



Published in final edited form as:

Dev Psychol. 2015 September ; 51(9): 1216–1225. doi:10.1037/dev0000027.

Patterns of Body Image Concerns and Disordered Weight- and Shape-Related Behaviors in Heterosexual and Sexual Minority Adolescent Males

Jerel P. Calzo^{1,2}, Katherine E. Masyn³, Heather L. Corliss⁴, Emily A. Scherer⁵, Alison E. Field^{1,2,6,7}, and S. Bryn Austin^{1,2,7,8}

¹Division of Adolescent and Young Adult Medicine, Boston Children's Hospital

²Department of Pediatrics, Harvard Medical School

³Harvard Graduate School of Education

⁴Graduate School of Public Health, San Diego State University

⁵Geisel School of Medicine, Dartmouth University

⁶Department of Epidemiology, Harvard School of Public Health

⁷The Channing Division of Network Medicine, Brigham and Women's Hospital and Harvard Medical School

⁸Department of Social and Behavioral Sciences, Harvard School of Public Health

Abstract

This study investigates body image concerns and disordered weight- and shape-related behaviors across adolescence and young adulthood in males and how patterns vary by sexual orientation. Participants were 5,388 males from the US national Growing Up Today Study. In 2001, 2003, and 2005 (spanning ages 15–20 years) participants reported sexual orientation, past-year desire for toned/defined muscles and concerns with weight and shape, and past-year binge eating, restrictive dieting, purging (vomiting or laxative use) and use of products to increase muscularity (e.g., creatine, steroids). Latent class analyses identified two patterns at ages 15–16 years and three patterns at 17–18 and 19–20 years: Healthy (all ages; low body image concerns and weight- and shape-related behaviors; 54%–74% of observations), Muscle-Concerned (ages 17–18 and 19–20; relatively high muscularity concern and product use; 18%–21% of observations), and Lean-Concerned (all ages; relatively high weight and shape concern, dieting, and binge eating; 19%–28% of observations). Latent transition analyses revealed that sexual minority males (i.e., mostly heterosexual, gay, and bisexual) were more likely than completely heterosexual males to be Lean-Concerned at ages 17–18 and 19–20 years and to transition to the Lean-Concerned class from the Healthy class. There were no sexual orientation differences in odds of being Muscle-Concerned. Both heterosexual and sexual minority males are at risk for presenting body image concerns and weight- and shape-related behaviors that may have deleterious health consequences. Results

suggest the need for screening for concerns and behaviors related to leanness and muscularity in early adolescence among all males, regardless of sexual orientation.

Keywords

Sexual Orientation; Body Image; Males; Adolescence; Muscularity; Eating Disorders

Research on body image and eating disorder risk among males is nascent relative to the research on females, possibly due to the lower prevalence of anorexia and bulimia nervosa among males (Darcy & Lin, 2012; Swanson, Crow, Le Grange, Swendsen, & Merikangas, 2011). Males in general report lower levels of body dissatisfaction (Calzo et al., 2012; Neumark-Sztainer, Paxton, Hannan, Haines, & Story, 2006) and engage in fewer disordered weight-related behaviors (e.g., binge eating, purging) than females (Field, Camargo, Taylor, Berkey, & Colditz, 1999; Swanson et al., 2011). However, greater recognition that male appearance ideals and body image concerns differ from females has led to increased interest in male eating disorder risk (Cafri & Thompson, 2004; Pope, Phillips, & Olivardia, 2000). Rather than striving for thinness, males may be more likely than females to be concerned with muscularity (Smolak & Murnen, 2008; Thompson & Cafri, 2007). Western masculine appearance ideals center on both muscularity (muscle size, tone, and definition) and low levels of body fat to emphasize leanness (Cafri & Thompson, 2004; Jones & Crawford, 2005; McCreary & Sasse, 2000; Muth & Cash, 1997; Pope et al., 2000). Consistent with these ideals, data from the United States, Canada, and Australia indicate that underweight and overweight/obese adolescent males are more likely than healthy weight males to be dissatisfied with their bodies (Austin, Haines, & Veugelers, 2009; Calzo et al., 2012; Kostanski, Fisher, & Gullone, 2004). Just as the drive for thinness may motivate individuals to adopt deleterious health behaviors, such as fasting and purging (Stice, 1998), the pursuit of muscularity and low body fat percentage may motivate risky health behaviors such as overeating and steroid use (Cafri et al., 2005; Eisenberg, Wall, & Neumark-Sztainer, 2012; Rodgers, Ganchou, Franko, & Chabrol, 2012; Smolak, Murnen, & Thompson, 2005).

