: the later in life data collection took place, the more positive the change in body image tended to be, though this effect appeared to be driven by ages under 30. Moderator analyses showed that patterns of mean-level change over time differed systematically between male and female samples. Male samples fluctuated in the direction of mean-level change over time, but overall showed improvements mean body image. Female samples changed in the opposite direction of male samples until age 16, with worsening mean-level body image in the preteen and early adolescent years, culminating in a nadir around

age 16 before improving, on average, during the late adolescent years and early twenties. For men and women, the largest changes in body image occurred between ages 10 and 14, and mean-level body image appeared to stabilize by approximately age 24. Due to a scarcity of longitudinal data for samples with age midpoints over age 30, we are less certain about what constitutes normative body image development in middle and late adulthood. Available data on middle-adulthood (i.e., age 38 to 54) suggested that samples of men and women may show decreasing mean-level in body esteem. On average, studies from this age period suggested that the importance attached to body and appearance may increase for men while declining for women. Neither cohort nor attrition rate significantly impacted mean-level change over time.

Body Image Development Across the Lifespan

Age 6–10

It has been posited that the foundations of body image development are laid during the preschool years, when children first develop awareness of their bodies and physical appearances, and begin to compare themselves to other children (Smolak, 2011). Though prevalence estimates have ranged widely, previous research has suggested that body dissatisfaction appears in a substantial minority of preschool children (Tatangelo et al., 2016), and may appear in the majority of children by age 10 (Dion et al., 2016). These studies have established that negative body image is not uncommon in children. Less clear is how much change characterizes normative body image development in childhood, and whether girls and boys differ in the direction or magnitude of normative change in childhood.

Our estimates of mean-level change in body image from age 6 to 10 were based on a small meta-analytic sample (k = 9 samples, 18 effect sizes). The studies assessed the constructs of body esteem, body dissatisfaction, and valuation using figure rating tasks, questionnaires, and

in one case, a single item. The effect sizes of change during this age range were small in magnitude (d_{year} = 0.008, -0.004, and 0.062 for all samples, male-only samples, and female-only samples, respectively), though they appeared more substantial when compounded to visually depict cumulative change during this four-year period.

Prior literature has suggested that children have either shown worsening body image, or no meaningful change during this age period (Nichols et al., 2018; Smolak, 2011). Contrastingly, we found that on average, samples of girls showed improvements in body image between ages 6 and 10, whereas boys showed worsening body image. Given the small meta-analytic sample for this age period, and the diversity of constructs and assessment methods, it is unlikely that our estimates of mean-level change accurately represent normative body image development in childhood– rather than reflecting genuine and meaningful change in body image, we believe these findings to be spurious. It can be difficult to validly assess body image in children, as children may interpret figure rating tasks and questionnaire items in different and often unintended ways, introducing measurement error. Indeed, as a previous review highlighted, assessment methods that purport to measure the same underlying body image construct can produce uncorrelated results in children (Tatangelo et al., 2016). Additional longitudinal research is needed to better characterize patterns of normative body image development in children under 10 years old. Given the potential impact that measurement can have, particularly at young ages, we recommend using more than one measure of body image. Future longitudinal research can elucidate how different body image constructs change over time in younger children, and the extent of continuity in absolute levels of body image constructs from childhood to adolescence.

Age 10–16

The pre- to mid-adolescent period was well-represented by 373 effect sizes in our meta-analytic dataset. Accordingly, we can be somewhat confident in our findings regarding this age period. Our results suggest that between ages 10 and 16, normative body image development looks markedly different for boys and girls. Samples of boys tended to show improving body image, resulting in cumulative mean-change of $d = 0.260$ during this age period. Improvements were of greatest magnitude between the ages of 10 and 14. Although on we found that on *average* boys tended to experience improvements in body image between ages 10 and 16, we wish to highlight that many individual boys may deviate from this pattern.

Conversely, samples of girls tended to show worsening body image, resulting in cumulative mean change of $d = -0.482$ during this age period. Among girls, effect sizes were also of largest magnitude between ages 10 and 14. The confidence intervals for yearly change estimates for 12-14 and 14-16 for girls did not cross zero, indicating these are the only age ranges during which samples of girls definitively showed worsening in mean-level overall body image. Among girls, cumulative mean-level change in body esteem and satisfaction showed nadirs around age 16; increases in body dissatisfaction also peaked at this age. Consistent with these results, prior studies examining the age of onset of eating disorders have also found peak incidence rates around age 14-15 for anorexia nervosa (Javaras et al., 2015), and age 16-20 for bulimia nervosa (Stice et al., 2013).

Previous literature has characterized adolescence, specifically the ages of 12 to 18 years, as a critical period in body image development for boys and girls (Voelker et al., 2015). Results of the current meta-analysis suggest that this critical period may take place earlier than

previously believed, with the largest changes taking place between ages 10 and 12 or possibly earlier.

Age 16–24

The late adolescence to young adulthood period (16 to 24) was also well-represented, with 270 effect sizes in our dataset. For male samples, average yearly change was small in magnitude (d_{year} = -0.024 – 0.071) and estimated to be negative for ages 16–18 and 22–24, but positive for 18–20 and 20–22. Given the confidence intervals of these estimates, we cannot be certain whether these yearly change estimates reflect true, meaningful fluctuations in body image, or idiosyncrasies and measurement error within our meta-analytic dataset– in other words, whether the values represent signal or noise. Rather than over-interpreting the small fluctuations in our yearly change estimates for male samples, we instead turn our attention to the total change within this age period: from age 16 to 24, the cumulative average change in overall body image among male samples can be summarized as a small net-positive improvement (cumulative d = 0.08). So, on average, boys may show stability or minor improvements in body image during late adolescence and young adulthood. We wish to highlight once again that many individual boys may deviate from this normative pattern of development.

Female samples also showed improvements in body image from age 16 to 24 (cumulative d = 0.330), with the largest magnitude of change occurring in the age range of 22 to 24 (cumulative d = 0.182). This finding contradicts the commonly held notion that body image is typically stable or worsens among girls during these years, and that "once established, body dissatisfaction does not appear to go away through simple development" (Wertheim & Paxton, 2011, p. 81). As depicted in Figure 2.3, however, cumulative improvements from age 16 to 24 did not fully reverse the average worsening of body image that took place in female samples

from age 10 to 16 (cumulative d = -0.482). Given the detrimental and wide-ranging consequences of negative body image (e.g., Bornioli et al., 2021; Shagar et al., 2017), we wish to underscore that the observed mean-level improvements, particularly in light of high *absolute* levels of body image concerns and dissatisfaction among women (Fiske et al., 2014), do not negate the need for intervention or suggest that girls will naturally overcome negative body image through simple development. Trends observed in the current meta-analysis represent normative development in non-clinical samples– individuals with the greatest disturbances in body image deviate, by definition, from this normative trajectory. Nonetheless, we are cautiously optimistic about the mean-level improvements in body image that were observed in female samples during emerging adulthood. This finding indicates that, all else being equal, typically developing girls can expect body image to improve somewhat during the transition to adulthood.

Our understanding of this encouraging result can be enriched by looking to personal accounts of individuals' journeys to overcome negative body image. In a prime example of how qualitative and quantitative studies can complement and inform each other, Gattario and Frisen (2019) interviewed 15 men and 16 women who had taken part in their quantitative longitudinal study (included in the current meta-analysis; Gattario et al., 2019). Participants were selected to participate in the qualitative study based on their trajectories of scores on the Body Esteem Scale for Adolescents and Adults (Mendelson et al., 2001): relative to the total sample, these participants showed low body esteem in early adolescence, but improved over time to eventually attain body esteem scores in the top quartile of the total sample. Quantitative data indicated that these participants' body esteem scores began to improve prior to age 18, but it took until the final measurement at age 24 for them to move into the top quartile of body esteem scores. To explain how they overcame negative body image, participants described turning points such as entering

different social groups, experiencing increased agency and empowerment, and intentionally using cognitive strategies to counteract negative body image. These participants are not representative of the norm– in fact, they were specifically selected to participate in the study *because* of their unique body esteem trajectories, which deviated from the sample norm and evidenced full recovery from negative body image. However, the factors to which these individuals attributed to their positive body image journeys are shared by many people of this age range, and may help explain why emerging adults, on average, experience improvements in body image.

Age 24–30

For male and female samples, mean-level body image plateaued by age 24, with no changes observed in studies with measurement interval midpoints between ages 24 and 30 (d_{year} = -0.001 and 0.001 for male and female samples, respectively). Primary longitudinal studies have shown diverse results with regards to the age at which mean-level body image stabilizes. For instance, the Growing Up Today Study found that mean-level body dissatisfaction stabilized by age 14 for boys, but continued to increase through to age 18 for girls (Calzo et al., 2012); the Norwegian Longitudinal Health Behavior Study (Holsen et al., 2012) and Project EAT (S. B. Wang et al., 2019) showed ages of mean-level stabilization largely consistent with our meta-analytic results; and in the Minnesota Twin Family Study, body dissatisfaction continued to increase among girls from age 11 to age 29 (Lowe et al., 2019). It is not surprising that studies with varying methodological characteristics and samples drawn from diverse populations have yielded different results– meta-analysis affords a viable way of resolving the conflicting findings of primary longitudinal studies. Results of the current study suggest that mean-level body image

stabilizes, on average, by approximately age 24– when results are averaged across primary longitudinal studies, there is little appreciable mean-level change past this age.

Age 30+

Scant longitudinal research has examined how body image changes over time in adults past the age of 30. Consequently, our understanding of body image development in middle- and late-adulthood stems from cross-sectional studies that have compared people in different age groups (Grogan, 2011; Matsumoto & Rodgers, 2020). It has been posited that as men age, they may experience a widening gap between their appearance and unrealistic appearance ideals, as well as age-related declines in body muscularity and functionality, which may increase their risk for body image disturbances (Grogan, 2011; Matsumoto & Rodgers, 2020). Accordingly, men may show stable or increasingly negative body image later in life (Grogan, 2011), as well as increases in drive for thinness (Brown et al., 2020). Results of the current meta-analysis are consistent with the notion that men may show worsening body image as they age: the average mean-level yearly change in overall body image was negative for male samples (d_{year} = -0.035). However, this finding was based on three effect sizes from only two studies, which reported on men in their early forties. Examining body image in adult men was not the goal of either of these studies: Sinton (2007) and Hochgraf et al. (2019) both collected data on fathers' body image concerns in the context of studies focused on their adolescent daughters.

Although women tend to report more negative *absolute* levels of body image than men at every age (Hilbert et al., 2012), it is commonly believed that women attach less importance to their bodies and appearances as they age, despite moving further away from internalized beauty ideals and potentially reporting greater dissatisfaction with their bodies (Grogan, 2011). Results of the current meta-analysis, though based only on four studies and 10 effect sizes, are consistent

with this understanding: estimates of yearly mean-level change in body esteem and valuation were both negative for samples of women with age midpoints between 38 and 54 (d_{year} = -0.028 and -0.015, respectively), suggesting that on average, older samples of women evaluated their bodies less positively over time, but also became less concerned about it.

Men and women may be at risk for worsening body image in adulthood, even if these changes tend to be of small magnitude. Additional longitudinal research may clarify this possibility, and better characterize normative body image development in older adults. It will be critical to examine body image concerns in ways that adequately capture gendered body ideals– for example, it would be pertinent to examine the development of muscularity concerns, as well as weight and shape concerns.

Magnitude of Mean-Level Change in Body Image

Mean-level changes observed in the current study were all small in magnitude, and with only two exceptions, non-significant. Thus, it could be argued that mean-level body image development is characterized by stability, rather than change. We note that the aim of the current study was primarily descriptive, rather than centered on null-hypothesis significance testing– our focus was on estimating the direction and magnitude of change in mean-level body image for specific age periods, and on describing the lifespan as precisely and comprehensively as possible, rather than on testing whether this change was statistically significant. To this end, we employed somewhat liberal inclusion criteria for our systematic review, and the result was a highly heterogeneous pool of included studies; we also examined mean-level change estimates separately for each age period, rather than aggregated across the lifespan, which reduced our statistical power to detect significant effects. Accordingly, it is not surprising that the confidence intervals around our change estimates are wide, and that most of these estimates are non-

significant. The resulting yearly mean-level change estimates are small, but when we consider their cumulative magnitude, these changes may be more than trivial– for example, a decrement in body image of nearly half a standard deviation between ages 10 and 16 would typically be considered a medium (Cohen, 1988) or large (Gignac & Szodorai, 2016) effect, depending how one chooses to interpret effect sizes. Given the numerous and wide-ranging impacts that body image may have (e.g., Bucchianeri et al., 2016), a change of this magnitude could have profound consequences.

Moderators of Mean-Level Change in Body Image

We found support for the notion that mean-level change in body image is moderated by gender, age, and time lag, but there were no discernable effects of construct, birth cohort, or attrition rate on mean-level body image change over time. Changes in overall body image tended to be more negative among female samples, and in studies where data were collected at younger ages. The effect of gender appeared to be driven by the many studies that examined body image development in adolescence. Strikingly, for every age range we examined between ages 6 and 18, male and female samples changed, on average, in opposite directions. Gender differences in yearly mean-level change were largest between ages 10 and 14.

Mean-level changes in body image may be explained by individual-level variables. Specifically, the years between ages 10 and 14 are characterized by many social, biological, and physical changes which differ by gender, but also on a person-to-person basis. Although puberty tends to coincide with increases in BMI irrespective of gender (Yang et al., 2021), puberty may move boys and girls in different directions from gendered body ideals, with different consequences for body image. In boys, puberty is accompanied by increases in height, shoulder width, and muscle mass, which may move them, on average, closer to cultural ideals (Voelker et

al., 2015). Indeed, prior longitudinal research has found that boys with *late* pubertal timing may experience more body dissatisfaction in early adolescence (Neumark-Sztainer et al., 2018). In the current meta-analysis, samples of boys tended to increase in mean-level body satisfaction, perceived attractiveness, and body esteem, and decrease in dissatisfaction during adolescence. Conversely, female puberty tends to be associated with alterations in body shape, and increases in fat deposits and body hair, which move girls further away from societal ideals of beauty and specifically the thin ideal (Fonseca & Matos, 2011). The onset of puberty and associated weight gain for girls of this age range likely contributes to the worsening of body image that has been observed in female samples between ages 10 and 14. Higher BMI has been associated with earlier pubertal timing (Brix et al., 2020), and the age of puberty onset has been decreasing worldwide (Eckert-Lind et al., 2020). It will be important for primary longitudinal studies to investigate the impact of BMI and pubertal timing on trends in body image development, while considering potential cohort effects.

Important gender differences may continue to influence body image development across the lifespan, as men and women experience different biological changes, role transitions, and sociocultural pressures (Guerin et al., 2017; Kilpela et al., 2015). Furthermore, BMI may have a stronger influence on women's body image than on men's (Ålgars et al., 2009). In addition to examining differences between men and women later in adulthood, future longitudinal research may aim to better represent individuals who inhabit gender identities beyond the binary of man or woman. Indeed, transgender adolescents have been identified being at high risk for body dissatisfaction and disordered eating (Romito et al., 2021), yet little is known about what constitutes normative body image development among transgender people.

Longer measurement intervals (i.e., where body image was measured at more distal time points) were associated with greater negative changes in mean-level body image. Previous longitudinal meta-analyses in the areas of personality and interest development have observed similar trends– larger changes may accumulate over time in one direction, and can thus be captured more readily in studies with longer measurement intervals (Hoff et al., 2018; Roberts et al., 2006). When planning longitudinal studies and evaluating the impacts of interventions aimed to prevent or reverse negative body image, it will be important to consider the magnitude and direction of expected normative change for a given age range, and how the timing of a study aligns with expected normative changes. It would also be pertinent to consider that longer measurement intervals may result in larger estimates of change for intervention and control groups alike.

We did not find a measurable impact of body image construct on mean-level change over time. Rather than suggesting that body image is unidimensional, we speculate that the lack of significant effect of construct was due to two factors. First, few effect sizes were available for some constructs, particularly at later age ranges, meaning that we were likely underpowered to detect significant moderator effects. Second, within each construct, there was considerable heterogeneity in measurement, with a variety of measures of differing psychometric strength (Kling et al., 2019). As such, the lack of effect of construct on mean-level change may reflect measurement problems of the constructs as constituted for this meta-analysis. From visually inspecting Figure 2.4 and examining the magnitude and direction of yearly mean-level change estimates, we cannot confidently say that all constructs change in the same ways over time. Additional longitudinal research is needed to determine whether meaningfully different age-related changes occur in different constructs of body image, such as constructs of an evaluative

nature versus those related to the importance and concern placed on body and appearance (i.e., valuation).

Patterns of mean-level body image change were consistent across samples from different generations–birth cohort did not explain variability in the effect sizes. The mean estimated year of birth ranged from 1946 to 2008 in our meta-analytic dataset, and age and time lag were statistically controlled for in these analyses, which allowed us to examine the unique effects of birth cohort over several generations while holding age constant. Our findings do not support claims that body image is either worsening or improving for younger generations. Attrition also did not appear to systematically bias characterizations of normative body image development, increasing our confidence in findings of the current meta-analysis; longitudinal studies should still, of course, aim to retain as many participants as possible (Barry, 2005).

Limitations and Future Directions

The current meta-analysis summarizes what longitudinal studies have told us about normative body image development. Unfortunately, there are glaring gaps in this knowledge. Longitudinal research has disproportionately focused on earlier phases of the lifespan, so current understandings of how body image develops past age 30 are based largely on cross-sectional data and retrospective personal accounts. Furthermore, although boys and men have been included in longitudinal studies, many of these studies have assessed body image in ways that may not capture the types of body image disturbances that men tend to experience. With the increasing availability of gender-appropriate measures (Kling et al., 2019), future longitudinal studies will be better positioned to investigate the development of body image constructs such as muscularity concerns across the lifespan. In addition to measuring body image constructs more relevant to men's experiences, there has also been an increasing focus on *positive* body image constructs

such as embodiment, body functionality, and body appreciation (Tylka & Wood-Barcalow, 2015), for which few longer-term longitudinal data were available. Another major gap concerns our understanding of how body image develops in different countries, cultural contexts, and ethnic groups. Our meta-analytic dataset was overwhelmingly composed of studies conducted with Western, Educated, Industrialized, Rich, and Democratic (WEIRD) samples, and thus it is unknown whether our findings generalize to samples that diverge from this description. We hope that the results of our review will motivate researchers to conduct longitudinal studies that can help tease apart how different constructs of body image change over time beyond young adulthood, in more diverse samples, and across different parts of the world.

Another set of limitations concerns our inclusion and exclusion criteria, and categorization of measures. Body image research has expanded rapidly over the past decades, resulting in a wide variety of measures available to assess body image constructs (Kling et al., 2019). Because there is no consensus or hard-and-fast rule about what is and is not body image, it was difficult to decide on inclusion and exclusion criteria concerning the types of constructs and measures we would include in our review. Ultimately, our choices of inclusion and exclusion criteria were driven by both theory and pragmatic considerations: we tried to balance theoretical specificity and clarity (i.e., including only those longitudinal studies that clearly assessed body image), with maximizing representation of body image development across the lifespan. Implicit in our approach of aggregating effect sizes across constructs and measures (i.e., to answer Research Question 1), is the assumption that different body image measures all show convergent validity, and that there is a single underlying latent construct of body image. Recognizing that this assumption may not hold, we also examined the moderating role of construct, and provided yearly change estimates separately for different body image constructs wherever sufficient data

were available. Categorizing measures into broad constructs of body image allowed us to synthesize findings, but inevitably resulted in some loss of information about the particular measures that represent each of these constructs. Furthermore, many studies used purpose-built body image measures, and some studies used measures that could arguably cross-load onto two or more body image constructs. Thus, there was heterogeneity in the psychometric quality of measures used to assess body image, and in many cases it was difficult to categorize measures. As more longitudinal data emerge, additional meta-analyses that focus on specific measures or constructs of body image could enable a more nuanced understanding of normative body image development.

Finally, the current meta-analysis describes mean-level patterns of normative body image development based on study and sample characteristics, but does not provide any information on individual differences. Characteristics such as adiposity (approximated using BMI) and pubertal timing, exhibit substantial inter-individual (i.e., within-study) heterogeneity, and are thus more suitably examined by primary studies. We acknowledge that many such factors play a critical role in body image development. Furthermore, as primary longitudinal studies have demonstrated (Lacroix et al., 2022; Nelson et al., 2018; S. B. Wang et al., 2019), there are in fact multiple patterns of body image development, which are obscured when only average mean-level change is examined, as in the current meta-analysis. Finally, our results pertain to how body image changes, and not to absolute levels of body image constructs. Absolute levels of body image constructs are at least as important as patterns of change over time: for example, an individual can demonstrate a trajectory of steadily increasing body satisfaction over time, but intervention may still be indicated if they exhibit a low absolute level of body satisfaction. This same argument extends to the aggregate level: a population that, on average, shows

improvements in body image over time (e.g., men), can still be at risk if the absolute level of body image concerns is high in that population. Indeed, recognizing that negative body image is quite normative, many preventative interventions take a universal, rather than selective approach (Kusina & Exline, 2019).

Conclusion

This meta-analysis synthesized longitudinal data from 142 samples and 128,254 participants to characterize normative body image development across studied portions of the lifespan. Though there remain large gaps in knowledge, our approach enabled a more comprehensive and precise description of body image development than has been afforded by individual longitudinal studies or narrative reviews. Male and female samples showed distinct trajectories of mean-level change: male samples showed fluctuations with a net-improvement in overall body image between ages 10 and 24; whereas female samples showed worsening body image between ages 10 and 16, but improvements between ages 16 and 24. Mean-level change was of greatest magnitude between ages 10 and 14, and stabilized around age 24. We found no discernable effects of construct, birth cohort, or attrition rate on mean-level change in body image. These findings highlight a need to revise current understandings of normative body image development: sensitive periods may occur somewhat earlier than previously believed, and body image generally improves among women during the transition from adolescence to adulthood. Additional longitudinal research is needed to clarify normative patterns of body image development in middle and late adulthood, and in more diverse populations.

Chapter 3: Trajectories and Personality Predictors of Eating Disorder Psychopathology Development in Girls from Preadolescence to Adulthood

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Abstract

Understanding how and among whom eating pathology develops may enable meaningful prescriptions for its prevention. The aims of the current study were to identify common trajectories of eating pathology development and to describe the personality characteristics of girls who demonstrate riskier, versus more favourable, trajectories. Participants were 760 female twins from the Minnesota Twin Family Study, who reported on eating pathology at approximate ages 11, 14, 18, 21, 25, and 29. Parents reported on twins' personality characteristics at age 11, and twins completed self-report personality questionnaires at age 14 and 18. Latent class growth modelling identified two distinct trajectories each of total eating pathology, binge eating, and weight preoccupation, and three distinct trajectories of body dissatisfaction. Girls who demonstrated the most pathological trajectories already showed elevated eating pathology at age 11. Girls who demonstrated trajectories with the highest levels of eating pathology tended to have greater self-reported proneness to anxiety and stress, less sociable personality styles, and greater feelings of alienation. Prevention efforts may be enhanced by expanding focus to target these personality characteristics, in addition to previously identified sociocultural risk factors.

Introduction

Eating disorders are among the deadliest and most difficult to treat of psychiatric disorders. Anorexia nervosa specifically has an annual crude mortality rate of 5.86 per 1000 (Arcelus et al., 2011) and carries a 57-fold increase in suicide risk relative to the general population (Keel et al., 2003). Unfortunately, even people who receive treatment for their eating disorders (who are, unfortunately, in the minority; Kazdin et al., 2017), remain at risk: after inpatient treatment for anorexia nervosa, the mortality risk remains over five time higher than for age- and gender-matched controls; after treatment for bulimia nervosa, the risk is twice as high as for controls (van Hoeken & Hoek, 2020). Even when eating disorders do not result in death, they are often chronic and relapsing (Kotilahti et al., 2020), imparting severe functional impairment and health risks including multi-systemic organ damage and infertility (van Hoeken & Hoek, 2020).

Below the threshold of clinical diagnosis, eating disorder psychopathology (EDP), which includes body dissatisfaction, compensatory behaviour, binge eating, and preoccupation with weight, is common and harmful (Crow et al., 2002). Body dissatisfaction, for example, characterized by discrepancies between one's perceived and ideal body weight, shape, or overall appearance (Cash, 2002), has been estimated to affect 11% to 72% of girls and women (Roy & Payette, 2012), and has been linked to a wide range of adverse outcomes, including: anxiety and depression (Davison & McCabe, 2005; Murray et al., 2018), initiating cigarette use (Howe et al., 2017), avoidance of social interactions (Mills et al., 2014), lower likelihood of receiving cancer screenings and completing breast self-examinations (Ridolfi & Crowther, 2013), and overall poorer physical and mental health-related quality of life (Griffiths et al., 2017; Wilson et al., 2013). Compensatory behaviour, defined as inappropriate weight control behaviours such as self-

induced vomiting, laxative use, excessive exercise, and fasting after a binge, affects approximately 14% of adolescent girls, and is associated with anxiety and depression symptoms, higher alcohol consumption, and lower self-worth (Abebe et al., 2012).

Despite recent advances in treatment and prevention (Hay, 2020), the global burden of eating disorders is growing. Years of healthy life lost due to disability (YLD) are one common measure of this burden. Between 2007 and 2017, YLD rates of eating disorders increased by 9.4%, in contrast to other mental disorders and noncommunicable diseases, for which YLD rates declined or remained stable (van Hoeken & Hoek, 2020). Programs designed to improve body image and prevent the development of eating disorders have demonstrated only modest effectiveness. For example, a meta-analytic review of stand-alone body image prevention programs found that only a quarter of commonly used techniques was associated with significant improvements in body image; on average, the effect of interventions on body image was small (Alleva et al., 2015)[4]. Another review that focused specifically on classroom-based prevention programs for adolescents similarly found effects that were short lived and small in magnitude (Kusina & Exline, 2019).

Development of EDP

Understanding how and among whom EDP develops may enable meaningful prescriptions for its prevention. In a sample of 745 female twins, Slane et al. (2014) found steady increases in EDP from 11 to 25 years. This finding is consistent with the results of other

[4] Effect sizes were interpreted using Cohen's (1992) descriptors where d = 0.20, 0.50, and 0.80 respectively denote small, medium, and large effects. We acknowledge the limitations of these benchmarks, as well as alternative effect size descriptors, which have limited meaning in the face of publication bias and the resultant inflation of published effects (Schäfer & Schwartz, 2019).

longitudinal studies examining EDP development from adolescence to adulthood (Bucchianeri et al., 2013; Rohde et al., 2015), suggesting average trajectories of gradual increases in EDP from childhood to young adulthood. Accordingly, our understanding of normative EDP development from late childhood to early adulthood can be summarized as follows: on average, it gets worse.

Multiple Developmental Trajectories

More recently, researchers have moved past plotting global average patterns of change in EDP over time, using statistical techniques that enable more nuanced descriptions of heterogeneous individual developmental trajectories and their antecedents. Latent class growth analysis (LCGA) is a type of longitudinal analysis that enables researchers to identify the most common developmental trajectories within a dataset. Several studies have used LCGA to uncover individual differences in EDP development that are obscured when samples are described in terms of a single average pattern. For example, Rodgers et al. (2016) studied adolescent girls from around age 13 to 14 and, within this short developmental period, identified four common trajectories of body dissatisfaction: *stable high* (9.3%), *moderate-increasing* (16.6%), *moderate-decreasing* (30.9%), and *stable low* (43.2%). S. B. Wang et al. (2019) studied boys and girls from age 15 to 31, and identified four common trajectories similar to those identified by Rodgers et al. (2016). Lacroix et al. (2022) studied boys and girls from age 11 to 15 and identified three trajectories: *high body esteem* (39.1%), *moderate body esteem* (46.1%), and *low body esteem* (14.8%), each trajectory characterised by largely stable body esteem across these years.

Predictors of EDP Development

Among the most widely-cited theoretical models for the development of EDP is the Tripartite Influence Model (Thompson et al., 1999). The Tripartite Influence Model proposes that sociocultural influences from three main sources (peers, parents, and the media) promote appearance comparisons and internalization of the thin ideal, which then lead to negative body image, and eventually to eating pathology. Many EDP prevention programs have been designed with these sociocultural influences in mind, for example by incorporating media literacy training, activities that target social comparison, and interpersonal skills practice (Alleva et al., 2015). However, some assumptions of the Tripartite Influence Model have received mixed support. For instance, there is little evidence to suggest that engagement with mass media precedes the development of proximal risk factors such as body dissatisfaction (Levine & Murnen, 2009; Roberts et al., 2022). Media literacy training, social comparison exercises, and interpersonal skills practice have demonstrated inconsistent benefits, particularly when employed as stand-alone interventions (Alleva et al., 2015; Kurz et al., 2022; Paxton et al., 2022). Might there be other more influential risk factors that precede the development of EDP?

Personality Characteristics and EDP Development. A potentially important yet under-explored predictor of EDP development is personality. Personality has been described as "stable enough to be meaningful and changeable enough to be worthy of study or intervention" (Shiner et al., 2021, p. 115). Personality-targeted approaches have been met with great success in the prevention of substance use disorders (Edalati & Conrod, 2018), and researchers have begun to discuss applying this strategy to the prevention (Marzola et al., 2020) and treatment (Fumagalli & Margola, 2022; Kaye et al., 2015) of EDP.

Before describing evidence for the relationship between personality and EDP, it is pertinent to describe organizing theories of personality and its development. Historically, personality has been defined in terms of two distinct components: temperament and character (Cloninger, 1994; Herzhoff et al., 2017). *Temperament* was used to describe biologically based patterns of emotional reactivity in infants and younger children, whereas *character* was used to refer to individual differences in traits that mature incrementally into adulthood (Herzhoff et al., 2017). Contemporary perspectives have largely abandoned this distinction, maintaining that the domains of temperament and character are more alike than different, and exhibit striking continuity (De Pauw & Mervielde, 2010; Herzhoff et al., 2017; Shiner et al., 2021). For the sake of simplicity and given the lack of a meaningful distinction between temperament and character, we henceforth use the term *personality* to refer to patterns of thinking, feeling, and behaving, encompassing both character traits and predispositions towards positive and negative affect states (Pervin, 2000). From infants' early temperamental tendencies emerge personality traits (John et al., 1994), most commonly understood through the lens of the Big Five model (McCrae & Costa Jr, 2008). The Big Five model conceptualizes personality along five trait dimensions: neuroticism, extraversion, conscientiousness, agreeableness, and openness to experience. There exist many alternatives to the Big Five model, including, for example, the HEXACO personality model, which adds a sixth factor of honesty-humility (Lee & Ashton, 2004); as well as the Big Three model of the Multidimensional Personality Questionnaire (MPQ; Tellegen & Waller, 2008), which examines 11 personality traits that load onto three higher-order factors.

Neuroticism, defined as the propensity toward experiencing negative emotions such as fear, sadness, and anger (Shiner et al., 2021, p. 119), has been identified as a fundamental domain of personality with enormous public health implications (Widiger & Oltmanns, 2017),

including through its role as a risk factor for psychological disorders in the internalizing domain. A meta-analysis of 59 longitudinal studies found large prospective associations between high neuroticism and symptoms or diagnosis of depression, anxiety, and non-specific mental distress (Jeronimus et al., 2016). In this meta-analysis, Jeronimus et al. (2016) adjusted for baseline symptoms and psychiatric history and demonstrated that neuroticism and common mental disorders are not only interwoven, but that high neuroticism is a predictor of risk which *precedes* the development of internalizing disorders. The robust prospective effect of neuroticism on internalizing disorders hardly decayed over time across shorter (1–4 years) and longer (4–50 years) study durations (Jeronimus et al., 2016). EDP falls within the spectrum of internalizing (Forbush et al., 2017; Kotov et al., 2017), and is highly comorbid with other internalizing disorders: 40.5%-59% of individuals with EDs report a lifetime mood disorder, and 54.2%-79.6% report a lifetime anxiety disorder (Udo & Grilo, 2019). Thus, as a known risk factor for internalizing disorders, and a well-established correlate of EDP specifically, neuroticism could be expected to prospectively increase risk for EDP. Two other personality factors that have been prospectively implicated in the development of EDP are perfectionism (specifically, perfectionistic concerns, rather than personal striving; Kehayes et al., 2019) and negative urgency (i.e., the tendency to act impulsively in an attempt to alleviate intense negative affect; Puccio et al., 2019).

Despite resounding calls for prospective studies to clarify the temporal relationships of personality with EDP (Allen & Walter, 2016; Cassin & von Ranson, 2005; Farstad et al., 2016), most research has continued to use cross-sectional designs (Allen & Robson, 2020). In a meta-analysis of 26 cross-sectional studies (N = 39,109), Allen and Robson (2020) found that body dissatisfaction was associated with higher levels of neuroticism (r = .30), and lower levels of

Extraversion (r = -.17) and Conscientiousness (r = -.16), and to a lesser extent Openness (r = -.10) and Agreeableness (r = -.08). In a systematic review that focused specifically on people with diagnosed eating disorders, Farstad et al. (2016) found that these individuals were characterized by higher levels of neuroticism, perfectionism, and avoidance motivation; heightened sensitivity to social rewards; and lower extraversion and self-directedness. Elevated perfectionism has also been associated cross-sectionally with greater importance of shape and weight (Wilksch & Wade, 2009).

Negative emotionality, analogous to the trait of neuroticism, has been a focus of prior prospective studies on personality and eating disorder psychopathology. In a study that examined 16-to-19-year-old boys and girls, Presnell et al. (2004) identified self-reported negative emotionality as a predictor of body dissatisfaction measured 9 months later. Contrastingly, Martin et al. (2000) found that negative emotionality at age 11–12 predicted higher drive for thinness and bulimia symptoms at age 13–14 but was only cross-sectionally related to body dissatisfaction. In another longitudinal study that examined boys and girls from approximately age 11 to 15, negative emotionality failed to emerge as a significant predictor of body esteem trajectories, but higher levels of *positive* emotionality, i.e., the tendency to more frequently experience positive emotions, were protective (Lacroix et al., 2022). One study that employed a laboratory paradigm to assess negative and positive emotionality in younger boys and girls, found that higher negative emotionality at age 6 predicted higher levels of body dissatisfaction at age 12; however, *higher* levels of *positive* emotionality surprisingly *also* predicted higher body dissatisfaction (Bufferd et al., 2022).

It is worth contextualizing these results by comparing these predictive relationships to those of other variables widely acknowledged as risk factors in etiological models such as the

Tripartite Influence Model. For instance, in their longitudinal study on risk factors for body dissatisfaction among adolescents, Presnell et al. (2004) also measured sociocultural pressures and thin-ideal internalization, and hypothesized that these factors would predict the development of body dissatisfaction. However, they found that body dissatisfaction was more strongly predicted by negative emotionality (β = .13, p < .001) than by pressure to be thin from peers (β = .08, p =.037); and neither thin ideal internalization (β = -.01, p =.811), nor pressure to be thin from family (β = .05, p =.151) or media (β = .06, p =.123) emerged as significant predictors. Similarly, Lacroix et al. (2022) found that neither thin ideal internalization, nor social comparisons, nor pressure from family, friends, or the media, emerged as significant predictors of later body esteem trajectories, whereas lower positive emotionality was associated with more negative development.

The somewhat disparate findings may be explained by a combination of factors, including methodological differences (incl. the constructs examined, the measures used, when data were collected, and how much time elapsed between data collection intervals) and sample characteristics (incl. sample age, size, and gender composition, attrition rates). Carefully designed longitudinal studies may help better represent the process of EDP development. To reconcile conflicting findings, it may be informative to characterize the individualized trajectories that are obscured when only global average development is examined, and to expand focus beyond neuroticism/negative emotionality, exploring the potentially predictive roles of a wider array of personality traits.

To reduce measurement error and confounding effects, several other factors merit consideration. There are challenges inherent to the measurement of personality in children. Self-reports and informant reports each have strengths and weaknesses (Shiner et al., 2021). For

instance, although self-report offers intimate access to low-visibility personality traits (i.e., internal tendencies that are not always directly accessible to others), the validity of young children's self-reports may be limited by their reading ability, understanding of personality constructs, and insight into their own characteristics (Shiner et al., 2021). Reports completed by adult informants such as parents or teachers may complement self-report data (Herzhoff et al., 2017), yet they carry the potential for informant bias. Differences in the nature and context of the relationships between the informant and the child mean that any individual informant bases their ratings on a unique sampling of behavioural observations. Available data suggest there is moderate correspondence between self- and other-reports of personality for youth: a study that examined the correspondence of self- and other-reports of Big Five personality traits between ages 14 and 29 (Rohrer et al., 2018) found that inter-rater reliability increased with age, and was highest for extraversion (r = .41), followed by agreeableness (r = .34), neuroticism (r = .33), openness (r = .31), and conscientiousness (r = .30). Given the moderate but incomplete correspondence between self- and other-report methods and their respective limitations, practice guidelines have suggested combining multiple sources of personality information (Shiner et al., 2021).

Beyond these measurement challenges, additional biological and socioeconomic factors also merit consideration. Adiposity, typically operationalized by the flawed proxy measure of body mass index (BMI; kg/m^2), is known to play a role in the development of EDP, such that increases in BMI are closely associated with increases in body dissatisfaction during adolescence and young adulthood (Bucchianeri et al., 2013). Presumably, the heavier girls are, the more they deviate from the thin ideal, and the more likely they are to experience body dissatisfaction and engage in disordered eating in an attempt to control their weight (Presnell et al., 2004). Pubertal

development has been shown to exert a similar influence, such that early pubertal timing has been associated with increased EDP among girls in cross-sectional and longitudinal research (Klump, 2013; Shope et al., 2022). There is also emerging evidence for small associations between pubertal development and personality maturation: early pubertal timing has been linked to lower Extraversion, Conscientiousness, and Agreeableness (Van den Akker et al., 2021). Finally, with increasing recognition of the importance of social determinants of mental health (Allen et al., 2014), there is a need to model and control for variables such as socioeconomic status (SES). By demonstrating that eating disorders present across all socioeconomic backgrounds, reviews have refuted the stereotype that eating disorders are "diseases of affluence" (Huryk et al., 2021; Mitchison & Hay, 2014). However, these findings are based on studies that examine global patterns of association, and it is unknown whether SES tends to differ among people who display riskier versus more positive trajectories of EDP development.

Current Study

Using data from the Minnesota Twin Family Study (MTFS; Iacono & McGue, 2002), a longitudinal study of twins and their parents, the current study aimed to identify common trajectories of EDP over a 17-year period from late childhood ending in adulthood, and describe the personality characteristics of individuals who exhibit these trajectories. Based on a previous examination of our sample (Slane et al., 2014), we hypothesized that global average trajectories of EDP development would be characterized by increases in total EDP, body dissatisfaction, and weight preoccupation over time, at least until age 25; and that compensatory behaviours and binge eating would fluctuate in adolescence, but level off and stabilize from age 18 to 29. We hypothesized that for each type of EDP, LCGA would reveal multiple developmental trajectories that deviate from global average patterns of development. LCGA is a data-driven approach that

does not test a priori predictions about the shape of individual trajectories; accordingly, we did not have specific hypotheses about the precise shapes of individual trajectories. Controlling for BMI, pubertal development, and SES, we explored the influence of personality traits to determine whether trajectory membership could be predicted by personality traits reported by parents at age 11, or self-reported at ages 14 and 18. We hypothesized that participants with more pathological trajectories of EDP would have higher levels of self- and parent-reported neuroticism-related traits at age 11, 14, and 18. The potential predictive roles of other personality traits were examined in an exploratory manner.

Describing trajectories and personality predictors of EDP development can enable meaningful prescriptions to enhance the effectiveness of prevention efforts. For example, identifying personality traits that predict problematic trajectories (e.g., high or increasing EDP) may inform the design of personality-targeted prevention programs, which have demonstrated effectiveness in other areas of adolescent mental health, such as the prevention of substance misuse (Conrod et al., 2013). Insights from the current study may also be incorporated to enhance treatment. For example, the novel approach of temperament-based treatment for anorexia nervosa (Kaye et al., 2015) targets coping skills to manage traits that contribute to symptomatology. Should the current study identify protective factors implicated in the development of EDP, future research could also investigate the impact of interventions that strive to enhance such protective factors.

Method

Participants

Participants were 760 female twins (i.e., 380 twin pairs) who took part in the MTFS (Iacono & McGue, 2002), an ongoing prospective study of same-sex twins reared in the same

household and their parents. The MTFS is a population-based study: public records were used to identify twins born in the state of Minnesota; more than 90% of twins born between 1971 and 1985 were located, and 83% of all eligible families agreed to participate. Exclusion criteria included: if the twins were adopted; if either twin had a disability which could hinder their participation in the day-long, in-person assessment; or if the family lived further than a 1-day drive from the University of Minnesota (Blonigen et al., 2008). To enable an understanding of body image development beginning in pre-adolescence, the current study examined data from a MTFS cohort of female twins recruited when they were approximately 11 years old. The twins were broadly representative of the Minnesota population at the time they were born (Iacono & McGue, 2002): approximately 60% came from the Minneapolis-St. Paul urban area, whereas the remainder were from rural areas and smaller cities. Nearly all participants (over 95%) were Caucasian. Participating twins and their families completed follow-up assessments at roughly three-year intervals, yielding a dataset with assessments at six waves: ages approximately 11, 14, 18, 21, 25, and 29 years. The retention rate at the final timepoint (i.e., over a 17-year follow-up period) was 79.9%. Research has supported the similarity of results from twin research and singletons: in a study comparing twins and singletons, twins have reported significantly lower levels of disordered eating than non-twins, but these differences were generally small (Munn-Chernoff et al., 2013).

Measures

Primary Outcomes

EDP. At each wave of data collection, twins completed the Minnesota Eating Behavior Survey (MEBS; Klump et al., 2000; von Ranson et al., 2005)[5], a 30-item true/false self-report questionnaire. The MEBS yields a total score of overall disordered eating attitudes and behaviours, as well as four subscales: body dissatisfaction, compensatory behaviour, binge eating, and weight preoccupation. Previous examinations of the MEBS's psychometric properties in samples of female and male MTFS participants yielded evidence of internal consistency, convergent validity, and criterion validity (the MEBS total score successfully discriminated girls with ED diagnoses from age-matched controls; von Ranson et al., 2005). For participants missing responses to one or fewer items on a subscale, items were averaged to yield prorated subscale scores. For the total score, for participants with 10% or less data missing (i.e., three or fewer items), items were averaged to yield a prorated total score.

In the current study, internal consistency was examined for the total score and each subscale at each wave of data collection (Appendix D). Cronbach's alpha values ranged from

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[5] The Minnesota Eating Behavior Survey (MEBS; previously known as the Minnesota Eating Disorder Inventory [M-EDI]) was adapted and reproduced by special permission of Psychological Assessment Resources, 16204 North Florida Avenue, Lutz, Florida 33549, from the Eating Disorder Inventory (collectively, EDI and EDI-2) by Garner, Olmstead, Polivy, Copyright 1983 by Psychological Assessment Resources. Further reproduction of the MEBS is prohibited without prior permission from Psychological Assessment Resources.

.86-.92 for the total score, .72-.83 for body dissatisfaction, .38-.76 for compensatory behaviour[6], .67-.84 for binge eating, and .78-.90 for weight preoccupation. Temporal stability of the MEBS subscales was also examined (Appendix E). Except for the compensatory behaviour subscale, all MEBS subscales had positive correlations among survey waves [total score: r = .34-.73; body dissatisfaction: r = .33-.68; binge eating: r = .12-.58; weight preoccupation: r = .33-.67; p < .001], with the highest correlations observed between ages 25 and 29. For the compensatory behaviour subscale, correlations ranged from .00-.54, with the lowest values observed between age 11 and the later survey waves.

Predictors

Personality. Personality was assessed at ages 11, 14, and 18 using three versions of the Multidimensional Personality Questionnaire (MPQ; Tellegen & Waller, 2008). The full-length MPQ examines 11 traits (i.e., primary scales) loading on three higher-order factors. The three factors are 1) positive emotionality, which includes the primary trait scales of achievement (diligence, tendency to enjoy demanding projects and value work over other activities), well-being (tendency to have a cheerful disposition, be optimistic, and live an active and exciting life),

[6] The lowest Cronbach's alpha value for Compensatory Behaviour was .38 at age 11; at subsequent waves of data collection, values ranged from .71-.76 for this subscale. We speculate that low internal consistency of the Compensatory Behaviour subscale at age 11 reflects the very low endorsement of compensatory behaviours at this age, as well as potentially measurement error due to 11-year-olds' unfamiliarity with the concepts queried by these items. Specifically, three of six items on the Compensatory Behaviour scale inquire about the use of laxatives, diet pills, and diuretics, giving specific examples of these types of medications. Such questions and specific names of drug agents may have been confusing to participants at age 11, which could have further reduced internal consistency.

social potency (tendency to prefer to take charge, be persuasive, enjoy influencing people, and be decisive), and social closeness (negative factor loading; tendency to be sociable, enjoy others' company, and value close interpersonal ties); 2) negative emotionality, which includes the primary trait scales of alienation (tendency to be suspicious of others' motives, feel they are treated unfairly, and see oneself as a victim), aggression (tendency to be competitive, intimidate others, and seek revenge), and stress reaction (tendency to be sensitive, irritable, and prone to worry and guilt); and 3) constraint, which includes the primary trait scales of traditionalism (tendency not to challenge authority, and to value high moral standards and a conservative social order), harm avoidance (tendency to prefer safe and tedious to potentially risk and exciting tasks), and control (tendency to be reflective, rational, cautious, and plan ahead). Absorption (tendency to experience vivid and compelling images and become easily engrossed in sensory stimuli) is a trait scale of the MPQ which does not load principally onto any of the four factors; we did not include the absorption scale because it is infrequently used in research, and we did not expect it to be meaningfully related to body image.

At age 11, parents completed a 33-item informant report version (Harkness et al., 1995) of the MPQ about each twin. In this version, three items load onto each of the 10 MPQ trait scales of interest. Biological mothers provided reports on their children, with three exceptions (i.e., six twins; 0.78% of dataset): for two families, biological fathers reported, and for one family, a stepmother reported. Each question was rated on a scale from one to four (1 = "my daughter is definitely low on this trait", 2 = "my daughter is probably low on this trait," 3 = my daughter is probably high on this trait", 4 = "my daughter is definitely high on this trait"). Given that only three items loaded onto each scale, these data were not prorated, so missing items led to missing scale scores.

At age 14, twins completed a 133-item self-report version of the MPQ. This abbreviated version omits four scales (achievement, social potency, social closeness, traditionalism), but the items and scale composition are otherwise identical to that of the full-length MPQ; eighteen items load onto each of the six trait scales. At age 18, twins completed the 198-item self-report version of the MPQ (Tellegen & Waller, 2008); eighteen items load onto each of the 10 trait scales of interest on this version. At ages 14 and 18, we prorated trait scale scores of participants who were missing responses to two or fewer items on a given trait scale; items were averaged to yield prorated scale scores. For consistency, trait scales at ages 14 and 18 were transformed to be on a scale of 3–12, the same as for age 11.

Internal consistency of personality trait scales was lowest at age 11 (i.e., parent responses to the 33-item MPQ, which has three items per subscale): for this version, Cronbach's alpha values ranged from .52–.57. Cronbach's alpha values were higher for the age 14 and 18 self-report versions of the MPQ (.85–.90 at age 14, .83–.91 at age 18). Low Cronbach's alpha values for the MPQ at age 11 could be attributed to several factors: the smaller numbers of scale items (Vaske et al., 2017), the lower stability of personality at younger ages (Bleidorn et al., In Press), or the fact that this scale was administered to parent informants, rather than the participants themselves. Appendix D presents Cronbach's alpha values for each scale at each wave of data collection, and Appendices F, G, and H present intercorrelations among personality trait scores across waves.

Trait Anxiety. The Trait scale of the State-Trait Anxiety Measure for Children (STAI-CH; Spielberger, 1973) was used to assess individual differences in proneness to anxiety, also described as "temporally stable anxiety across situations" (Muris et al., 2002). At age 11, children self-reported the frequency with which they experienced 20 anxiety-related symptoms

(e.g., “I worry about making mistakes,” “I notice my heart beats fast”) on a scale from 1 (hardly ever) to 3 (often). The STAI-CH has demonstrated internal consistency and convergent and discriminant validity in non-clinical adolescent samples (Muris et al., 2002). It also discriminates well between youth with and without anxiety disorders, and has demonstrated moderate sensitivity to treatment response (Seligman et al., 2004). For participants with 10% or less data missing (i.e., two or fewer items), items were averaged to yield a prorated total score. In our sample, Cronbach’s alpha for the Trait scale of the STAI-CH was .83.

Control Variables

Body Mass Index (BMI; kg/m^2). Height and weight were measured at each study visit, allowing for the calculation of BMI.

Socioeconomic Status. We used parent-reported household income at baseline as an indicator of socioeconomic status (SES). Income was entered as an ordinal variable, with 13 categories in ordered denominations ranging from less than $10,000/year to more than $80,000/year.

Pubertal Development. The Pubertal Development Scale (PDS; Petersen et al., 1988) is an interview measure designed to assess Tanner stages of pubertal development. The PDS assesses changes in four secondary sex characteristics (i.e., increases in height, appearance of body hair, skin changes, breast development) using a 4-point scale from 1 (“development has not yet begun”) to 4 (“development seems completed”); menarche is rated dichotomously as absent (1) or present (2). Accordingly, total scores on the PDS range from 4 to 18. Longitudinal examinations of the PDS’s psychometric properties in community samples have provided evidence of internal consistency (Cronbach’s alpha ranging from .68 - .83 with a median of .77), sensitivity to change (evidenced by increasing mean scores in girls and boys from age 11 through

13), and convergent validity evidenced by high correlations with physician and interviewer ratings, and predictable associations with objectively measured changes in height (Petersen et al., 1988). Variability in pubertal development is low in girls past age 15, with epidemiological research suggesting that over 99% of girls over this age are post-pubertal (Wu et al., 2002). Accordingly, the PDS was only administered at the first and second waves of data collection. In our sample, Cronbach's alpha for the PDS was .73 at age 11 and .60 at age 14.

Data Analytic Plan

LCGA: Overview

We used LCGA to identify the most common trajectories of disordered eating development from age 11 to 29. Conventional growth curve modeling approaches assume that individual participants come from a single population, that a single growth trajectory can adequately approximate an entire population, and that covariates influence each individual in the same way, potentially failing to capture the diverse and complex patterns of change over time among members of different subgroups (Jung & Wickrama, 2008). Conversely, LCGA can describe patterns of heterogeneity within a larger population. This form of analysis acknowledges that different sub-populations may be characterized by different growth patterns, that not all individuals change in the same direction or at the same rate, and that covariates may differentially influence these sub-populations. In contrast to variable-centered approaches such as regression, factor analysis, and structural equation modeling, which focus on describing relationships among variables, LCGA has been described as a person-centered analysis approach, where the goal is to classify individuals into groups so that individuals within a group are more similar than individuals between groups (Jung & Wickrama, 2008). LCGA characterizes profiles of individuals by constructing multiple common trajectories of growth over

time. LCGA offers many advantages over other techniques, the most important being that it is a data-driven approach which does not make a priori assumptions about the shape of developmental trajectories (Preacher, 2010).

A data set of at least 300 to 500 cases is preferable for running LCGA, although the analysis can be applied to data sets of at least 100 cases (Nagin, 2005). As such, the sample size of the current study was considered adequate for conducting LCGA. All models were fitted using Mplus, version 8 (Muthén & Muthén, 2007), using 500 final iterations and 20 random start values. We used the Mplus cluster option to account for nonindependence of observations within twin pairs, assigning the family as the cluster unit. This method has been shown to successfully correct for family resemblance or dependency in phenotypic twin and family data, irrespective of the source of such dependency (genetic or environmental; Rebollo et al., 2012), and has been used extensively in previous longitudinal twin studies (e.g., Lyons et al., 2017; Neumann et al., 2011; Wichers et al., 2013) as well as cross-sectional behavioural genetic twin studies (e.g., Briley & Tucker-Drob, 2013; South et al., 2017).

Global Average EDP Development

We fitted single average growth models of MEBS total and subscale scores, adding terms to estimate the intercept (i.e., initial level of the EDP outcome), slope (i.e., linear change in EDP over time), quadratic (i.e., an upturn or downturn in EDP, beyond linear change), and cubic (i.e., a second inflection in EDP levels over time) parameters in a stepwise manner. In this step, we also examined the influence of BMI, pubertal development, and SES as assessed at baseline, establishing whether these variables were associated with any of our parameters. We examined model fit using the following model fit cut-off values, suggested by Hu and Bentler (1999): Standardized Root Mean Squared Residual (SRMR) close to .08 or below; Root Mean Square

Error (RMSE) values close to .06 or below; and Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) values close to .95 or greater. Mplus tests of model fit computations are robust to violations of normality and independence of observations (Muthén et al., 2006).

Identification of EDP Trajectories

We conducted LCGA to identify the most common trajectories of MEBS total and subscale scores, controlling for BMI, pubertal development, and SES as needed (established by the results of the previous step). The variance and covariance estimates for the growth factors within each class were fixed to zero, as is standard in LCGA models, which assume homogeneity of individual growth trajectories within classes. In line with previous recommendations (Jung & Wickrama, 2008; Nylund et al., 2007), LCGA proceeds by running, in a stepwise manner, models with an increasing number of class solutions (i.e., trajectories). To determine the optimal number of trajectory classes, we compared each increasingly complex model to its precedent by examining Bayesian information criteria (BIC) values and classification accuracy (i.e., entropy), and employing the Lo, Mendell, and Rubin (2001) likelihood ratio test (LMR), as well as the rule of thumb that no class should contain less than 5% of the full sample (Delucchi et al., 2004). For each EDP variable, we ceased to examine increasing class solutions once the more complex models failed to improve fit and classification accuracy, or yielded under-populated classes.

Comparison of Predictor Levels Across Classes

We conducted pairwise chi-squared comparison tests to examine whether levels of predictor variables differed among people categorized into different EDP trajectories. These comparisons were added to the best-performing trajectory models that we identified in the previous step.

Predictors of EDP Trajectories

For each EDP variable, we conducted multinomial logistic regressions to examine whether the most likely trajectory class membership (i.e., the categorical outcome) could be predicted by personality and trait anxiety variables measured at ages 11, 14, and 18; we reported odds ratios and 95% confidence intervals for these results. To reduce the number of comparisons and the potential inflation of Type I error rates, we only included in these regressions the personality variables that had been shown in the previous set of analyses to differ across each respective EDP class.

Results

Little's (1988) missing completely at random (MCAR) test indicated that data were missing completely at random [$\chi 2$ (5874) = 1971.67, p = 1.00]. We accordingly used full information maximum likelihood estimation, ensuring individuals with some missing data were included in analyses.

Sample Characteristics

Descriptive statistics for continuous study variables at each wave are presented in Table 3.1 and Table 3.2. Household income reported at baseline in USD ranged from under $10,000 per year to over $80,000 per year; the median response was between $40,000 and $45,000; the mode was over $80,000; the 25th percentile was between $30,000 and $35,000; and the 75th percentile was between $60,000 and $70,000.

Table 3.1: Descriptive Statistics at Ages 11–18

	Age 11 *n* = 760		Age 14 *n* = 710		Age 18 *n* = 675	
Characteristic	M(SD)	Range	M(SD)	Range	M(SD)	Range
Age (years)	11.70 (0.46)	10.75–12.58	14.77 (0.57)	13.57–16.91	18.28 (.71)	16.76–20.34
BMI	19.35 (3.72)	13.33–37.57	22.16 (4.20)	14.63–38.79	21.66 (4.37)	12.46–38.70
Pubertal Development	9.93 (2.54)	5.00–18.00	14.82 (1.86)	8.00–18.00	–	–
MEBS						
Total score	5.6 (4.85)	0–23	5.8 (5.61)	0–26	6.47 (5.58)	0–27
Body Dissatisfaction	1.15 (1.69)	0–6	1.86 (2.08)	0–6	2.12 (2.13)	0–6
Compensatory Behaviour	0.08 (0.34)	0–3	0.22 (0.65)	0–6	0.27 (0.68)	0–6
Binge Eating	1.07 (1.42)	0–7	0.86 (1.32)	0–7	1.03 (1.38)	0–7
Weight Preoccupation	2.52 (2.26)	0–8	2.33 (2.43)	0–8	2.49 (2.36)	0–8
Personality						
Achievement	8.74 (1.87)	3–12	–	–	8.07 (1.37)	3–12
Well-being	10.18 (1.48)	3–12	9.44 (1.43)	3–12	9.31 (1.45)	3–12
Social potency	8.33 (1.96)	3–12	–	–	7.57 (1.38)	3–12
Social closeness	10.06 (1.52)	3–12	–	–	9.36 (1.42)	3–12
Alienation	5.16 (1.77)	3–12	5.72 (1.47)	3–12	5.52 (1.42)	3–12
Aggression	4.83 (1.49)	3–12	5.90 (1.53)	3–12	5.51 (1.38)	3–12
Stress reaction	6.70 (1.74)	3–12	7.02 (1.61)	3–12	7.21 (1.57)	3–12
Traditionalism	9.39 (1.43)	3–12	–	–	8.75 (1.09)	3–12
Harm avoidance	8.70 (1.92)	3–12	8.36 (1.68)	3–12	8.44 (1.64)	3–12
Control	7.72 (1.87)	3–12	8.01 (1.30)	3–12	8.11 (1.29)	3–12
Trait Anxiety	32.51 (6.13)	20–54	–	–	–	–

Note. BMI = Body mass index (kg/m^2); MEBS = Minnesota Eating Behavior Survey. MEBS scores at age 14 were transformed to correspond to scores at age 11, as well as previously published norms (e.g., Patrick et al., 2002), which are on a scale of 3–12.

Table 3.2: Descriptive Statistics at Survey Ages 21 to 29

	Age 21 *n* = 705		Age 25 *n* = 683		Age 29 *n* = 607	
Characteristic	M(SD)	Range	M(SD)	Range	M(SD)	Range
Age (years)	20.99 (0.62)	19.57–23.22	25.25 (0.78)	23.22–27.96	29.06 (0.49)	28.32–31.11
BMI	24.48 (5.24)	15.85–48.72	25.63 (6.00)	15.50–50.48	27.32 (6.68)	18.51–46.14
MEBS						
Total score	6.4 (5.64)	0–25	6.99 (5.58)	0–25	7.92 (5.72)	0–28
Body Dissatisfaction	2.2 (2.16)	0–6	2.54 (2.19)	0–6	2.67 (2.19)	0–6
Compensatory Behaviour	0.25 (0.68)	0–5	0.21 (0.62)	0–6	0.22 (0.61)	0–6
Binge Eating	0.99 (1.39)	0–7	1.06 (1.44)	0–7	1.4 (1.61)	0–7
Weight Preoccupation	2.44 (2.33)	0–8	2.68 (2.29)	0–8	3.11 (2.35)	0–8

Note. BMI = Body mass index (kg/m^2); MEBS = Minnesota Eating Behavior Survey.

Global Average EDP Development

We first examined global mean-level longitudinal trends in EDP across our sample. We fitted a series of increasingly complex growth models for the MEBS total score and four subscales, capturing change in EDP from age 11 to 29. We first estimated only the intercept, and then added the slope, quadratic, and cubic terms in a stepwise manner.

For the MEBS total score and the body dissatisfaction and compensatory behaviour subscales, fit was maximized in the most complex models in which all four growth parameters were estimated. For the binge eating and weight preoccupation subscales, fit was maximized in the model in which only the three parameters of intercept, slope, and quadratic terms were estimated. Subsequent models for MEBS total score, body dissatisfaction, and compensatory behaviour estimated all four growth parameters, whereas models for binge eating and weight preoccupation estimated only the intercept, slope, and quadratic terms. In line with our hypotheses, global average trajectories were characterized by increases in total EDP, body dissatisfaction, and weight preoccupation between ages 11 and 29. Binge eating and compensatory behaviour were infrequently reported, and both appeared to show minor fluctuations over time.

Next, we added the covariates of baseline BMI, pubertal development, and SES to the best-fitting models identified above, to investigate the influence of these potential confounds on the growth parameters of MEBS total and subscale scores. These analyses informed if and how these candidate control variables were incorporated in subsequent analyses. For MEBS total and body dissatisfaction scores, there were significant effects of BMI on intercepts ($MEBS_{Total}$: B = .51, SE = .05, $p < .001$; $MEBS_{Body\ Dissatisfaction}$: B = .66, SE = .05, $p < .001$), indicating an association of higher BMI with higher total MEBS scores and higher levels of body

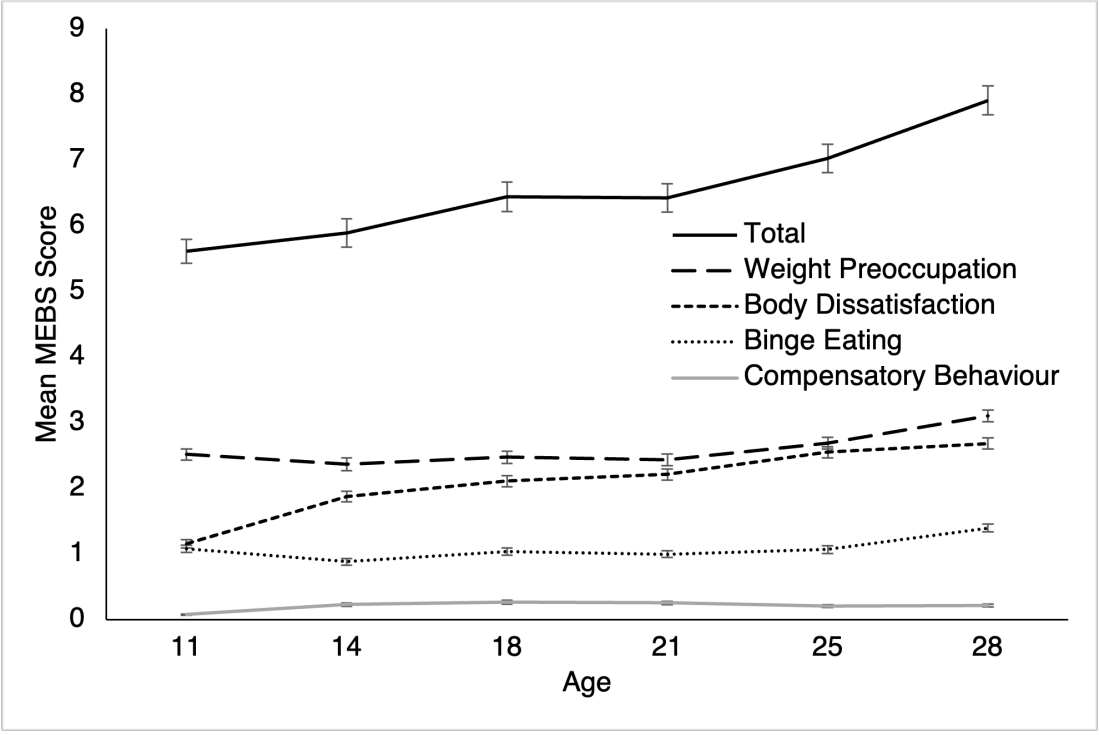
dissatisfaction at baseline. There were also significant effects of SES on the slope ($MEBS_{Total}$: B = .28, SE = .10, $p < .01$; $MEBS_{Body\ Dissatisfaction}$: B = .34, SE = .10, $p < .01$), quadratic ($MEBS_{Total}$: B = -.50, SE = .19, $p < .01$; $MEBS_{Body\ Dissatisfaction}$: B = -.63, SE = .14, $p < .001$), and cubic ($MEBS_{Total}$: B = .76, SE = .30, $p < .05$; $MEBS_{Body\ Dissatisfaction}$: B = .96, SE = .10, $p < .001$) terms, indicating an association of higher SES with greater growth in MEBS total scores and body dissatisfaction over time. There were also significant effects of BMI on the intercepts of compensatory behaviour (B = .19, SE = .06, $p < .01$), binge eating (B = .22, SE = .08, $p < .01$), and weight preoccupation (B = .53, SE = .05, $p < .001$), indicating that individuals with higher BMI at baseline tended to have higher levels of these symptoms at baseline. Based on these results, subsequent models controlled for the influence of BMI on intercepts, as well as the effect of SES on slope, quadratic, and cubic terms. We did not control for the influence of pubertal development in subsequent analyses, given that there were no significant effects of pubertal development scores on any of the growth parameters, for any of EDP variables. Fit statistics for all growth models are presented in Table 3.3. Figure 3.1 depicts global average trajectories of the MEBS total and subscale scores, controlling for BMI and SES.

Table 3.3: Fit statistics for baseline models depicting single growth curves

Parameters Estimated	BIC	ABIC	RMSEA	CFI	TLI	SRMR
		Total Score				
I	23871.370	23845.967	.161	.736	.792	.126
I S	23577.147	23542.217	.094	.923	.928	.066
I S Q	23504.477	23456.846	.058	.978	.973	.031
I S Q C	23505.747	23454.940	.057	.981	.974	.032
Final baseline model*	22578.790	22515.283	.040	.986	.980	.028
		Body Dissatisfaction				
I	16439.388	16413.985	.200	.555	.649	.197
I S	15952.500	15917.571	.110	.887	.894	.069
I S Q	15846.850	15799.219	.060	.974	.968	.035
I S Q C	15840.322	15789.515	.051	.983	.977	.035
Final baseline model*	15037.349	14973.843	.047	.980	.972	.039
		Compensatory Behaviour				
I	6967.150	6951.746	.111	.088	.280	.188
I S	6707.120	6672.191	.084	.558	.585	.106
I S Q	6585.092	6537.461	.052	.872	.840	.055
I S Q C	6574.320	6523.513	.045	.912	.881	.050
Final baseline model*	6340.059	6276.552	.039	.924	.892	.048
		Binge Eating				
I	13787.463	13762.060	.104	.716	.776	.122
I S	13628.927	13593.998	.063	.913	.919	.064
I S Q	13582.491	13534.859	.027	.988	.985	.029
I S Q C	13588.011	13537.205	.028	.988	.983	.029
Final baseline model*	13134.017	13076.861	.040	.962	.951	.040
		Weight Preoccupation				
I	17161.160	17135.757	.119	.830	.866	.095
I S	17027.965	16993.035	.079	.938	.941	.061
I S Q	16982.769	16935.137	.044	.985	.981	.027
I S Q C	16988.102	16937.295	.046	.985	.980	.028
Final baseline model*	16301.074	16243.918	.032	.988	.985	.029

Note. MEBS = Minnesota Eating Behavior Survey; I = intercept; S = slope; Q = quadratic term; C = cubic term; BIC = Bayesian information criteria values; ABIC = adjusted Bayesian information criteria values; RMSEA = root mean squared error of approximation; CFI = comparative fit index; TLI = Tucker-Lewis index; SRMR = standardized root mean squared residual. *Final baseline models estimated bolded growth terms and controlled for the impact of body mass index and socioeconomic status. n = 735.

Figure 3.1: Average Eating Disorder Psychopathology Trajectories of Total Sample (SE)



Note. MEBS = Minnesota Eating Behavior Survey.

Identification of EDP Trajectories

When model fit, classification accuracy, and class size were examined, four-class solutions did not yield improvements over three-class solutions for any EDP outcomes; thus, we did not examine solutions of five or more classes. In Table 3.4, we present fit statistics for the one-, two-, three-, and four-class models of MEBS total and subscale score growth, controlling for BMI and SES. As expected, LCGA revealed multiple trajectories of total EDP, body dissatisfaction, binge eating, and weight preoccupation. Two-class solutions performed best for the MEBS Total scale, and the Binge Eating and weight preoccupation subscales; a three-class solution performed best for the body dissatisfaction subscale. These trajectories are described in the sections that follow. For the compensatory behaviour subscale, a one-class solution performed best– this result indicates homogeneity of trajectories for this outcome, rather than multiple trajectories. Given that compensatory behaviour had a one-class solution, it was not included in subsequent analyses.

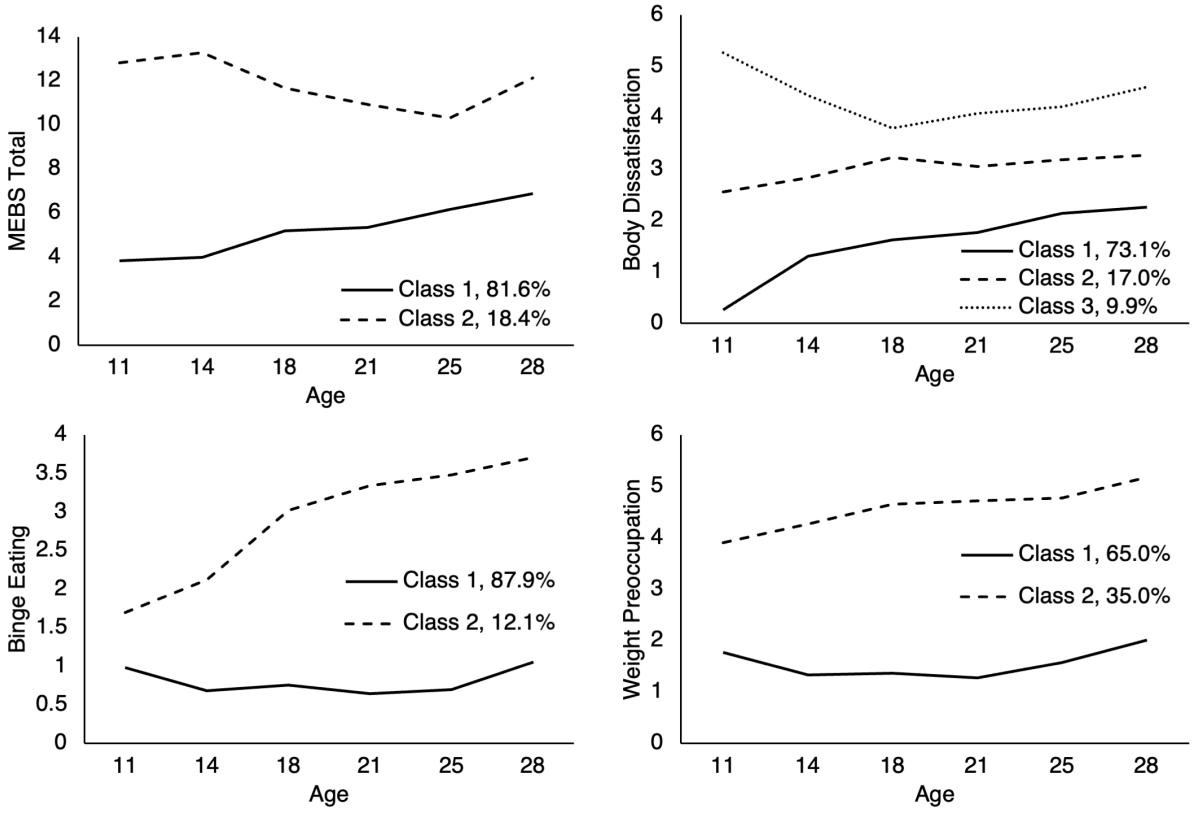
All models converged on replicated solutions. The class solutions described below provided optimal balances of fit and entropy, and had no underpopulated classes. Trajectories are depicted in Figure 3.2 and estimates of growth parameters for each of the trajectories are presented in Table 3.5 through Table 3.8.

Table 3.4: Fit Indices for Increasing Class Solutions of Eating Disorder Psychopathology Development

No. of classes	BIC	LMR-LRT *p*	Smallest Class n (%)	Entropy
		MEBS Total Score		
1	22578.790	–	–	–
2	22472.699	.002	135 (18.4%)	.82
3	22422.506	.231	65 (8.8%)	.83
4	22413.556	.156	42 (5.7%)	.83
		MEBS Body Dissatisfaction		
1	15037.349	–	–	–
2	14781.169	<.001	126 (17.1%)	.92
3	14633.815	<.001	73 (9.9%)	.94
4	14565.937	.029	61 (8.2%)	.88
		MEBS Compensatory Behaviour		
1	6825.997	–	–	–
2	6043.983	.129	52 (7.1%)	.97
3	5253.563	.328	45 (6.1%)	.98
4	4980.092	.586	12 (1.6%)	.96
		MEBS Binge Eating		
1	13894.765	–	–	–
2	13146.925	<.001	89 (12.1%)	.92
3	12953.217	.010	57 (7.7%)	.91
4	12838.377	.339	30 (4.1%)	.88
		MEBS Weight Preoccupation		
1	17403.900	–	–	–
2	16469.045	<.001	257 (65.0%)	.82
3	16321.703	.001	93 (12.7%)	.81
4	16222.453	.365	114 (15.5%)	.79

Note. MEBS = Minnesota Eating Behavior Survey; BIC = Bayesian information criteria values; LMR-LRT = Lo-Mendell-Rubin likelihood ratio test. n = 735.

Figure 3.2: Trajectories of Eating Disorder Psychopathology Development



Note. MEBS = Minnesota Eating Behavior Survey.

For each type of eating disorder psychopathology development, we have labelled the most common and favourable trajectories "Class 1" to facilitate interpretation.

Total Score

The first class (*Low Increasing; n* = 600, 81.6%) was characterized by initially low MEBS total scores which increased gradually and steadily. The second class (*High Decreasing; n* = 135, 18.4%) was characterized by initially high MEBS total scores which decreased between ages 14 and 25, and then increased by age 29.

Table 3.5: Growth Parameters and Mean Levels of Predictor Variables Across Eating Pathology Trajectories

	MEBS Total Score Trajectories					
	Class 1 Low Increasing (81.6%)			Class 2 High Decreasing (18.4%)		
Growth parameter	*B* (SE)			*B* (SE)		
Intercept	3.79 (0.21)***			12.85 (0.65)***		
Slope	0.41 (0.46)			1.40 (1.31)		
Quadratic	0.08 (0.21)			-1.28 (0.55)*		
Cubic	-0.01 (0.03)			0.19 (0.07)*		
Predictor	Age 11 *M* (SE)	Age 14 *M* (SE)	Age 18 *M* (SE)	Age 11 *M* (SE)	Age 14 *M* (SE)	Age 18 *M* (SE)
Achievement	8.75 (0.09)	–	8.11 (0.06)	8.68 (0.17)	–	8.03 (0.13)
Well-being	10.19 (0.07)	9.52 (0.06)$_c$	9.40 (0.06)$_b$	10.16 (0.13)	9.14 (0.13)$_c$	8.95 (0.14)$_b$
Social potency	8.30 (0.09)	–	7.56 (0.06)	8.49 (0.20)	–	7.67 (0.14)
Social closeness	10.00 (0.07)	–	9.42 (0.06)$_c$	10.30 (0.14)	–	9.09 (0.14)$_c$
Alienation	5.10 (0.08)	5.55 (0.06)$_a$	5.41 (0.06)$_a$	5.38 (0.18)	6.50 (0.14)$_a$	6.07 (0.14)$_a$
Aggression	4.82 (0.07)	5.81 (0.07)$_b$	5.45 (0.06)$_c$	4.89 (0.15)	6.34 (0.16)$_b$	5.80 (0.14)$_c$
Stress reaction	6.65 (0.08)	6.78 (0.07)$_a$	7.02 (0.07)$_a$	6.88 (0.16)	8.04 (0.15)$_a$	8.03 (0.15)$_a$
Traditionalism	9.38 (0.07)	–	8.76 (0.05)	9.42 (0.13)	–	8.64 (0.11)
Harm avoidance	8.74 (0.09)	8.41 (0.08)	8.43 (0.07)	8.57 (0.18)	8.17 (0.16)	8.48 (0.16)
Control	7.74 (0.09)	8.06 (0.06)$_c$	8.17 (0.06)$_c$	7.66 (0.18)	7.76 (0.13)$_c$	7.86 (0.12)$_c$
Trait anxiety	31.74 (0.25)$_a$	–	–	35.53 (0.56)$_a$	–	–

Note. MEBS = Minnesota Eating Behavior Survey. $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.

Means sharing a common subscript are significantly different between Class 1 and Class 2, as indicated by pairwise chi-squared comparison tests with significance levels of (a) $p < .001$; (b) $p < .01$; and (c) $p < .05$. $n = 735$.

Body Dissatisfaction

The first class (*Low Increasing; n* = 537, 73.1%) was characterized by initially low body dissatisfaction, increasing gradually and steadily over time. The second class (*Moderate; n* = 125, 17.0%) was characterized by moderate levels of body dissatisfaction, slightly increasing over time. The third class (*High; n* = 73, 9.9%) was characterized by initially high levels of body dissatisfaction, decreasing throughout adolescence but increasing through early adulthood.

Table 3.6: Growth Parameters and Mean Levels of Predictor Variables Across Body Dissatisfaction Trajectories

	Body Dissatisfaction Trajectories								
	Class 1 Low Increasing (73.1%)			Class 2 Moderate (17.0%)			Class 3 High (9.5%)		
Growth parameter	*B* (SE)			*B* (SE)			*B* (SE)		
Intercept	0.26 (0.02)***			5.27 (0.13)***			5.27 (0.13)***		
Slope	1.21 (0.12)***			-1.23 (0.34)***			-1.23 (0.34)***		
Quadratic	-0.32 (0.06)***			0.35 (0.15)*			0.35 (0.15)*		
Cubic	0.01 (0.01)***			-0.03 (0.02)			-0.03 (0.02)		
Predictor	Age 11 *M* (SE)	Age 14 *M* (SE)	Age 18 *M* (SE)	Age 11 *M* (SE)	Age 14 *M* (SE)	Age 18 *M* (SE)	Age 11 *M* (SE)	Age 14 *M* (SE)	Age 18 *M* (SE)
Achievement	8.23 (0.09)	–	8.16 (0.06)$_{c}$	8.59 (0.18)	–	7.78 (0.13)$_{c}$	8.39 (0.22)	–	8.16 (0.16)
Well-being	10.17 (0.07)	9.53 (0.07)$_{b}$	9.41 (0.07)$_{c}$	10.39 (0.15)	9.40 (0.13)$_{c}$	9.05 (0.15)$_{c}$	9.91 (0.19)	8.90 (0.19)$_{b,c}$	9.12 (0.16)
Social potency	8.28 (0.09)	–	7.57 (0.06)	8.57 (0.19)	–	7.55 (0.13)	8.34 (0.27)	–	7.71 (0.21)
Social closeness	9.99 (0.07)	–	9.42 (0.06)	10.21 (0.15)	–	9.16 (0.14)	10.29 (0.18)	–	9.21 (0.18)
Alienation	5.10 (0.08)	5.63 (0.07)$_{b}$	5.45 (0.06)$_{c}$	5.14 (0.18)	5.88 (0.15)	5.76 (0.14)$_{c}$	5.61 (0.25)	6.21 (0.19)$_{b}$	5.78 (0.19)
Aggression	4.80 (0.07)	5.81 (0.07)	5.40 (0.06)$_{c}$	4.86 (0.15)	6.17 (0.17)	5.88 (0.15)$_{c}$	5.03 (0.23)	6.25 (0.22)	5.75 (0.18)
Stress reaction	6.66 (0.08)$_{a}$	6.84 (0.07)$_{a,b}$	7.06 (0.07)$_{a,b}$	6.58 (0.18)	7.36 (0.17)$_{b}$	7.51 (0.16)$_{b}$	7.17 (0.23)$_{a}$	7.81 (0.19)$_{a}$	7.87 (0.19)$_{a}$
Traditionalism	9.38 (0.07)	–	8.78 (0.05)	9.42 (0.14)	–	8.63 (0.09)	9.40 (0.20)	–	8.64 (0.16)
Harm avoidance	8.71 (0.09)	8.37 (0.08)	8.38 (0.07)	8.69 (0.18)	8.38 (0.16)	8.55 (0.16)	8.66 (0.25)	8.29 (0.24)	8.69 (0.22)
Control	7.76 (0.89)	8.05 (0.06)	8.18 (0.06)$_{c}$	7.68 (0.20)	7.97 (0.13)	7.89 (0.12)$_{c}$	7.52 (0.23)	7.72 (0.18)	7.98 (0.16)
Trait anxiety	31.65 (0.26)$_{a, b}$	–	–	33.87 (0.60)$_{b, c}$	–	–	36.16 (0.77)$_{a, b, c}$	–	–

Note. MEBS = Minnesota Eating Behavior Survey. $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.

Means sharing a common subscript significantly differ between classes, as indicated by pairwise chi-squared comparison tests with significance levels of (a) $p < .001$; (b) $p < .01$; and (c) $p < .05$.

Binge Eating

The first class (*Low; n* = 646, 87.9%), was characterized by binge eating levels which remained low across all time points. The second class (*Increasing; n* = 89, 12.1%) was characterized by initially low-to-moderate levels of binge eating which increased at each time point, most steeply in adolescence.

Table 3.7: Growth Parameters and Mean Levels of Predictor Variables Across Binge Eating Trajectories

	MEBS Binge Eating Trajectories					
	Class 1 Low (87.9%)			Class 2 Increasing (12.1%)		
Growth parameter	*B* (SE)			*B* (SE)		
Intercept	0.97 (0.06)***			1.62 (0.03)***		
Slope	-0.28 (0.04)***			0.79 (0.26)**		
Quadratic	0.06 (0.01)***			-0.08 (0.04)		
	Age 11	Age 14	Age 18	Age 11	Age 14	Age 18
Predictor	*M* (SE)	*M* (SE)	*M* (SE)	*M* (SE)	*M* (SE)	*M* (SE)
Achievement	8.73 (0.08)	–	8.10 (0.06)	8.78 (0.21)	–	8.00 (0.14)
Well-being	10.21 (0.06)	9.50 (0.06)$_c$	9.40 (0.06)$_b$	9.99 (0.18)	9.06 (0.18)$_c$	8.76 (0.18)$_b$
Social potency	8.33 (0.08)	–	7.57 (0.06)	8.39 (0.23)	–	7.62 (0.17)
Social closeness	10.06 (0.07)	–	9.44 (0.06)$_a$	10.02 (0.18)	–	8.75 (0.17)$_a$
Alienation	5.07 (0.07)$_b$	5.66 (0.06)$_b$	5.45 (0.06)$_a$	5.71 (0.23)$_b$	6.22 (0.15)$_b$	6.12 (0.16)$_a$
Aggression	4.81 (0.06)	5.84 (0.06)$_b$	5.44 (0.06)$_b$	4.96 (0.17)	6.44 (0.20)$_b$	6.02 (0.17)$_b$
Stress reaction	6.66 (0.08)	6.90 (0.07)$_a$	7.06 (0.06)$_a$	6.91 (0.19)	7.93 (0.18)$_a$	8.25 (0.17)$_a$
Traditionalism	9.40 (0.06)	–	8.76 (0.05)	9.32 (0.16)	–	8.58 (0.14)
Harm avoidance	8.71 (0.08)	8.37 (0.07)	8.45 (0.07)	8.67 (0.20)	8.28 (0.19)	8.32 (0.21)
Control	7.66 (0.08)	8.04 (0.06)$_c$	8.15 (0.05)	8.14 (0.21)	7.71 (0.15)$_c$	7.85 (0.15)
Trait anxiety	32.25 (0.24)$_c$	–	–	34.06 (0.76)$_c$	–	–

Note. MEBS = Minnesota Eating Behavior Survey. $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.

Means sharing a common subscript are significantly different between Class 1 and Class 2, as indicated by pairwise chi-squared comparison tests with significance levels of (a) $p < .001$; (b) $p < .01$; and (c) $p < .05$.

Weight Preoccupation

The first class (*Low; n* = 478, 65.0%) was characterized by low levels of weight preoccupation with a small decrease in adolescence, followed by small increases between ages 21 and 29. The second class (*High Increasing; n* = 257, 35.0%) was characterized by high levels of weight preoccupation which increased over time.

Table 3.8: Growth Parameters and Mean Levels of Predictor Variables Across Weight Preoccupation Trajectories

	MEBS Weight Preoccupation Trajectories					
	Class 1 Low (65.0%)			Class 2 High Increasing (35.0%)		
Growth parameter	*B* (SE)			*B* (SE)		
Intercept	1.76 (0.12)***			3.95 (0.21)***		
Slope	-0.45 (0.08)***			0.33 (0.14)*		
Quadratic	0.10 (0.02)***			-0.02 (0.03)		
Predictor	Age 11 *M* (SE)	Age 14 *M* (SE)	Age 18 *M* (SE)	Age 11 *M* (SE)	Age 14 *M* (SE)	Age 18 *M* (SE)
Achievement	8.76 (0.10)	–	8.10 (0.07)	8.70 (0.13)	–	8.07 (0.10)
Well-being	10.23 (0.07)	9.54 (0.07)$_{c}$	9.47 (0.07)$_{a}$	10.10 (0.11)	9.26 (0.11)$_{c}$	9.01 (0.10)$_{a}$
Social potency	8.37 (0.10)	–	7.59 (0.07)	8.27 (0.15)	–	7.55 (0.10)
Social closeness	10.00 (0.08)	–	9.44 (0.07)	10.16 (0.11)	–	9.20 (0.10)
Alienation	5.10 (0.09)	5.54 (0.07)$_{a}$	5.36 (0.07)$_{a}$	5.27 (0.13)	6.10 (0.10)$_{a}$	5.87 (0.10)$_{a}$
Aggression	4.84 (0.07)	5.85 (0.08)	5.40 (0.06)$_{b}$	4.82 (0.11)	6.05 (0.11)	5.73 (0.10)$_{b}$
Stress reaction	6.60 (0.09)	6.71 (0.08)$_{a}$	6.91 (0.07)$_{a}$	6.88 (0.12)	7.64 (0.11)$_{a}$	7.80 (0.11)$_{a}$
Traditionalism	9.36 (0.08)	–	8.73 (0.05)	9.44 (0.10)	–	8.76 (0.08)
Harm avoidance	8.67 (0.10)	8.33 (0.09)	8.37 (0.08)	8.75 (0.13)	8.42 (0.12)	8.56 (0.11)
Control	7.62 (0.09)	7.98 (0.07)	8.15 (0.06)	7.92 (0.13)	8.04 (0.09)	8.04 (0.09)
Trait anxiety	31.56 (0.29)^{a}	–	–	34.19 (0.42)^{a}	–	–

Note. MEBS = Minnesota Eating Behavior Survey. $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.

Means sharing a common subscript are significantly different between Class 1 and Class 2, as indicated by pairwise chi-squared comparison tests with significance levels of (a) $p < .001$; (b) $p < .01$; and (c) $p < .05$.

Comparison of Predictor Levels Across Trajectory Classes

Table 3.5 through Table 3.8 display the mean scores for each predictor variable in each trajectory class for the variables of MEBS total, body dissatisfaction, binge eating, and weight preoccupation scores. Note that with one exception (trait anxiety, self-reported at age 11) personality variables were parent-reported at age 11, and self-reported at ages 14 and 18. Achievement, social potency, social closeness, and Traditionalism were not measured at age 14. Pairwise chi-squared tests revealed significant personality differences depending on EDP trajectory membership; these differences are described in the subsections that follow.

In the service of completeness, we also examined mean scores in each trajectory on the higher-order personality factors of negative emotionality, positive emotionality, and constraint measured at age 11 and age 18 (these factors could not be computed for age 14, due to the use of an abbreviated version of the MEBS). These scores are displayed in Appendix I. For personality factors that significantly differed between trajectories, we also performed regressions to determine whether these factors predicted trajectory membership; these regressions did not show significant effects of any higher-order personality factor. Because the ten personality trait scales provide richer information than the three higher-order factors, we focus on the trait scales in the present study.

Total EDP

Compared to girls in the more favourable *Low Increasing* trajectory class, those in the *High Decreasing* class had higher levels of self-reported trait anxiety at age 11; lower levels of well-being and control, and higher alienation, aggression, and stress reaction at age 14 and 18; and lower levels of social closeness at age 18.

Body Dissatisfaction

Compared to those classified in the more favourable trajectories, girls in the *High* trajectory class tended to have higher levels of parent-reported stress reaction and self-reported trait anxiety at age 11; lower levels of well-being, and higher levels of alienation and stress reaction at age 14; and higher levels of stress reaction at age 18.

Binge Eating

Compared to girls classified in the more favourable *Low* trajectory, those in the *Worsening* trajectory tended to have higher levels of parent-reported alienation and self-reported trait anxiety at age 11; lower levels of well-being and control, and higher alienation, aggression, and stress reaction at age 14 and 18; and lower levels of social closeness at age 18.

Weight Preoccupation

Compared to girls classified in the more favourable *Low* trajectory, those in the *High Increasing* trajectory tended to have higher levels of self-reported trait anxiety at age 11; lower levels of well-being at ages 14 and 18; and higher levels of alienation and stress reaction at ages 14 and 18.

Prediction of Trajectory Class Membership

We performed multinomial logistic regressions to further examine predictors of membership in trajectories of total EDP, body dissatisfaction, binge eating, and weight preoccupation (Table 3.9). We based our selection of predictors for these regression models on the results of prior analyses: for each respective type of EDP, the personality traits shown in the previous set of analyses to differ across classes were included as predictors of trajectory outcome. These analyses also controlled for baseline SES and BMI, given that these factors were shown to have significant effects on EDP trajectories.

For global EDP development, compared to *Low Increasing* trajectory (Class 1), girls classified within the *High Decreasing* (Class 2) trajectory had higher levels of trait anxiety at age 11, and higher levels of alienation and stress reaction at age 14. The most impactful predictor was stress reaction at age 14: for every one-unit increase in stress reaction at age 14, girls were 1.6 times as likely to demonstrate the *High Decreasing* trajectory. For every one-unit increase in alienation scores at age 14, girls were 1.29 times as likely to demonstrate the *High Decreasing* trajectory. The impact of self-reported trait anxiety at age 11, despite being statistically significant, was so small that it is unlikely to be practically meaningful, as evidenced by an odds ratio of 1.06.

For body dissatisfaction, girls with higher trait anxiety at age 11 and stress reaction at age 14 were more likely to demonstrate the *High* (Class 3) and *Moderate* (Class 2) trajectories, rather than *Low Increasing* trajectory (Class 1). Specifically, for every one-unit increase in trait anxiety at age 11, girls were 1.12 times as likely to demonstrate the *High* trajectory, and 1.06 times as likely to demonstrate the *Moderate* trajectory; for every one-unit increase in stress reaction at age 14, girls were 1.39 times as likely to demonstrate the *High* trajectory, and 1.24 times as likely to demonstrate the *Moderate* trajectory.

For binge eating, only stress reaction at age 14 and social closeness at age 18 emerged as significant predictors of trajectory class membership. For every one-unit increase in stress reaction, girls were 1.53 times as likely to demonstrate the *Worsening* trajectory (Class 2) instead of the *Low* trajectory (Class 1). Social Closeness was protective: for every one-unit increase in social closeness at age 18, the chance of demonstrating the *Worsening* trajectory was reduced by about one quarter.

For weight preoccupation, every one-unit increase in trait anxiety at age 11 corresponded to 1.05 times higher odds of demonstrating the *High Increasing* trajectory (Class 2), rather than the *Low* trajectory (Class 1; i.e., only marginally higher odds). A one-unit increase in stress reaction at age 14 corresponded to 1.23 times the odds of demonstrating the *High Increasing* trajectory; and a one-unit increase in stress reaction at age 18 corresponded to similarly increased odds (1.22 times as likely to demonstrate the *High Increasing* weight preoccupation trajectory).

Table 3.9: Predictors of Eating Disorder Psychopathology Trajectories

	Total Score	Body Dissatisfaction		Binge Eating	Weight Preoccupation
Predictor	Class 2 vs. Class 1	Class 3 vs. Class 1	Class 2 vs. Class 1	Class 2 vs. Class 1	Class 2 vs. Class 1
Alienation (Age 11)	–	–	–	1.15 [1.01, 1.32]	–
Stress Reaction (Age 11)	–	0.99 [0.82, 1.21]	0.87 [0.75, 1.01]	–	–
Trait Anxiety (Age 11)	**1.06** [1.02, 1.10]	**1.12** [1.06, 1.18]	**1.06** [1.02, 1.10]	1.00 [0.96, 1.04]	**1.05** [1.01, 1.08]
Well-being (Age 14)	1.17 [0.96, 1.43]	0.81 [0.61, 1.07]	0.97 [0.82, 1.15]	1.06 [0.85, 1.31]	1.10 [0.91, 1.32]
Alienation (Age 14)	**1.29** [1.03, 1.62]	0.95 [0.72, 1.25]	0.90 [0.74, 1.09]	.89 [0.71, 1.12]	1.07 [0.89, 1.28]
Aggression (Age 14)	0.99 [0.83, 1.19]	0.99 [0.77, 1.30]	1.08 [0.90, 1.29]	1.04 [0.85, 1.27]	
Stress Reaction (Age 14)	**1.60** [1.27, 2.01]	**1.39** [1.04, 1.87]	**1.24** [1.02, 1.50]	**1.53** [1.26, 1.86]	**1.23** [1.03, 1.48]
Control (Age 14)	0.97 [0.78, 1.20]	0.94 [0.67, 1.31]	1.08 [0.88, 1.33]	0.85 [0.68, 1.05]	–
Well-being (Age 18)	–	–	–	–	0.92 [0.77, 1.09]
Social Closeness (Age 18)	0.93 [0.79, 1.10]	1.08 [0.84, 1.38]	0.91 [0.77, 1.06]	**0.77** [0.66, .90]	–
Alienation (Age 18)	–	–	–	–	0.97 [0.80, 1.16]
Stress Reaction (Age 18)	–	–	–	–	**1.22** [1.02, 1.47]

Note. Values are odds ratios with 95% confidence intervals in brackets, controlling for BMI and socioeconomic status at age 11. Boldface type indicate significant odds ratios. Dash indicates predictors which were not included in regressions for each trajectory class prediction model.

Discussion

Prevention efforts may be enhanced by improving our understanding of how girls come to develop EDP, and the characteristics of girls who display more pathological, versus normative, developmental trajectories. The current study examined trajectories of EDP development from late childhood to early adulthood and characterized these trajectories based on personality characteristics measured at ages 11, 14, and 18.

Trajectories of EDP Development

Most of our participants showed low, increasing global EDP and body dissatisfaction over time. For global EDP, this pattern characterized 81.6% of girls; and for body dissatisfaction, 73.1% of girls. Thus, a pattern of linear increases in EDP, and body dissatisfaction specifically, during the transition from late childhood to early adulthood, appeared to be normative in this sample. The most common trajectories of binge eating and weight preoccupation, respectively demonstrated by 87.9% and 65.0% of girls, were characterized by fluctuations and small reductions in late adolescence and the early twenties, and an increase by age 29. Because most girls show these developmental trajectories, they accordingly have also emerged in previous studies where global average developmental patterns were modeled across entire samples (e.g., Bucchianeri et al., 2013; Rohde et al., 2015; Slane et al., 2014). The present results thus replicate prior research that has identified normative mean-level patterns of gradually increasing EDP among adolescent and young-adult girls and women– indeed, the majority of participants in our study showed this pattern.

The most pathological trajectories of EDP development deviated considerably from these normative patterns. Girls classified within the most pathological trajectories of global EDP (18.4%), body dissatisfaction (9.9%), and weight preoccupation (35.0%) already showed highly

elevated levels of each of these outcome variables by age 11. Girls with the most pathological trajectories of global EDP and body dissatisfaction deviated from the normative pattern of linear increases in EDP over time: for these trajectory groups, levels of global EDP and body dissatisfaction somewhat reassuringly *decreased* in adolescence, before increasing again by age 29. This finding is consistent with the results of S. B. Wang et al. (2019), who also identified a trajectory of high body dissatisfaction that decreased, and then increased again between the approximate ages of 15 to 31. Girls with the most pathological patterns of binge eating (12.1%) and weight preoccupation (35.0%) showed increases on these variables at every time point, most steeply between ages 14 and 18 for binge eating. The National Comorbidity Survey has established age 12.6 as the mean age of onset of Binge Eating Disorder (Swanson et al., 2011)– our results show an increase in symptoms throughout adolescence that, in comparison, appears somewhat delayed given the younger average age of onset.

Overall, our results suggest that girls with the most pathological patterns of EDP development (i.e., those who likely have the highest risk for developing eating disorders; Rohde et al., 2015), deviate markedly from normative patterns of development. Taken together with previous studies that have identified subgroups who already demonstrate persistent high body dissatisfaction and EDP by early adolescence (Rodgers et al., 2016; S. B. Wang et al., 2019), our results also suggest that sensitive periods for disordered eating development may occur earlier than previously believed (Liechty & Lee, 2013; Vanderkruik et al., 2020).

A one-class solution emerged indicating a single trajectory of compensatory behaviour. Rather than reflecting true homogeneity of compensatory behaviour trajectories, we suspect this finding reflects measurement error (evidenced by low internal consistency and temporal stability of our compensatory behaviour subscale) as well as low base rates of compensatory behaviour

within our community-based sample. Longitudinal studies with larger samples are needed to clarify the most common patterns of compensatory behaviour development.

Personality Predictors

Personality traits related to neuroticism seem to play an important role in differentiating trajectories of EDP, with the caveat that such traits may be best captured through self-report methods. We obtained partial support for our hypothesis that less favourable trajectories of EDP would be predicted by higher levels of neuroticism-related traits at ages 11, 14, and 18. Specifically, self-reported proneness to anxiety at age 11 predicted membership in the higher-risk trajectories of global EDP, body dissatisfaction, and weight preoccupation, but not binge eating. Self-reported stress reaction (i.e., tendencies to be sensitive, irritable, and prone to worry and guilt) at age 14 predicted membership in riskier trajectories for all EDP outcomes. Parent-reported levels of stress reaction at age 11, however, did not differentiate developmental trajectories for any EDP outcomes. The correlation of parent-reported stress reaction at age 11 with self-reported stress reaction at age 14 was only .19, whereas the correlation between self-reported stress reaction scores at age 14 and 18 was .63; this difference in correlation strength raises concerns about the validity of informant reports on this personality trait– the failure of parent-reported stress reaction to predict EDP trajectories may reflect factors such as measurement error, informant biases, psychopathology of parents, or reliability issues. Neuroticism-related traits, which encompass proneness to negative emotions such as anxiety and stress, may not be directly entirely observable (Herzhoff et al., 2017; Shiner et al., 2021), even to people closest to the individual– as such, parent reports may have failed to accurately capture twins' levels of the stress reaction trait at age 11.

Adolescents who struggle with interpersonal relationships in adolescence were also more likely to demonstrate riskier EDP trajectories. Specifically, girls who demonstrated the high-risk global EDP trajectory, showed greater tendencies to be suspicious of others' motives, feel they are treated unfairly, and see oneself as a victim (i.e., alienation), at age 14. Conversely, girls who tend to be sociable, enjoy others' company, and value close interpersonal ties (i.e., high in social closeness) were less likely to show pathological trajectories of binge eating. These findings are consistent with prior research that has shown that the interpersonal difficulties among people with eating disorders often predate the onset of illness (Cardi et al., 2018), and conversely, that good social skills may play a protective role (Uzunian & Vitalle, 2015). The Transactional Model of Child Positive Affect (Davis & Suveg, 2014) provides a framework that can help to understand potential relationships among negative emotionality, interpersonal concerns, and trajectories of EDP. This model posits that higher positive affect invites more positive reactions from others, which provide youth with more opportunities to refine their social skills; youth with better social skills would be less likely to be teased, and would go on to develop higher self-esteem and more positive body image; conversely, youth with initially lower levels of positive affect would be more vulnerable to bullying, lower self-esteem, body dissatisfaction, and eating pathology (Davis & Suveg, 2014).

Implications

Prevention programming has advanced considerably: a 2019 review (Kusina & Exline) found a greater proportion (68%) of universal programs showed a benefit for at least one body image outcome, than did a 2013 review on this topic (43%; Yager et al.). However, effect sizes of body image programming have remained small, and have continued to show attenuation over time: only 5 of 34 programs (14.7%) reviewed by Kusina and Exline had significant effects on

body image at both post-intervention and follow-up, compared to 3 of 16 programs (18.7%) reviewed by Yager et al. in 2013. Even programs that *do* effectively enhance body image and reduce EDP often fail to demonstrate effectiveness in preventing full-blown eating disorders– in part because it is challenging to achieve adequate statistical power to demonstrate an effect on a single, low-incidence outcome such as eating disorder incidence (Levine, 2020).

We are still far from achieving the targets of effective body image and eating disorder prevention programming. It may be worth expanding the focus of body image and EDP prevention programming to better address personality traits related to neuroticism. In our study, such traits characterized participants in the more pathological trajectory groups, and yet, these traits are not well-targeted in current body image and EDP prevention programming (Kusina & Exline, 2019). It may be worth examining how well transdiagnostic treatment approaches such as the Unified Protocol (UP; Farchione et al., 2012), which was explicitly developed to target neuroticism (Sauer-Zavala, Fournier, et al., 2021), apply to EDP. In recent years, there has been a push toward trans-diagnostic *prevention* approaches (Colizzi et al., 2020), in addition to treatment. Rather than targeting specific disorders (e.g., eating disorders) and their risk factors (e.g., thin ideal internalization), paradigms such as the clinical high at-risk mental state (CHARMS) have identified broad-spectrum transdiagnostic criteria and pathogenic mechanisms that place young people at elevated risk for developing a *range* of serious mental illnesses (J. A. Hartmann et al., 2019). The CHARMS paradigm has opened the door for trialling transdiagnostic prevention programs such as the UP for the Transdiagnostic Prevention of Emotional Disorders (Sauer-Zavala, Tirpak, et al., 2021). By targeting pluripotent developmental processes and risk factors in this way, transdiagnostic prevention approaches hold promise in their potential to effectively prevent or delay a broad range of psychopathological trajectories and mental

illnesses, reducing the need for multiple disorder-specific prevention programs (Colizzi et al., 2020).

Given that neuroticism-related traits (i.e., stress reaction and trait anxiety) predicted trajectories of EDP development in the current study, and that neuroticism has been shown to give rise to a broader range of psychopathological trajectories and other serious mental illnesses (Jeronimus et al., 2016), it represents a worthy target for transdiagnostic prevention. Although trials have demonstrated that neuroticism can be effectively targeted in treatment (Carlucci et al., 2021; Sauer-Zavala, Fournier, et al., 2021), the benefits of targeting neuroticism in prevention of EDP have yet to be established. Transdiagnostic prevention programs that target neuroticism have shown strong feasibility and acceptability in initial proof-of-concept (Bentley et al., 2018) and pilot studies (Bernstein et al., 2021), but their efficacy remains to be examined in larger-scale trials. Given that the current study identified neuroticism as a predictor of EDP trajectories, EDP outcomes should be investigated in trials that examine the effectiveness of transdiagnostic prevention approaches such as those based on the UP. In line with the Transactional Model of Child Positive Affect (Davis & Suveg, 2014), targeting neuroticism may also have benefits for promoting the protective factor of social closeness, and reducing teasing and feelings of alienation.

Limitations

The current study contains limitations that must be acknowledged. First, the sample comprised girls who were mainly White. Although families who participated in the MTFS were broadly representative of the sociodemographic composition of the state of Minnesota at the time they were recruited (Iacono & McGue, 2002), this sociodemographic composition has shifted greatly since the early 1990s. Whereas in 1990, only 6.3% of Minnesotans were persons of

colour, that proportion reached 23.7% in 2020 (Minnesota Compass, 1960-2053). Our findings may not generalize to girls of different ethnicities and geographical locations. Second, we focused on exploring personality predictors of EDP trajectories, rather than including a wider range of predictors in our models. Future studies may attempt to include a wider range of potential predictor variables, potentially clarifying the relative importance of sociocultural factors, versus pluripotent transdiagnostic risk factors such as personality traits. Future studies may also explore reciprocal relationships between personality, EDP, and other internalizing and externalizing disorders. Third, we recognize the limitations of the way personality was measured in the current study. Informant effects were potentially introduced in this study by assessing personality through parent-report at age 11, and self-report at age 14 and 18. Parent-reported personality had small correlations with later self-reported personality trait scores. Except for self-reported trait anxiety at age 11, the personality traits that significantly predicted trajectory group membership in our regression models were all measured at age 14 or 18. These traits differentiated adolescents who demonstrated pathological EDP trajectories from those who showed more common developmental patterns; however, we cannot describe these traits as "risk factors" given they did not precede the development of EDP. Future prospective studies may clarify the relationship of self-reported and parent-reported personality characteristics with EDP.

Conclusion

The current study enhances understanding of the most common trajectories of EDP development among girls during the transition from late childhood to early adulthood. The most pathological trajectories of global EDP, body dissatisfaction, weight preoccupation, and binge eating development deviated considerably from normative patterns, both in terms of baseline levels of these outcomes, as well as their patterns of change over time: whereas most girls tended

to develop EDP gradually during the transition to adulthood, the subgroups with the most pathological trajectories already showed concerningly elevated EDP by age 11. In early adolescence, girls in these high-risk subgroups tended to have higher levels of neuroticism-related traits, as well as lower levels of social closeness, and in the case of binge eating, greater feelings of alienation. Our results highlight the importance of further examining the impact of neuroticism-related traits, which hold promise as potential targets of transdiagnostic prevention approaches.

Chapter 4: One Size Does Not Fit All: Trajectories of Body Image Development and their Predictors in Early Adolescence

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Abstract

Negative body image predicts many adverse outcomes. The current study prospectively examined patterns of body esteem development in early adolescence and identified predictors of developmental subtypes. 328 girls and 429 boys reported annually across a 4-year period (M_{age} at baseline = 11.14, SD = 0.35) on body esteem, appearance ideal internalisation, perceived sociocultural pressures, appearance comparisons, appearance-related teasing, self-esteem, positive and negative affect, and dietary restraint. We performed latent class growth analysis to identify the most common trajectories of body esteem development and examine risk and protective factors for body image development. Three developmental subgroups were identified: (a) *High Body Esteem* (39.1%); (b) *Moderate Body Esteem* (46.1%); and (c) *Low Body Esteem* (14.8%). Body esteem was stable within the *Low* trajectory and there were minor fluctuations in the *High* and *Moderate* trajectories. Greater appearance-related teasing, lower self-esteem, less positive affect, and higher dietary restraint predicted the *Low* trajectory, whereas higher self-esteem and lower dietary restraint best predicted the *High* trajectory. Low body esteem appears to be largely stable from age 11. Prevention programming may be enhanced by incorporating components to address transdiagnostic resilience factors such as self-esteem and positive affect.

Introduction

Body image is a multifaceted construct that has been defined as how individuals think, feel, and behave in relation to their own bodies (Thompson et al., 1999). It includes many interrelated constructs (Kling et al., 2019) such as body esteem, a major contributor to global self-esteem (Tiggemann, 2011) that encompasses self-evaluations and the degree of satisfaction with one's physical appearance, weight, and shape (Mendelson et al., 2001); perceived physical attractiveness, the degree to which individuals believe themselves to be generally good looking (Marsh et al., 1994); and body dissatisfaction, denoting negative evaluations of physical characteristics and a discrepancy between a person's perceived actual and ideal body (Cash & Pruzinsky, 1990).

Body image is a critical area of wellbeing among adolescents. Unfortunately, negative body image impacts many adolescent girls (Wertheim & Paxton, 2011) and boys (Cohane & Pope, 2001). Body dissatisfaction prospectively predicts negative outcomes including eating disorders (Beato-Fernandez et al., 2004), depression (Stice & Bearman, 2001), suicide attempts (Rodriguez-Cano et al., 2006), and risky health behaviours (Bornioli et al., 2019). Conversely, body appreciation (i.e. acceptance, respect, and favourable opinions toward one's body) has been found to predict adaptive eating behaviors and decreases in dieting, alcohol, and cigarette use over time (Andrew et al., 2016). Though substantial progress has been made in the development of programs to improve body image and prevent eating disorders, many programs demonstrate limited effectiveness among adolescents, particularly in the long term (Yager et al., 2013). Given the relative intractability of negative body image and its wide-ranging adverse outcomes, it is critical to explore the developmental roots of this problem and identify risk and protective factors associated with it.

Longitudinal Research on Body Image Development

Most longitudinal studies on body image have examined developmental trends across entire samples, allowing researchers to describe a single average pattern. For example, research suggests that on average, body dissatisfaction shows linear increases from late childhood to young adulthood (e.g., Bucchianeri et al., 2013). Correspondingly, investigations of the related construct of body esteem have found scores to decrease and subsequently stabilize during this same period (Frisén et al., 2015). Describing a single average pattern of development using conventional growth modeling approaches assumes that a single growth trajectory can adequately approximate an entire population, and that covariates (i.e., risk and protective factors, as well as other confounding variables that may predict the outcome) influence each individual in the same way (Jung & Wickrama, 2008).

Normative average characterizations of body image development, though they may be accurate at the population level, can fail to capture important individual differences. Recent studies have employed a person-centered approach by examining multiple trajectories of body image development, identifying subgroups of individuals who exhibit distinct patterns of body image development over time. For example, Nelson et al. (2018) identified *three* trajectories of appearance esteem from age 10 to 24: high and relatively stable (53%), moderate early adolescent decline (36%), and steep early adolescent decline (11%). Examining boys' and girls' perceptions of their own physical attractiveness between ages 12 and 16, Morin et al. (2017) identified three trajectories: high (48.0%), increasing (34.1%), and decreasing (17.9%) perceived attractiveness. Studies that have applied similar analyses to the construct of body dissatisfaction have also found evidence for multiple developmental trajectories between ages 15 and 31 (S. B. Wang et al., 2019), and specifically in girls throughout early adolescence (Rodgers et al., 2016).

Although these studies examining latent body image trajectories have examined different body image constructs over different developmental periods, all have found sizeable subgroups of adolescents with stable positive body image, as well as subgroups with more concerning trajectories.

Theoretical Frameworks and Risk Factors for Body Image Disturbance

Several theoretical models provide frameworks for understanding the development of negative body image. One such model is the Tripartite Influence Model (Thompson et al., 1999), which posits that sociocultural appearance pressures transmitted by the media, parents, and peers (including through weight- and appearance-related teasing) promote both internalisation of societal appearance ideals and the tendency to engage in appearance comparisons, which ultimately influences the development of later body image and eating disturbances. This model of sociocultural influences has been well supported in longitudinal studies of adolescent girls and boys (Frisch et al., 2020; S. J. Paxton et al., 2006). Consistent with the Tripartite Influence Model, subgroups who exhibit different body image trajectories have been shown to vary in terms of appearance-related teasing (Rodgers et al., 2016; S. B. Wang et al., 2019), relationships with peers and parents (Morin et al., 2017; S. B. Wang et al., 2019), internalisation of cultural appearance ideals, and engagement in appearance comparisons (Rodgers et al., 2016).

An extension of the Tripartite Influence Model is the Biopsychosocial Model (Rodgers et al., 2014) which posits that, in addition to sociocultural influences, individual psychological and biological factors also play a role in the development of body image and eating disturbances. The primary individual psychological factor included in this model is negative affect, specifically its components of depressive symptoms and low self-esteem. In the Biopsychosocial Model, the tendency to experience negative affect is proposed to be associated with a preference for, and

selective attention to, negative information about oneself and the world, leading to the perception of one's own appearance as being very discrepant from the societal ideal (Rodgers et al., 2014; Stice & Whitenton, 2002). In this way, negative affect is included as a risk factor for, rather than only an outcome of, body image disturbance and disordered eating. The biological factor proposed in the biopsychosocial model is body size as approximated by body mass index (kg/m^2; BMI): it is expected that individuals living in larger bodies are likely to perceive themselves as more distant from societal body ideals, increasing the risk for negative body image and disordered eating. The biopsychosocial model has been supported in cross-sectional research with adolescent girls (Rodgers et al., 2014) and additional longitudinal research provides evidence for the predictive role of negative affect (Bearman et al., 2006). Furthermore, subgroups who exhibit different body image trajectories have been shown to vary in levels of depressive symptoms, and self-esteem (S. B. Wang et al., 2019). BMI has received mixed support as a risk factor for negative body image and disordered eating and may not always prospectively predict increases in body dissatisfaction once other risk factors have been accounted for (e.g., Bearman et al., 2006; Frisch et al., 2020).

Dietary restraint is an additional potential risk factor for body image disturbances, not explicitly accounted for in either the Tripartite or Biopsychosocial Models. Dietary restraint has typically been conceptualized as an outcome of negative body image and there is considerable longitudinal evidence for such a relationship (e.g., Neumark-Sztainer et al., 2006). However, longitudinal studies have also found evidence for a relationship in the reverse direction, whereby self-reported dietary restraint and attempts to achieve particular body goals predict increases in body dissatisfaction (Barker & Galambos, 2003; Bearman et al., 2006). The influence of dietary restraint on subsequent body image development can be conceptualized in terms of biological

and psychological aspects: attempts to reduce body weight via self-imposed dietary restraint often result in failure and may predict weight gain (Klesges et al., 1992), which could lead to frustration and increased dissatisfaction with one's body (Bearman et al., 2006). Though dietary restraint has not yet been examined as a predictor of body image trajectories, individuals with more concerning body image trajectories have reported higher rates of *peer* dieting (S. B. Wang et al., 2019).

Gender is another factor that may influence body image development. Although negative body image impacts boys and men, the importance of appearance over body functionality is more strongly emphasized for women, and thus it is not surprising that women have been consistently found to exhibit more negative body image than men (Murnen, 2011). Though longitudinal studies examining average body image development across entire samples have found no gender differences in growth curves of body esteem (Frisén et al., 2015) or body dissatisfaction (Bucchianeri et al., 2013), studies that have examined multiple trajectories of body image development have found that larger proportions of girls and women demonstrate more concerning trajectories (Morin et al., 2017; Nelson et al., 2018; S. B. Wang et al., 2019).

Further research is needed to replicate identified body image trajectories and their predictors, and in particular to increase understanding of stability and change in body image during the early adolescent period. Early adolescence is characterized by profound changes and growth in many life domains. Advances in cognitive abilities, expanding and increasingly important social relationships, the onset of puberty, and increasing pressure to find one's place in society have led researchers to describe early- to mid-adolescence as a critical period in terms of the pathogenesis of mental health problems (Alberga et al., 2012; Oldehinkel et al., 2011). Given the important physical, psychological, cognitive, and social changes that occur during this

period, it cannot be assumed that earlier growth trajectories mirror the patterns of change over time observed later in adolescence and adulthood, or that covariates influence these earlier trajectories in the same ways. Longitudinal research with younger samples may examine whether previously identified risk factors remain predictive when measured at earlier ages. This research may also either establish the continuity of previously identified trajectories or capture earlier developmental changes, determining the age range during which body image trajectories stabilize. If body image is found to stabilize by the pre-teen years in higher-risk subgroups, it may be beneficial to intervene earlier, while body image is still developing and perhaps more responsive to preventive initiatives.

In addition to helping identify individuals at highest risk and prevent negative outcomes, examining trajectories of body image development may increase understanding of individuals who exhibit healthier patterns. A recent shift in the field of child and adolescent mental health has emphasized the importance of focusing on resilience and protective factors (Sonuga-Barke, 2019) in addition to psychopathology. Studies examining body image development have largely focused on the development of body *dis*satisfaction, rather than the more global construct of body esteem. Identifying factors that characterize subgroups with consistently *high* body esteem, or that predict trajectories of improvement among adolescents with initially low body esteem, could yield meaningful prescriptions for strengths-based promotion of positive body image.

The Current Study

The primary aim of the current study was to identify the most common trajectories of body esteem development in girls and boys between ages 11 and 15. Secondary aims were to examine the extent to which psychological and sociocultural factors, as well as dietary restraint, distinguished and prospectively predicted these trajectories. We hypothesized multiple patterns

of body esteem development would emerge; more concerning trajectories would be predicted by greater initial internalisation of appearance ideals, perceived sociocultural appearance pressures, appearance comparisons, appearance-related teasing, negative affect, and dietary restraint; whereas healthier trajectories of body image development would be predicted by lower levels of the aforementioned variables, as well as higher levels of self-esteem and positive affect.

Method

Ethical Considerations

The trial was approved by the university ethics internal review board and registered (#RCTN16782819). Informed active consent was obtained from school senior management (during recruitment), informed assent from parents (prior to baseline assessment), and informed consent from students (at baseline assessment).

Participants

Our sample comprised 328 girls and 429 boys who were participants from control schools in a body image intervention trial. Participants were recruited from two state-maintained co-educational schools in the South of England. One school had above-average socioeconomic status, and the other school was below the national average, as indicated by the proportion of students receiving free school meals. Participating schools received a £1300 honorarium over the course of three years. Students completed questionnaires under standardised conditions supervised by teachers and trained research staff. Data collected at baseline and one-, two-, and three-year follow-up were analyzed. Notably, 91 Year 8 girls from one control school were excluded from analysis because they inadvertently received another body image intervention

during the trial. Retention rates were 86.0% at one-year follow-up, 74.5% at two-year follow-up, and 56.9% at three-year follow-up.[7]

The trial employed a cohort sequential design such that at baseline, 55.4% (n = 419) of participants were in Year 7 and 44.6% (n = 338) were in Year 8. To avoid biases in estimation of developmental change due to this design (Mehta & West, 2000), we rescaled time codes to have a value of zero at Year 7 for both cohorts. This strategy produced a dataset of 757 participants with five timepoints: Year 7, Year 8, Year 9, Year 10, and Year 11. Data from Year 7 and Year 11 were available only for students who were in Year 7 and Year 8 at baseline, respectively. The mean age was 11.14 (*SD* = 0.35) in Year 7, 12.15 (*SD* = 0.37) in Year 8, 13.24 (*SD* = 0.43) in Year 9, 14.26 (*SD* = 0.45) in Year 10, and 15.25 (*SD* = .44) in Year 11. The majority of participants indicated they had been born in the UK (94.9%), spoke primarily English at home (92.5%), and identified their ethnic/racial background as white (84.0%).

Measures

Body esteem. A large array of measures exists to assess various components of the multidimensional construct of body image (Kling et al., 2019). The current study focuses on body esteem, reflecting global body appraisals and the degree of satisfaction/dissatisfaction with one's body and appearance. Body esteem was assessed using the Appearance and Weight subscales of the Body Esteem Scale for Adolescents and Adults (BESAA; Mendelson et al., 2001), a measure with strong evidence of favourable psychometric properties (Kling et al., 2019). On a scale of 1 (*Never*) to 5 (*Always*), participants responded to 18 items, both positively

[7] The low retention rate at three-year follow-up was due to one school being unable to accommodate data collection into their timetable.

(e.g., “I’m pretty happy about the way I look”) and negatively valenced (“My weight makes me unhappy”). After reverse-scoring negatively valenced items, we derived a total score by averaging all 18 items; higher scores indicated higher body esteem. Cronbach’s alpha values for the total score ranged from .89 to .95 (*M* = .92) for boys, and .95 to .96 (*M* =.95) for girls, indicating high internal consistency at every timepoint.

Internalisation of appearance ideals. The extent to which participants had cognitively bought into cultural appearance ideals was assessed using the General (9 items) and Athletic (5 items) Internalisation subscales of the Sociocultural Attitudes Towards Appearance Questionnaire-3 (SATAQ-3; Thompson et al., 2004). Items reflect the extent of general media appearance ideal internalisation (e.g., “I would like my body to look like the bodies of people who are on TV”); and athletic appearance ideal internalisation (e.g., “I wish I looked as athletic as sports stars”). Participants rated each item from 1 (*Totally disagree)* to 5 (*Totally agree*), and items were averaged to yield subscale total scores. Both subscales had high internal consistency at every time point: for the General Internalisation subscale, Cronbach’s alpha values ranged from .89 to .98 (*M* =.95) for boys, and .91 to .98 (*M* =.96) for girls; for the Athletic subscale, these values ranged from .87 to .97 (*M* =.92) for boys, and .85 to .97 (*M* =.91) for girls.

Perceived sociocultural pressures. Based on questions adapted from the Perceived Sociocultural Pressure Scale (Stice & Agras, 1998), participants reported the amount of pressure they felt to lose weight, change their body shape or build, have bigger muscles, or change their appearance. Twelve items (e.g. “I’ve felt pressure to lose weight from my friends”) requested participants to rate from 1 (*None*) to 5 (*A lot*) the amount of pressure they had felt from friends (4 items), family (4 items), and the media (4 items). Items were averaged to yield three total scores

indicating the degree of perceived pressure from each source. Cronbach's alpha values at the five timepoints ranged from .72 to .94 (*M* =.85) for boys, and .76 to .88 (*M* =.83) for girls.

Appearance comparisons. To assess frequency of engagement in appearance-related social comparisons, we administered the Social Comparison to Models and Peers Scale (Jones, 2001). Participants responded to 8 questions on a scale from 1 (*Never*) to 5 (*Always*) regarding how frequently they compared themselves to two different targets ('celebrities and people in the media,' or 'other people my age') on the basis of weight, body shape or build, face, and fashion/style. Items were averaged to yield total scores, with higher scores indicating greater tendency to compare oneself to others. Cronbach's alpha values at the five timepoints ranged from .81 to .94 (*M* =.90) for boys, and .87 to .93 (*M* =.91) for girls.

Appearance- and weight-related teasing. To assess the frequency with which participants experienced appearance- and weight-related teasing, we administered two items adapted from questions used in a previous study (Neumark-Sztainer et al., 2007). Participants responded on a scale from 1 (*Never*) to 5 (*Always*) to the questions "How often have you been teased about your weight or body shape?" and "How often have you been teased about the way you look?". Responses were averaged to yield a total score, with higher scores indicating more frequent experiences of teasing. Cronbach's alpha values at the five timepoints ranged from .58 to .86 (*M* =.69) for boys, and .69 to .86 (*M* =.77) for girls.

Self-esteem. To assess global attitudes about the self, we administered a shortened version (Neumark-Sztainer et al., 2007) of the Rosenberg Self-Esteem Scale (Rosenberg, 1965). Participants rated their agreement with six items (e.g., "I feel that I have a number of good qualities") on a scale from 1 (*Strongly disagree*) to 4 (*Strongly agree*). Responses were averaged to yield a total score, with higher scores indicating higher global self-esteem. Cronbach's alpha

values at the five timepoints ranged from .65 to .82 (*M* =.77) for boys, and .66 to .87 (*M* =.81) for girls.

Positive and Negative Affect. To assess frequency of positive and negative mood states, we administered the Positive and Negative Affect Schedule for Children, Child Shortened Version (PANAS-C; Ebesutani et al., 2012). Participants were asked to rate five positive (e.g., cheerful) and five negative (e.g., sad) mood states based on how often they had felt that way on a scale from 1 ("Very slightly/Not at all") to 5 ("Extremely/Very much"). Items were averaged to yield total Positive Affect and Negative Affect subscale scores, which had high internal consistency at every time point: for the Negative Affect subscale, Cronbach's alpha values ranged from .77 to .92 (*M* =.86) for boys, and .85 to .91 (*M* =.88) for girls; for the Positive Affect subscale, these values ranged from .91 to .96 (*M* =.94) for boys, and .92 to .93 (*M* =.93) for girls.

Dietary restraint. To assess restrained eating, we administered the Restraint subscale (10 items) of the Dutch Eating Behaviour Questionnaire (van Strien et al., 1986). Participants rated 10 items (e.g., "Do you deliberately eat less in order not to become heavier?") on a scale from 1 (*Not at all*) to 5 (*Very much*). Items were averaged to yield a total score, with higher scores indicating more restrained eating. Cronbach's alpha values ranged from .92 to .97 (*M* =.94) for boys, and .94 to .97 (*M* =.96) for girls.

Analyses

To identify trajectories of body esteem development over five time points, we used latent class growth modeling (LCGM). Conventional growth modeling assumes that participants come from a single population, that a single growth trajectory can adequately approximate this population, and that covariates influence everyone in the same way (Jung & Wickrama, 2008, p. 302). Conversely, LCGM takes into account population heterogeneity by acknowledging that

different subgroups may be characterized by different growth patterns, not all individuals change in the same direction or at the same rate, and covariates may influence subgroups in different ways. LCGM has been described as a person-centered statistical approach, where the goal is to classify individuals into groups so that individuals within a group are more similar than individuals between groups (Jung & Wickrama, 2008).

All models were fitted in Mplus software version 8 (Muthén & Muthén, 2007), using 500 final iterations and 20 random start values. First, we fitted single average growth models of body esteem development, adding terms to estimate, in a stepwise manner, the intercept (initial levels of body esteem), slope (linear change in body esteem over time), quadratic (an upturn or downturn in body esteem beyond linear change), and cubic parameters (a second inflection in body esteem levels over time). In these growth models, we examined the influence of the time-invariant potential covariates of gender, school, and cohort on the intercept, slope, quadratic, and cubic growth terms, allowing us to determine whether each of these covariates predicted initial levels of body esteem and patterns of change over time. We did not have reason to expect that covariates would impact change in body esteem over time, beyond initial levels; modeling these effects allowed us to rule out such possibilities.

Second, we conducted LCGM to identify the most common trajectories of body image development. In these trajectory analyses, we modeled any effects of time-invariant covariates that were found significant in the previous analyses. Although we did not examine trajectories separately for boys and girls, we examined the proportion of girls and boys who demonstrated each trajectory; the data-driven approach of LCGM allowed for the possibility that, if trajectories were more different than similar between girls and boys, participants would segregate into separate trajectory classes by gender. The variance and covariance estimates for the growth

factors within each class were fixed to zero. In line with previous recommendations (Jung & Wickrama, 2008; Nylund et al., 2007), to determine the number of classes of body esteem development, we examined Bayesian information criteria (BIC) values and classification accuracy (i.e., entropy), and employed the Lo, Mendell, and Rubin (2001) likelihood ratio test (LMR), bootstrap likelihood ratio test (BLRT), and rule of thumb that no class should contain less than 5% of the full sample (Delucchi et al., 2004).

Third, we conducted pairwise chi-squared tests comparing Year 8 levels of the psychological and sociocultural predictor variables across the identified trajectories. Fourth, we conducted multinomial logistic regressions to examine the extent to which these variables predicted trajectory membership, controlling for the influence of covariates identified in the first set of analyses.

Results

Little's (1988) Missing Completely at Random (MCAR) test indicated that data were missing completely at random for both younger [$\chi^2(6871) = 6716.79$, $p = .907$] and older [$\chi^2(4905) = 4713.06$, $p = .975$] cohorts, despite known systematic missingness of data at three-year follow-up for one of the cohorts within one of the schools. We used full information maximum likelihood estimation, ensuring individuals with some missing data were included in analyses. We also examined the influence of school when initially fitting models of BES growth and controlled for this variable, along with other covariates, in subsequent analyses.

Global Average Body Esteem Development

We fitted a series of increasingly complex models of BES growth by first estimating only the intercept of BES, and then adding slope, quadratic, and cubic terms in a stepwise manner. As reported in Table 4.1, fit was maximized in the most complex model in which all four growth

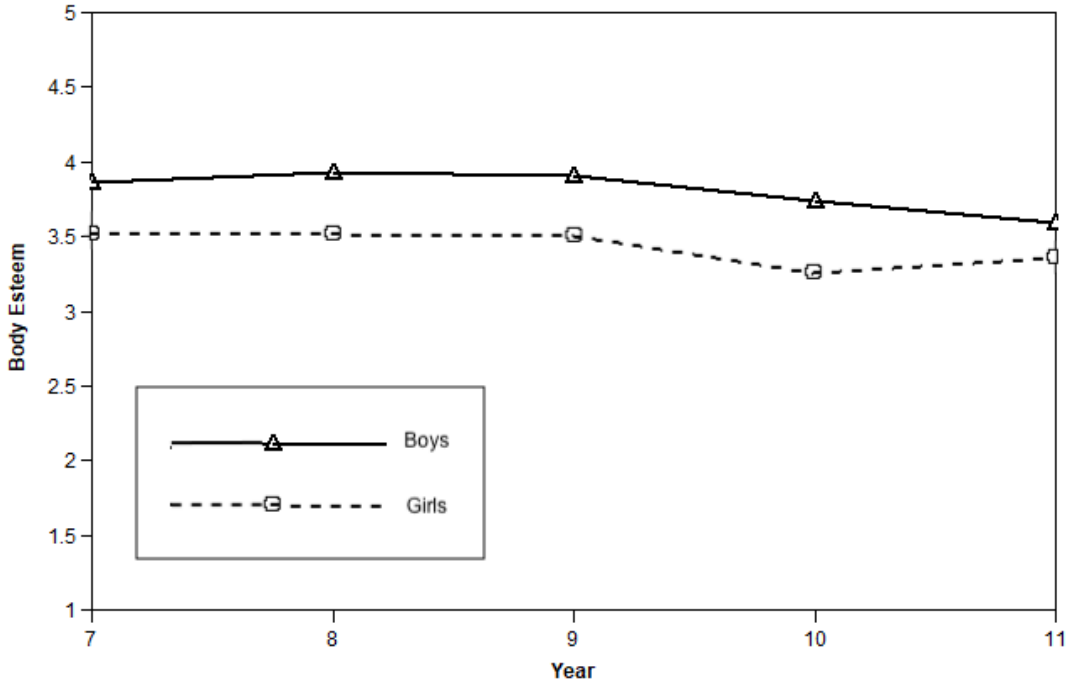
parameters were estimated. Next, we added gender, school, and cohort to the model. There were significant effects of gender (B = -.34, SE = .07, $p < .001$), school (B = -.04, SE = .01, $p = .013$), and cohort (B = -.71, SE = .26, $p = .007$) on the intercept of BES, but not on the slope, quadratic, or cubic terms, $p > .05$. Boys, individuals who entered the study in Year 7 (i.e., the younger cohort), and individuals in one of the two schools, began with initially higher levels of body esteem. Subsequent models estimated all four growth parameters, controlling for the impact of gender, school, and cohort on BES intercept. Figure 4.1 depicts body esteem trajectories for girls and boys separately, controlling for school and cohort.

Table 4.1: Fit Statistics for Baseline Models Depicting a Single Growth Curve of Body Esteem Development

Parameters Estimated	BIC	ABIC	RMSEA	CFI	TLI	SRMR
I	5106.89	5084.66	.114	.858	.894	.163
I S	5069.20	5037.44	.096	.924	.924	.150
I S Q	5051.78	5007.33	.077	.973	.951	.106
I S Q C	5047.83	5000.20	.066	.984	.965	.087
Final baseline model*	4992.16	4941.35	.053	.959	.945	.060

Note. I = intercept; S = slope; Q = quadratic term; C = cubic term; BIC = Bayesian information criteria values; ABIC = adjusted Bayesian information criteria values; RMSEA = root mean squared error of approximation; CFI = comparative fit index; TLI = Tucker-Lewis index; SRMR = standardized root mean squared residual. *This final baseline model controlled for the impact of gender, school, and cohort on the intercept of body esteem.

Figure 4.1: Average Body Esteem Trajectories of Boys and Girls



Note. On average, participants were 11.14 years old in Year 7, 12.15 years old in Year 8, 13.24 years old in Year 9, 14.26 years old in Year 10, and 15.25 years old in Year 11.

Identification of Body Esteem Trajectories

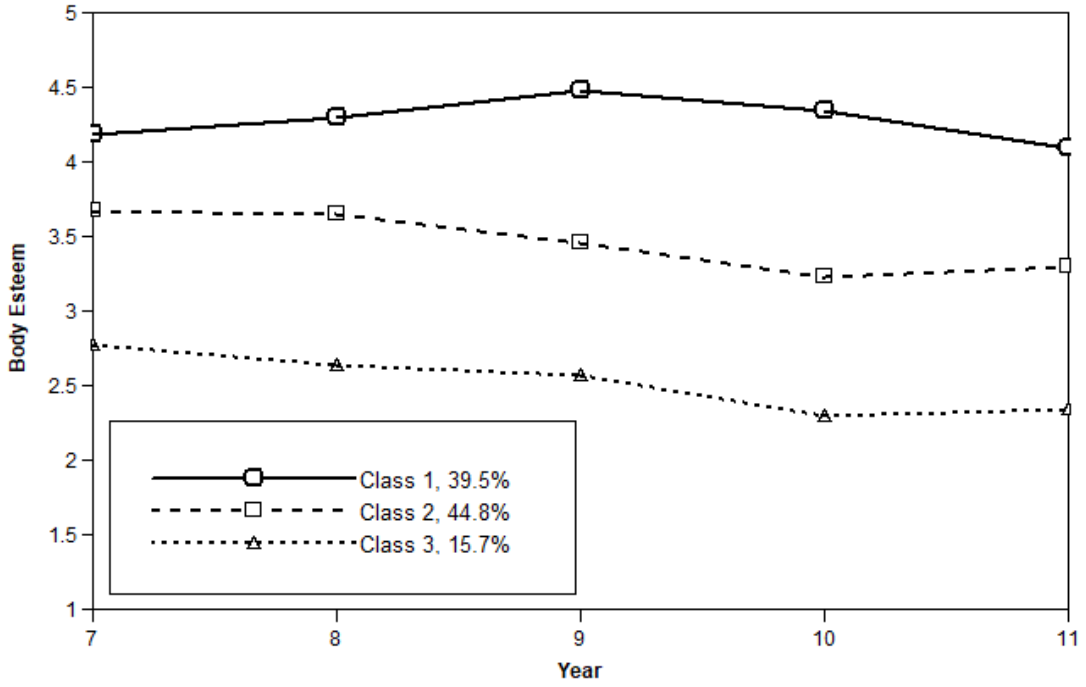
In Table 4.2, we present fit statistics for the one-, two-, three-, and four-class models of BES growth, with and without controlling for covariates. All models converged on a replicated solution. A three-class solution for body esteem development, controlling for gender, school, and cohort, provided an optimal balance of model fit and entropy, and did not have any underpopulated classes. The first class (n = 293, 39.1%), labelled "high body esteem," included individuals whose body esteem started out high, increased slightly between years 7 and 9, and then returned to a level similar to baseline. This class included a slightly larger proportion of boys (n = 194, 66.2%) than girls. The second class (n = 346, 46.1%), labelled "moderate body esteem," included individuals with moderate levels of body esteem that decreased between years 7 and 10, and then increased slightly in year 11. This class also included a slightly larger proportion of boys (n = 211, 61.0%) than girls. The third class (n = 111, 14.8%), labelled "low body esteem," displayed constant low body esteem across time, and included mostly girls (n = 92, 82.9%). Trajectories are depicted in Figure 4.2 and estimates of the growth parameters for each of these trajectories are presented in Table 4.3.

Table 4.2: Fit Indices for Increasing Class Solutions of Body Esteem Development

No. of classes	BIC	LMR-LRT *p*	BLRT *p*	Smallest Class n (%)	Entropy
1	5047.83	–	–	–	–
2	5250.68	.0020	< .001	276 (36.8%)	.71
3	5043.49	<.001	< .001	105 (14.1%)	.74
4	5031.67	.0564	< .001	12 (1.6%)	.79
1[a]	4992.16	–	–	–	–
2[a]	5163.58	<.001	<.001	348 (46.4%)	.71
3[a]	5003.73	<.001	<.001	111 (14.8%)	.74
4[a]	5001.29	.3987	<.001	27 (3.6%)	.78

Note. BIC = Bayesian information criteria values; LMR-LRT = Lo-Mendell-Rubin likelihood ratio test; BLRT = Bootstrap likelihood ratio test. [a] Models controlling for gender, school, and cohort.

Figure 4.2: Trajectories of Body Esteem Development



Note. On average, participants were 11.14 years old in Year 7, 12.15 years old in Year 8, 13.24 years old in Year 9, 14.26 years old in Year 10, and 15.25 years old in Year 11.

Table 4.3: Growth Parameters and Mean Levels of Predictor Variables Within Each Body Esteem Trajectory

	Body esteem trajectory		
	Class 1 High body esteem	Class 2 Moderate body esteem	Class 3 Low body esteem
	Estimate (*SE*)	Estimate (*SE*)	Estimate (*SE*)
Growth parameter			
Intercept	4.09 (0.06)***	3.58 (0.07)***	2.71(0.14)***
Slope	0.30 (0.10)**	0.34 (0.13)*	0.10 (0.20)
Quadratic	-0.05 (0.07)	-0.31 (0.08)***	-0.16(0.12)
Cubic	0.00 (0.01)	0.05 (0.01)***	0.03 (0.02)
	M (*SE*)	*M* (*SE*)	*M* (*SE*)
Predictor			
General ideal internalisation	1.67 (0.06)	1.94 (0.08)	2.48 (0.11)
Athletic ideal internalisation	1.70 (0.07)	2.41 (0.08)	2.98 (0.12)
Pressure from friends	1.16 (0.03)	1.43 (0.04)	1.91 (0.11)
Pressure from family	1.16 (0.03)	1.36 (0.04)	1.67 (0.09)
Pressure from media	1.12 (0.03)	1.34 (0.05)	2.04 (0.12)
Appearance comparisons	1.45 (0.04)	1.87 (0.06)	2.76 (0.13)
Teasing	1.29 (0.05)	1.60 (0.06)	2.32 (0.12)
Self-esteem	3.36 (0.03)	2.94 (0.03)	2.27 (0.06)
Positive affect	4.22 (0.06)	3.78 (0.07)	3.21 (0.13)
Negative affect	1.41 (0.04)	1.66 (0.05)	2.69 (0.13)

Note. ***$p < .001$, **$p < .10$, *$p < .05$. Growth parameters refer to the main outcome variable, body esteem, e.g. the intercept refers to mean baseline levels of body esteem within each trajectory. Mean values of predictor variables at Year 8 were significantly different between all pairs of classes ($p < .001$), with one exception: levels of general ideal internalisation differed between the high and moderate classes, but at a lower level of significance ($p = .013$).

Predictors of Body Esteem Trajectories

Comparison of Predictor Levels in Year 8 Across Classes. Table 4.3 displays the mean scores for each predictor variable in the three body esteem development classes. Pairwise chi-squared comparison tests revealed significant differences among the three body esteem trajectories on all predictor variables. General and athletic appearance ideal internalisation, perceived appearance pressure from friends, family, and the media, appearance comparisons, appearance-related teasing, and negative affect were highest in the low body esteem class, followed by the moderate and high body esteem classes, respectively. The reverse was true of self-esteem and positive affect, which were highest in the high body esteem class, followed by the moderate and low body esteem classes.

Prediction of Body Esteem Class Membership. Multinomial regression revealed that, together, the predictor variables as measured in Year 8 successfully predicted class membership $\chi^2(28) = 387.89$, $p < .001$, Nagelkerke $R^2 = .58$, controlling for gender, cohort, and school. Overall, appearance-related teasing [$\chi^2(2) = 10.43$, $p = .005$], self-esteem [$\chi^2(2) = 52.36$, $p < .001$], positive affect [$\chi^2(2) = 9.34$, $p = .009$], and dietary restraint [$\chi^2(2) = 21.41$, $p < .001$] were significant predictors in the model. Higher self-esteem ($B = 1.21$, $SE = .25$, $p < .001$) and lower dietary restraint ($B = -.42$, $SE = .17$, $p = .015$) significantly predicted belonging to the high body esteem class compared to the moderate body esteem class. More frequent perceptions of appearance-related teasing ($B = .53$, $SE = .21$, $p = .011$), lower self-esteem ($B = -2.11$, $SE = .51$, $p < .001$), less positive affect ($B = -.44$, $SE = .19$, $p = .021$), and higher dietary restraint ($B = .74$, $SE = .21$, $p < .001$) significantly predicted belonging to the low body esteem class compared to the moderate body esteem class. Internalisation, appearance-related social pressures and comparisons did not predict class membership.

Discussion

Our results increase understanding of body image trajectories in early adolescence, examining the more global construct of body esteem. We identified three developmental subgroups, characterized by differing levels of relatively stable body esteem: (a) *High Body Esteem* (39.1%); (b) *Moderate Body Esteem* (46.1%); and (c) *Low Body Esteem* (14.8%). In the current study, the low body esteem trajectory was predicted by greater appearance-related teasing, lower self-esteem, less positive affect, and higher dietary restraint, whereas the high body esteem trajectory was predicted by higher self-esteem and lower dietary restraint. The variables of appearance ideal internalisation, appearance-related social pressures, and appearance comparisons did not emerge as significant predictors in the current study.

Our findings extend those of previous studies that have examined change over time in various body image constructs, across various ages. Consistent with prior studies of appearance esteem (Nelson et al., 2018) and perceived attractiveness (Morin et al., 2017), we identified a subgroup of adolescents with stable high body esteem. Studies examining body dissatisfaction have similarly identified subgroups with stable high and low trajectories (Rodgers et al., 2016; S. B. Wang et al., 2019). It is worth noting, however, that the number of trajectories (three vs. four), the proportions of adolescents in each subgroup, the amount of stability versus change within more concerning body image trajectories, as well as the identified predictors of body image development, have varied across studies. The three trajectories identified by Morin et al. (2017) tended to converge over time toward more positive self-perceptions, whereas Nelson et al. (2018) found evidence of declines in appearance and weight esteem. Conversely, our identified trajectories remained relatively stable, which is particularly concerning for our trajectory with stable low body esteem (14.8%). Our results suggest that earlier in adolescence, the more global

and transdiagnostic variables of self-esteem and positive affect, as well as the eating- and appearance-related variables of dietary restraint and self-reported teasing better predict subsequent trajectories than do previously identified sociocultural risk factors.

Inconsistencies across studies may result not only from differences in the developmental periods under study, but also from variability in the body image constructs assessed (e.g., global body esteem, versus perceived attractiveness, or dissatisfaction with appearance, weight, and specific body parts). Due to what has been described as a "plethora of constructs," experts in body image research have called for consolidation and consensus in relation to constructs and methods used within the field (Atkinson et al., 2020). To examine how various body image constructs correspond to each other in terms of change over time, it may be informative for longitudinal studies to administer multiple measures and examine the degree to which changes over time are consistent depending on the measures used.

If there is a critical period for body image development, the lack of meaningful developmental change within each of the identified trajectories indicates this period may occur prior to age 11, suggesting a need for earlier intervention. Unfortunately, evidence for interventions for pre-adolescents (Holt & Ricciardelli, 2008) is less robust than evidence for interventions for adolescents (Yager et al., 2013). Though there may exist a critical period prior to age 11 during which low body esteem becomes ingrained, another possibility is that there is a subgroup of individuals who demonstrate low body esteem as early as cognitive abilities and assessment methods permit this experience and its measurement. In any case, it may be beneficial to deviate from universal prevention approaches and specifically target this high-risk subgroup in childhood or early adolescence, before low body esteem becomes entrenched.

Our findings point to factors that predict the development of high body esteem. Though the number of early adolescents (28.2% of girls and 4.4% of boys in our study) who evidenced low levels of body esteem from age 11 is concerning, the majority of the sample reported moderate (49.2% of boys and 41.2 % of girls) or high (45.2% of boys and 30.2% of girls) body esteem, consistent with prior studies (Rodgers et al., 2016; S. B. Wang et al., 2019). In line with the shift toward focusing on resilience and protective factors in youth mental health (Sonuga-Barke, 2019), understanding more about this high body esteem subgroup may assist in the selection of therapeutic targets. In the current study, adolescents with higher self-esteem and lower dietary restraint were more likely to display the high body esteem trajectory. In addition, although research has typically focused on how negative affect confers risk for psychosocial maladjustment (Davis & Suveg, 2014; Gilbert, 2012), we found a lack of positive affect, rather than the presence of negative affect, to emerge as a significant predictor of the low body esteem trajectory. These results are consistent with a qualitative study that interviewed adults who had overcome negative body image: participants emphasized social context and discontent with life in general as contributing to negative body image, and noted that experiencing agency and empowerment (conceptually similar to self-esteem) contributed to improvements in body image (Gattario & Frisen, 2019). Our results can also be interpreted in line with the Transactional Model of Child Positive Affect (Davis & Suveg, 2014). According to this model, youth who exhibit more positive affect invite positive reactions from others, resulting in increased opportunities to build social skills. These youth may be less likely to be teased, more likely to develop higher body esteem and self-esteem more generally, and less likely to engage in restrictive eating behaviours. Conversely, youth low in positive affect may miss out on such

opportunities, setting the stage for a feedback loop that perpetuates teasing, low self-esteem, and negative body image (Davis & Suveg, 2014).

Incorporating components to address transdiagnostic risk and protective factors such as positive affect may therefore enhance interventions delivered in late childhood and early adolescence. Although the most effective existing body image interventions tend to focus on specific sociocultural risk factors such as appearance ideal internalisation and body talk, incorporating additional transdiagnostic cognitive behavioural skills such as stress management, mindfulness, and cognitive restructuring may further improve body image outcomes (Alleva et al., 2015). As Yager et al. (2013) aptly stated, "future prevention efforts need to determine which approaches and content are most appropriate for each age level." As a next step, prevention and health promotion research may examine whether programs delivered in late childhood and early adolescence can be enhanced by targeting children with stable low body esteem and incorporating components to address transdiagnostic risk and protective factors that are most relevant for this subgroup. Finally, our finding that self-reported dietary restraint as early as age 12 strongly predicted body esteem trajectory membership adds to mounting evidence of the negative physical and psychological sequelae of self-directed dieting in children and adolescents (Canadian Paediatric Society, 2004).

Our findings showed that gender was important to understanding initial levels and developmental trajectories of body esteem. As indicated by a significant effect of gender on body esteem intercept, levels of body esteem at baseline significantly differed between boys (M = 3.84) and girls (M = 3.51). This finding is consistent with prior research demonstrating that girls and women experience higher levels of body dissatisfaction than boys and men (Murnen, 2011). It is worth noting, however, that the difference in mean scores, though statistically significant,

was by no means large, with boys' and girls' scores situated within half a standard deviation of each other. The small magnitude of this gender difference in body esteem may reflect a body image gender gap that has begun to narrow: evidence from a cross-temporal meta-analysis across 31 years and 326 unique samples suggests that while boys' and men's body dissatisfaction has been constant over time, girls' and women's body dissatisfaction may be decreasing, reflecting sociocultural shifts in body acceptance and diversity that counter thinness-related pressures for girls and women (Karazsia et al., 2017). Regarding the influence of gender on change in body image over time, there was no significant effect of gender on body esteem's slope, quadratic, or cubic growth parameters, but there were differences in the proportion of boys and girls within each trajectory class. Specifically, the low body esteem trajectory was comprised primarily of girls (82.9%), whereas the moderate and high body esteem trajectories demonstrated more even gender distributions (61% and 66.2% boys, respectively). Taken together, our findings indicate that gender is more important in determining initial levels of body esteem and trajectory membership, rather than patterns of change over time within individuals.

Our study has several limitations. First, our sample included primarily white, British adolescents, and our findings may not generalize to populations that do not share these characteristics. Second, we were unable to control for several potentially important covariates, including BMI, which has been shown to impact body image (McCabe & Ricciardelli, 2003). Provision of height and weight data was optionally self-reported in the current study and a minority of participants reported this information. Third, there was substantial attrition from baseline to follow-up assessments in our study, similar to other longitudinal studies (e.g., S. B. Wang et al., 2019). Fourth, we note that our measures of self-esteem and appearance teasing had internal consistency values somewhat lower than ideal (.5-.7 range). This type of reliability is

heavily influenced by the number of items on a scale (Vaske et al., 2017), which may partly explain the low values for these brief measures. Fifth, we relied on a global measure of participants' attitudes and feelings about their appearance and weight, which does not fully capture the construct of body image, particularly the influence of specific societal body ideals. An important task for future research is to examine body image development using measures that better capture gendered body image ideals (i.e. the drive for thinness versus muscularity), as well as other aspects of body image such as body functionality (i.e., the degree of emphasis placed on what one's body can *do*).

Conclusion

In summary, our results expand understanding of body esteem development in the early adolescent years and suggest this development may follow multiple trajectories, distinct in terms of baseline levels of positive affect, self-esteem, teasing, and dietary restraint. In future, researchers should seek to replicate trajectories of body image development in even younger and more diverse samples while comprehensively assessing this construct and its potential covariates.

Chapter 5: General Conclusion

This dissertation examined normative and pathological patterns of body image development through three studies. In the first study, a longitudinal meta-analysis was performed that aggregated data from 142 unique samples and examined average patterns of mean-level change in body image across the lifespan. This meta-analysis identified distinct, gender-moderated patterns of normative development. Whereas boys showed small fluctuations and an overall net-improvement in body image between ages 10 and 24, girls showed worsening body image between ages 10 and 16, but improvements between ages 16 and 24. Mean-level changes were largest between ages 10 and 14, and stabilized by age 24. We found no discernable impact of construct, birth cohort, or attrition rate on mean-level change in body image over time.

The second and third studies took a person-centred approach, and examined trajectories of body image and eating pathology development in two separate samples: the Minnesota Twin Family Study (MTFS) sample of 760 female twins assessed between ages 11 and 29; and a U.K. sample of 429 boys and 328 girls assessed between ages 11 and 15. In the MTFS sample, three trajectories of body dissatisfaction emerged, as well as two trajectories each for total eating disorder psychopathology (EDP), binge eating, and weight preoccupation. Girls in the most pathological trajectory groups already showed elevated EDP by age 11 and tended to have greater self-reported proneness to anxiety and stress, less sociable personality styles, and greater feelings of alienation. In the U.K. sample, three trajectories of body esteem emerged, each characterized by relatively stable body esteem. Girls and boys who showed the low body esteem trajectory tended to report greater appearance-related teasing, lower global self-esteem, less positive affect, and higher dietary restraint, whereas girls and boys in the more positive trajectory

tended to report higher self-esteem and lower dietary restraint. As with the MTFS sample, pathological trajectories appeared to take root before age 11.

The current findings offer some cause for optimism. In the U.S. sample, most of the female twins demonstrated the low-increasing (73%) or moderate (17%) trajectories of body dissatisfaction, as well as the low weight preoccupation trajectory (65%). In the U.K. sample, nearly 40% of adolescents demonstrated high body esteem that was relatively stable between ages 11 and 15. As well, though meta-analytic findings do not examine absolute levels of body image, these findings do suggest that on average, body image tends to improve for girls and women between ages 16 and 24, and generally shows net improvements for boys and men.

Meta-analytic results, as well as primary longitudinal studies that only examine mean-level development across an entire sample, mask considerable variability in adolescents' body image development. Sizeable subgroups deviated considerably from the trajectories displayed by most participants–in the MTFS sample, for example, pathological subgroups showed change in body image in directions opposite to most of the sample. In recent years, person-centered approaches like latent class growth modelling have proliferated as a method to explore individual differences in body image and eating pathology development (e.g., Morin et al., 2017; Nelson et al., 2018; Rodgers et al., 2016; Verschueren et al., 2020; Yu, 2016; Zimmer-Gembeck et al., 2018). Given the diversity of constructs and age ranges examined, and the variety of trajectories these studies have identified, it may be informative to follow up the current research with a systematic review that specifically examines the extent to which trajectories of body image and EDP development replicate across studies. It will be important to summarize this literature to examine the extent to which, with a data-driven approach like latent class growth modelling, the resulting number and

patterns of trajectories are consistent across studies and generalizable to other groups, or rather, reflect unique study methodology and sample characteristics.

This dissertation extends well-documented gender differences in body image development, suggesting that not only do boys and girls differ in the types and absolute levels of body image concerns expressed, but that they also differ in their patterns of change over time. In our U.K. study, a larger proportion of girls, compared to boys, demonstrated the low body esteem trajectory, consistent with prior trajectory studies (Morin et al., 2017; Nelson et al., 2018; S. B. Wang et al., 2019). Furthermore, in the meta-analysis, gender moderated mean-level change effect sizes, such that studies conducted on female samples were more likely to find worsening body image over time. Until age 18, male and female samples tended to show mean-level change in body image in opposite directions: during age ranges when male samples showed improvements, female samples tended to show worsening body image, and vice versa.

In the service of improving prevention programming, it will be important to weigh the costs and benefits of single-gender versus mixed-gender intervention delivery. Evidence suggests that interventions delivered in mixed-gender environments may be just as effective as single-gender environments in improving body image, but may show differences in effectiveness when it comes to other outcomes such as global self-esteem and thin ideal internalization (Chua et al., 2020). If psychoeducation is provided surrounding the ways in which body image typically develops, the impact of gender-specific content should be examined. For example, it may be normalizing for girls to learn that it is common for body image to worsen between ages 10 and 16, and that many girls already struggle with body image by age 11. It may also be somewhat comforting to learn that body image tends to improve as girls enter adulthood. Given the powerful impact of expectations in shaping behaviour and experiences (termed the "pygmalion"

effect; Good et al., 2018), it would be important to rule out possible iatrogenic effects of such psychoeducation messages.

There may be specific sensitive periods of the lifespan during which body image changes more rapidly, and is more responsive to intervention (Arango et al., 2018). Although there is a lack of longitudinal research specifically examining sensitive periods in body image development, prior theoretical understandings have described adolescence, and specifically age 12 to 18, as such a period (Voelker et al., 2015; Wertheim & Paxton, 2011), given that it coincides with puberty and greater sensitivity of body image to experimental manipulations. We accordingly hypothesized in our meta-analysis that the greatest magnitude of change in mean-level body image would occur between the ages of 12 and 18. However, the results of the current set of studies indicated that if there is a primary sensitive period for body image development, it likely takes place earlier than previously believed (Voelker et al., 2015). Specifically, meta-analytic results suggested that on average, the largest magnitude of mean-level change occurs between ages 10 and 14. In the Minnesota Twin Family Study, girls with the highest body dissatisfaction, weight preoccupation, and global eating pathology already evidenced these elevations at baseline, when they were only 11 years old. Similarly, in the U.K. study, our subgroup of boys and girls with the lowest body esteem (14.8% of the total sample) tended to already show low body esteem by age 11. Thus, important developments in body image may take place earlier in childhood.

This finding has important implications for the prevention of eating disorders and body image disturbances. According to reviews, many interventions designed to target body image among children are delivered between ages 11 and 15 (Kurz et al., 2022). The average age of youth who receive universal eating disorders prevention programs is 13 years; selective

prevention (i.e., programs that are targeted to individuals who show elevated risk factors) tends to be delivered even later, when participants are 17.6 years old on average (Watson et al., 2016). The current results suggest that rather than waiting until later in adolescence to deliver selective prevention, it may be possible to identify subgroups of children with negative body image earlier on. Although the present research suggests that profound changes in body image may occur around age 10 to 12, or possibly even earlier, it is unclear whether delivering interventions earlier would have benefits: a review of the effectiveness of universal prevention programs delivered to children from 5 to 17 years old found no moderating effect of age on the effectiveness of such programs (Chua et al., 2020).

Meta-analytic findings did not support the hypothesis that the construct of valuation (i.e., the salience, centrality, and degree of investment in appearance or body; Cash, 1994) changes in meaningfully different ways, compared to other body image constructs. In fact, we did not find that any constructs moderated patterns of change in body image. Nonetheless, we cannot rule out the possibility that constructs change in meaningfully different ways. This analysis was limited by the availability of longitudinal research examining each construct, and by the extent to which the measures used to assess body image were reliable and valid measures of the underlying constructs they were designed to assess. Indeed, differences in the constructs assessed and measures used may be one of many possible explanations for the different trajectories we identified in our two primary studies– the MTFS examined the negatively valanced constructs of body dissatisfaction, weight preoccupation, compensatory behaviour, and binge eating, whereas the U.K. study examined the positively valanced construct of body esteem. It would be informative for future longitudinal studies to examine change over time in multiple body image constructs, to better understand the extent to which change in different body image constructs is

correlated within individuals. For example, it would be informative to assess, in a single longitudinal study, an evaluative construct such as body dissatisfaction, a construct related to investment or valuation, and a positive body image construct, such as body appreciation, to examine the extent to which these different body image constructs change in correlated versus independent ways. Such research may also support the construct validity of body image measures.

Both primary studies suggested that personality characteristics, specifically traits related to neuroticism and negative emotionality, differ between people who exhibit normative, versus pathological trajectories of body image and eating pathology development. Adolescents who struggled interpersonally were also more likely to develop negative body image and eating pathology: less sociable personality styles, greater feelings of alienation, and appearance-related teasing predicted membership in more pathological developmental trajectories. Neuroticism has been shown to give rise to a broader range of psychopathological trajectories and serious mental illnesses (Jeronimus et al., 2016). Similarly, in line with the Research Domain Criteria, dysfunction in social processing (i.e., 'Systems for Social Processes') has been identified as a transdiagnostic phenotype that increases the risk for mental health concerns including eating disorders (Caglar-Nazali et al., 2014), personality disorders, and substance use disorders (Hanegraaf et al., 2021). In etiological models of eating pathology development such as the Tripartite Influence Model (Thompson et al., 1999) and its extension, the Biopsychosocial Model (Rodgers et al., 2014), neuroticism and social functioning merit attention alongside sociocultural variables that specifically increase risk for eating pathology. Neuroticism and social functioning may also represent useful targets for transdiagnostic prevention programs.

The current work identified large gaps in knowledge. First, few longitudinal studies have investigated body image development past the age of 30. Among male and female samples of participants with mean ages of 38 to 54 at the midpoint of data collection intervals, estimates of mean-level change were negative, suggesting a worsening of body image. Available evidence suggested that towards middle-adulthood, valuation may increase in men while decreasing, as hypothesized, in women. No data were available for ages 30 to 38, and our results do not provide information about absolute levels of body image between ages 38 and 54, only the direction of change. In addition to replicating trajectories and clarifying normative changes in body image during later and earlier phases of the lifespan, it will be important for longitudinal research to better represent more diverse populations, including people who identify as transgender and other gender minorities, as well as people with a larger variety of ethnicities and nationalities.

Conclusions

The current work represents an effort to study the development of body image, a complex and multifaceted construct. Too often, body image development is described only in terms of mean-level change, without recognizing the considerable individual variation in developmental trajectories, or acknowledging that individual longitudinal studies may produce markedly different pictures of body image development. This dissertation examined over seven decades' worth of archival data, providing a more complete, complex, and nuanced picture of body image development. Adolescents who demonstrate pathological trajectories of EDP development may have a predisposition toward negative emotionality, as well as experiences of teasing and social alienation; personality and interpersonal factors thus merit increased attention in etiological models and prevention programming. Adolescence is marked by important gender differences in the direction and magnitude of mean-level body image change, as well as the proportion of girls

and boys who demonstrate normative versus pathological trajectories. Boys, on average, may show greater stability and more positive change, whereas girls may be more likely to show worsening body image and EDP, particularly in early adolescence. The normative improvements in body image exhibited in female samples between ages 16 and 24 give hope that negative body image will subside as many girls enter adulthood. Critically, among girls with the most pathological trajectories, negative body image may already be entrenched by age 11, suggesting it may be worth exploring earlier delivery of targeted prevention programming. Even with intervention and extensive societal and systemic changes, individual and gender-based differences will continue to play an important role in shaping adolescent body image development. Overall, the patterns of change identified in the current work bring a new perspective to theories of body image development and have widespread practical implications for prevention programming.

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Appendix A: Permissions

Wednesday, June 22, 2022 at 13:21:33 Atlantic Daylight Time

Subject: Re: Permission to include paper in dissertation
Date: Wednesday, June 22, 2022 at 12:52:59 PM Atlantic Daylight Time
From: Phillippa Diedrichs
To: Kirsty Garbett, Melissa Atkinson, Emilie Lacroix

[△EXTERNAL]

Hi Emilie,

Absolutely! Good luck with your defence. I'm sure you will be brilliant.

Phillippa

Phillippa Diedrichs, PhD
Professor of Psychology

Centre for Appearance Research
University of the West of England

[redacted]

My pronouns are she/her/hers

From: Kirsty Garbett [redacted]
Sent: Wednesday, June 22, 2022 3:31:21 PM
To: Melissa Atkinson [redacted]; Emilie Lacroix [redacted]; Phillippa Diedrichs [redacted]
Subject: Re: Permission to include paper in dissertation

Echo'ing Mel. This is terrific news and I give permission for this manuscript to be submitted as part of your thesis.

All the best,

Kirsty

[redacted]

From: Melissa Atkinson [redacted]
Sent: Wednesday, June 22, 2022 1:07 pm
To: Emilie Lacroix [redacted]; Kirsty Garbett [redacted]; Phillippa Diedrichs [redacted]
Subject: RE: Permission to include paper in dissertation

Hi Emilie,

That's great news – congrats on getting to this point!

I am more than happy to give permission for you to include the manuscript in your dissertation.

Best,
Melissa

Melissa Atkinson, PhD
Senior Lecturer (Psychology)
[redacted]University of Bath
[redacted]

From: Emilie Lacroix [redacted]
Sent: 21 June 2022 22:48
To: Melissa Atkinson [redacted]; Kirsty Garbett [redacted]; Phillippa Diedrichs [redacted]
Subject: Permission to include paper in dissertation

[redacted]

Hi Melissa, Kirsty, and Phillippa,

I hope this email finds you well!

If you recall, a manuscript you contributed to will form part of my dissertation, which I will be defending in July 2022. My dissertation is manuscript-style, where individual manuscripts will be included as chapters in the dissertation document. I am required by the University of Calgary Faculty of Graduate Studies to document that all co-authors have granted permission for the manuscripts to be included.

Please reply to this email to indicate whether you give permission for me to include the following manuscript in my doctoral dissertation:

Lacroix, E., Atkinson, M., Garbett, K. M., & Diedrichs, P. (2020). One size does not fit all: Trajectories of body esteem development and their predictors in early adolescence. *Development and Psychopathology*, 1-10. https://doi.org/10.1017/S0954579420000917

My dissertation will be added to the institutional repository at the University of Calgary and the Library and Archives Canada:

University of Calgary Theses Repository – The Vault http://theses.ucalgary.ca/
Library and Archives Canada http://collectionscanada.gc.ca/obj/s4/f2/frm-nl59-2-e.pdf

I would greatly appreciate if you can respond as soon as possible, or by July 3rd at the latest. Please don't hesitate to ask if you have any questions.

Thank you very much,

Emilie

Appendix B: Full Medline Search Strategy for Systematic Review and Meta-analysis

1. body image.mp.
2. body dissatisf*.mp.
3. body satisf*.mp.
4. body appreciat*.mp.
5. body esteem.mp.
6. shape concern*.mp.
7. weight concern*.mp.
8. musc* concern*.mp.
9. (overvaluation adj3 weight).mp.
10. (overvaluation adj3 shape).mp.
11. (drive adj3 muscularity).mp.
12. (drive adj3 thinness).mp.
13. weight dissatisf*.mp.
14. thin ideal.mp.
15. body ideal.mp.
16. exp Body Image/
17. longitudinal.mp.
18. develop*.mp.
19. prospective.mp.
20. exp Longitudinal Studies/
21. exp Prospective Studies/
22. cohort studies/ or longitudinal studies/

23. Aging/

24. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16

25. 17 or 18 or 19 or 20 or 21 or 22 or 23

26. 24 and 25

27. limit 26 to animals

28. limit 26 to (animals and humans)

29. 27 not 28

30. 26 not 29

Note. A truncation symbol (*) at the end of a word retrieves variations of the end of the word. For example, “dissatisf*” would retrieve publications including the words “dissatisfied” and “dissatisfaction.” MP stands for multi-purpose. In Ovid databases, .MP searches examine the following fields: Title, Original Title, Abstract, Subject Heading, Name of Substance, and Registry Word.

Appendix C: Supplementary Analysis: Mean-level Yearly Change in Body Image Using Different Test-retest Reliabilities to Estimate Variance of Effect Sizes

			r = .25			*r* = .50			*r* = .75		
Age range	*k*	N_{ES}	d_{year}	95% CI	*Q*	d_{year}	95% CI	*Q*	d_{year}	95% CI	*Q*
6-10	9	18	.008	[-.081, .097]	131.155*	.008	[-.081, .096]	190.357*	.007	[-.081, .096]	349.035*
10.1-12	23	48	-.047	[-.133, .039]	735.721*	-.041	[-.130, .047]	1061.782*	-.034	[-.125, .057]	1928.125*
12.1-14	57	168	-.057	[-.112, -.002]	1709.517*	-.053	[-.103, -.003]	2232.125*	-.052	[-.114, -.010]	4417.110*
14.1-16	61	158	-.022	[-.039, -.005]	973.474*	-.021	[-.039, -.004]	1445.432*	-.020	[-.039, -.002]	2811.004*
16.1-18	16	34	-.021	[-.063, -.020]	130.587*	-.024	[-.067, -.020]	194.322*	-.025	[-.070, -.020]	379.737*
18.1-20	31	111	.007	[-.020, .034]	530.903*	.009	[-.018, .036]	783.081*	.013	[-.016, .042]	1504.794*
20.1-22	11	37	.049	[-.033, .130]	256.403*	.052	[-.035, .139]	379.532*	.054	[-.036, .144]	730.566*
22.1-24	6	32	.061	[-.080, .203]	474.709*	.061	[-.080, .203]	546.665*	.062	[-.080, .203]	719.081*
24.1-30	8	43	-.003	[-.014, .009]	77.612*	-.003	[-.014, .009]	115.769*	-.003	[-.014, .009]	227.429*
38-54	4	13	-.028	[-.065, .009]	22.553*	-.026	[-.063, .010]	32.216*	-.026	[-.060, .009]	57.193*

Appendix D: Internal Consistency of Eating and Personality Measures

	Age 11 *n* = 760	Age 14 *n* = 710	Age 18 *n* = 675	Age 21 *n* = 705	Age 25 *n* = 683	Age 29 *n* = 607
Measure/Subscale	Cronbach's Alpha					
Minnesota Eating Behavior Survey						
Total Score	.86	.92	.90	.89	.87	.88
Body Dissatisfaction	.83	.80	.76	.75	.72	.72
Compensatory Behaviour	.38	.76	.71	.71	.75	.73
Binge Eating	.67	.83	.81	.83	.84	.83
Weight Preoccupation	.78	.90	.89	.89	.86	.87
Multidimensional Personality Questionnaire						
Achievement	.77	–	.87	–	–	–
Well-being	.70	.90	.91	–	–	–
Social potency	.68	–	.87	–	–	–
Social closeness	.55	–	.88	–	–	–
Alienation	.60	.88	.89	–	–	–
Aggression	.61	.88	.88	–	–	–
Stress reaction	.53	.89	.89	–	–	–
Traditionalism	.58	–	.77	–	–	–
Harm avoidance	.67	.85	.83	–	–	–
Control	.52	.86	.86	–	–	–
Trait anxiety (State-Trait Anxiety Measure for Children)	.83	–	–	–	–	–
Pubertal Development Scale	.73	.60	–	–	–	–

Note. Ages are approximate.

Appendix E: Temporal stability of Minnesota Eating Behavior Survey scores (Pearson's Product-Moment Correlation)

	Age 11 *n* = 705-710	Age 14 *n* = 686	Age 18 *n* = 637	Age 21 *n* = 685	Age 25 *n* = 662	Age 29 *n* = 671
			Total Score			
Age 11	--					
Age 14	.59***	--				
Age 18	.43***	.59***	--			
Age 21	.43***	.53***	.67***	--		
Age 25	.34***	.46***	.54***	.63***	--	
Age 29	.38***	.46***	.52***	.59***	.73***	--
			Body Dissatisfaction			
Age 11	--					
Age 14	.52***	--				
Age 18	.41***	.58***	--			
Age 21	.41***	.54***	.65***	--		
Age 25	.33***	.46***	.48***	.58***	--	
Age 29	.35***	.43***	.45***	.55***	.68***	--
			Compensatory Behaviour			
Age 11	--					
Age 14	.23***	--				
Age 18	.10*	.23***	--			
Age 21	.09*	.22***	.51***	--		
Age 25	.00	.21***	.27***	.37***	--	
Age 29	.15***	.27***	.22***	.36***	.54***	--
			Binge Eating			
Age 11	--					
Age 14	.31***	--				
Age 18	.20***	.41***	--			
Age 21	.17***	.34***	.50***	--		
Age 25	.12***	.24***	.36***	.50***	--	
Age 29	.14***	.24***	.36***	.48***	.58***	--
			Weight Preoccupation			
Age 11	--					
Age 14	.51***	--				
Age 18	.38***	.55***	--			
Age 21	.38***	.46***	.59***	--		
Age 25	.34***	.42***	.50***	.58***	--	
Age 29	.33***	.43***	.49***	.54***	.67***	--

Note. Ages are approximate. *** $p < .001$, * $p < .05$

Appendix F: Correlations Among Age 11 and Age 14 Personality Trait Scores

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Age 11																
1. Achievement	--															
2. Well-Being	.45**	--														
3. Social Potency	.33**	.32**	--													
4. Social Closeness	.16**	.43**	.32**	--												
5. Alienation	-.15**	-.40**	-.04	-.17**	--											
6. Aggression	-.15**	-.32**	.12**	-.24**	.38**	--										
7. Stress Reaction	-.13**	-.39**	-.10*	-.19**	.45**	.29**	--									
8. Traditionalism	.30**	.28**	-.05	.08*	-.16**	-.37**	-.10*	--								
9. Harm Avoidance	-.07	-.07	-.31**	-.06	.01	-.21**	.08	.26**	--							
10. Control	.41**	.15**	-.12**	.02	-.06	-.21**	-.05	.43**	.28**	--						
Age 14																
11. Well-Being	.13**	.23**	.08	.09*	-.16**	-.09*	-.16**	.09*	-.09*	.03	--					
12. Alienation	-0.06	-.16**	-.02	-.03	.15**	.09*	.14**	-.10*	.01	-.09*	-.49**	--				
13. Aggression	-.10*	-.17**	.01	-.09*	.11*	.16**	.04	-.28**	-.12**	-.20**	-.30**	.46**	--			
14. Stress Reaction	-.03	-.11**	.01	.01	.11**	.03	.19**	-.06	.07	-.03	-.45**	.66**	.38**	--		
15. Harm Avoidance	-.06	.00	-.07	.05	.05	-.01	.04	.09*	.28**	.15**	-.03	-.04	-.23**	.04	--	
16. Control	.18**	.11*	-.06	.01	-.07	-.15**	-.04	.22**	.24**	.34**	.25**	-.32**	-.47**	-.25**	.35**	--

Note. Ages are approximate. Age 11 personality scores were based on parent-report, whereas age 11 personality scores were based on self-report.

** $p < .01$; ** $p < .05$

Appendix G: Correlations Among Age 11 and Age 18 Personality Trait Scores

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Age 11																				
1. Achievement	--																			
2. Well-Being	.45**	--																		
3. Social Potency	.33**	.32**	--																	
4. Social Closeness	.16**	.43**	.32**	--																
5. Alienation	-.15**	-.40**	-.04	-.17**	--															
6. Aggression	-.15**	-.32**	.12**	-.24**	.38**	--														
7. Stress Reaction	-.13**	-.39**	-.10*	-.19**	.45**	.29**	--													
8. Traditionalism	.30**	.28**	-.05	.08*	-.16**	-.37**	-.10*	--												
9. Harm Avoidance	-.07	-.07	-.31**	-.06	.01	-.21**	.08	.26**	--											
10. Control	.41**	.15**	-.12**	.02	-.06	-.21**	-.05	.43**	.28**	--										
Age 18																				
11. Achievement	.30**	.15**	.12**	.02	-.04	.00	.01	.10*	.01	.15**	--									
12. Well-Being	.12**	.17**	.05	.01	-.13**	-.07	-.12**	.01	-.06	-.01	.42**	--								
13. Social Potency	.16**	.15**	.28**	.16**	-.09*	.02	-.11*	-.06	-.19**	-.04	.35**	.41**	--							
14. Social Closeness	-.01	.14**	.06	.10*	-.14**	-.07	-.12**	-.04	-.03	-.02	.09*	.57**	.34**	--						
15. Alienation	-.13**	-.10*	.01	.06	.12**	.07	.09*	-.07	-.02	-.09*	-.17**	-.48**	-.08*	-.39**	--					
16. Aggression	-.10*	-.07	.00	-.01	.01	.11**	.00	-.15**	-.08*	-.12**	-.23**	-.33**	.13**	-.28**	.50**	--				
17. Stress Reaction	-.04	-.09*	.01	.04	.09*	.04	.17**	.01	.03	.00	-.14**	-.55**	-.16**	-.43**	.62**	.37**	--			
18. Traditionalism	.04	.09*	.05	.07	-.01	.00	.01	.11*	.08*	.12**	.30**	.29**	.09*	.19**	-.18**	-.29**	-.16**	--		
19. Harm Avoidance	-.10*	-.02	-.02	.03	.03	-.04	.03	.10*	.27**	.09*	-.14**	-.07	-.19**	.09*	.00	-.16**	.06	.15**	--	
20. Control	.20**	.08	-.01	.01	-.03	-.08*	-.02	.18**	.24**	.32**	.37**	.10**	-.05	-.01	-.25**	-.31**	-.11**	.39**	.29**	--

Note. Ages are approximate. ** $p < .01$; ** $p < .05$. Personality scores were based on self-report.

Appendix H: Correlations Among Age 14 and Age 18 Personality Trait Scores

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Age 14																
1. Well-Being	--															
2. Alienation	-.49**	--														
3. Aggression	-.30**	.46**	--													
4. Stress Reaction	-.45**	.66**	.38**	--												
5. Harm Avoidance	-.03	-.04	-.23**	.04	--											
6. Control	.25**	-.32**	-.47**	-.25**	.35**	--										
Age 18																
7. Achievement	.32**	-.12**	-.22**	-.11*	-.06	.28**	--									
8. Well-Being	.56**	-.29**	-.23**	-.34**	-.07	.13**	.42**	--								
9. Social Potency	.28**	-.06	.02	-.06	-.17**	-.09*	.35**	.41**	--							
10. Social Closeness	.24**	-.20**	-.16**	-.23**	.01	-.01	.09*	.57**	.34**	--						
11. Alienation	-.25**	.51**	.34**	.44**	.02	-.22**	-.17**	-.48**	-.08*	-.39**	--					
12. Aggression	-.15**	.27**	.57**	.24**	-.11**	-.28**	-.23**	-.33**	.13**	-.28**	.50**	--				
13. Stress Reaction	-.26**	.36**	.20**	.63**	.07	-.13**	-.14**	-.55**	-.16**	-.43**	.62**	.37**	--			
14. Traditionalism	.22**	-.12**	-.21**	-.09*	.16**	.28**	.30**	.29**	.09*	.19**	-.18**	-.29**	-.16**	--		
15. Harm Avoidance	-.07	-.01	-.09*	.06	.61**	.17**	-.14**	-.07	-.19**	.09*	.00	-.16**	.06	.15**	--	
16. Control	.06	-.15**	-.21**	-.10*	.29**	.56**	.37**	.10**	-.05	-.01	-.25**	-.31**	-.11**	.39**	.29**	--

Note. Ages are approximate. ** $p < .01$; * $p < .05$. Personality scores were based on self-report.

Appendix I: Growth Parameters and Mean Levels of Personality Factors Across Eating Pathology Trajectories

	Total Score		Body Dissatisfaction		
	Class 1 Low Increasing (81.6%)	Class 2 High Decreasing (18.4%)	Class 1 Low Increasing (73.1%)	Class 2 Moderate (17.0%)	Class 3 High (9.5%)
Factor and Age	*M* (SE)	*M* (SE)	*M* (SE)	*M* (SE)	*M* (SE)
Positive Emotionality (11)	37.26 (0.22)	37.71 (0.45)	37.29 (0.23)	37.86 (0.47)	36.92 (0.59)
Negative Emotionality (11)	16.58 (0.17)	17.16 (0.38)	$16.58\ (0.18)_{c}$	16.58 (0.38)	$17.80\ (0.55)_{c}$
Constraint (11)	25.83 (0.18)	25.64 (0.38)	25.82 (0.19)	25.80 (0.40)	25.57 (0.50)
Positive Emotionality (18)	123.34 (0.64)	120.34 (1.33)	$123.52\ (0.67)_{c}$	$120.17\ (1.42)_{c}$	122.38 (1.81)
Negative Emotionality (18)	$83.56\ (0.61)_{a}$	$91.38\ (1.36)_{a}$	$83.85\ (0.64)_{b,c}$	$87.84\ (1.49)_{c}$	$89.58\ (1.78)_{b}$
Constraint (18)	139.34 (0.70)	138.23 (1.38)	139.56 (0.71)	137.36 (1.34)	138.95 (2.19)
	Binge Eating		Weight Preoccupation		
	Class 1 Low (87.9%)	Class 2 Increasing (12.1%)	Class 1 Low (65.0%)	Class 2 High Increasing (35.0%)	
	M (SE)	*M* (SE)	*M* (SE)	*M* (SE)	
Positive Emotionality (11)	37.38 (0.21)	31.17 (0.56)	37.37 (0.25)	37.30 (0.35)	
Negative Emotionality (11)	$16.56\ (0.17)_{c}$	$17.59\ (0.46)_{c}$	16.55 (0.20)	16.98 (0.27)	
Constraint (11)	25.74 (0.17)	26.09 (0.41)	25.62 (0.20)	26.10 (0.26)	
Positive Emotionality (18)	123.21 (0.61)	120.26 (1.72)	$123.72\ (0.70)_{c}$	$121.14\ (1.03)_{c}$	
Negative Emotionality (18)	$83.82\ (0.59)_{a}$	$93.85\ (1.53)_{a}$	$82.89\ (0.68)_{a}$	$89.28\ (0.98)_{a}$	
Constraint (18)	139.45 (0.64)	136.86 (1.86)	138.73 (0.78)	139.89 (0.97)	

Note. MEBS = Minnesota Eating Behavior Survey.

Means sharing a common subscript are significantly different between classes, as indicated by pairwise chi-squared comparison tests with significance levels of (a) $p < .001$; (b) $p < .01$; and (c) $p < .05$. $n = 735$.