Identifying developmental patterns of male body image concerns and associated behaviors can help generate models of eating disorder risk assessment, prevention, and treatment that are relevant to the experiences of boys and men. One area that has received considerable focus is the role that sexual orientation may play in modifying the development and expression of male body image concerns and behaviors. Sexual minority (i.e., gay, bisexual, mostly heterosexual) males are more likely than heterosexual males to be diagnosed with clinical eating disorders, to be dissatisfied with their bodies, to be concerned with weight and shape, and to engage in a range of disordered weight-related behaviors (Andersen, 1999; Austin et al., 2004; Blashill, 2010; Calzo, Corliss, Blood, Field, & Austin, 2013; Carlat, Camargo, & Herzog, 1997; Kaminski, Chapman, Haynes, & Own, 2005; Kane, 2010). Sexual orientation disparities in concerns and behaviors may emerge through multiple processes, including different appearance ideals in heterosexual and sexual minority social contexts (Bruce & Harper, 2011; Kane, 2010), or level of internalization and conformity to masculinity and femininity ideologies (Blashill, 2011; Blashill & Vander Wal, 2009). It is also possible that negative body image among sexual minority males is related to identity-

related stigma and that disordered weight- and shape-related behaviors are adopted and reinforced as methods of coping with stress (Bruce & Harper, 2011; Meyer, 2003).

As research on male eating disorder risk continues to grow, so too has recognition that body image concerns and disordered weight-related behaviors are not limited to sexual minority men. Recent studies utilizing United States national data from the Growing Up Today Study (GUTS) have found that heterosexual male adolescents are more likely than sexual minority male adolescents to attempt to gain weight (Calzo et al., 2013) and to be overweight or obese by young adulthood (Austin, Ziyadeh, et al., 2009). Attempts to gain weight increase three-fold across adolescence, with over 30% of adolescent males attempting to gain weight in the past year by the age of 16 years old (Calzo et al., 2013). Most concerning is that the majority of males reporting past year weight-gain attempts are healthy weight or overweight/obese, thus indicating that these attempts were medically unnecessary. Such weight gain attempts are likely connected to a desire to be more muscular (McCreary & Sasse, 2000). Results from the Eating and Activity in Teens Study (EAT 2010) -- an epidemiologic study of socioeconomically and racially/ethnically diverse youth across Minnesota -- found that 11.6% of boys often change their diet to increase muscle size or tone, 5.9% use anabolic steroids, and 10.5% use other muscle-building substances (e.g., creatine) (Eisenberg et al., 2012). The high prevalence of muscle-building product use is disturbing given their easy access, limited scientific evidence of effectiveness, and, in the case of steroids, wide range of negative psychological and physical health consequences (e.g., depressed mood, aggression, cardiovascular health risk) (Bell, Dorsch, McCreary, & Hovey, 2004; Cafri et al., 2005; McCreary, Hildebrandt, Heinberg, Boroughs, & Thompson, 2007; Pope et al., 2000). Furthermore, the US Food and Drug Administration (FDA) recognizes products marketed as muscle-building supplements as among the most dangerous categories of substances on the market (Cohen, Maller, DeSouza, & Neal-Kababick, 2014). Despite attempts by the FDA to regulate the safety of products marketed as muscle-building supplements, recent research has found that US markets continue to sell products that include unsafe amounts of pharmaceutical ingredients, or that are adulterated with dangerous or banned pharmaceutical ingredients not listed on packaging (Cohen et al., 2014).

Longitudinal research with heterosexual and sexual minority males can help to identify key leverage points for preventing negative body image, disordered weight and shape-related behaviors, and their harmful sequelae. Recent cross-sectional and longitudinal studies indicate that concerns with weight and shape and desire for bigger muscles may increase in males from middle to late adolescence (Calzo et al., 2013; Jones, Bain, & King, 2008; McCabe & Ricciardelli, 2004) and that the prevalence of steroids and other product use may increase with age (Johnston, O'Malley, Bachman, & Schulenberg, 2010). However, prospective research examining the joint development of body image concerns and disordered weight- and shape-related behaviors in both heterosexual and sexual minority males is lacking.

The goals of this study were (1) to examine the diverse ways in which body image concerns and behaviors are manifested in males from middle to late adolescence and (2) to examine how sexual orientation modifies risk for problematic patterns of concerns and behaviors

across adolescence. To characterize the nuances of development, advanced finite mixture modeling techniques (specifically latent class analysis [LCA] and an extension of LCA, latent transition analysis [LTA] (Collins & Lanza, 2010; Muthen & Muthen, 2000)) were applied to identify groupings of individuals with similar patterns of concerns and behaviors across time and the ways in which sexual orientation may modify shifts between patterns across time.

It was hypothesized that at least two patterns of body image concern and disordered weight-related behaviors would emerge. First, although males are generally less concerned with thinness than are females, it was expected that a small proportion of males would exhibit concerns with thinness and behaviors in pursuit of that ideal (restrictive dieting, purging). Most males who exhibited body image concerns were hypothesized to be concerned with muscularity and to engage in behaviors consistent with that ideal (i.e., use of products to gain weight and build muscle mass). The proportion of males in both the lean-concerned and muscle-concerned groups was hypothesized to increase with age. Furthermore, sexual minority males were expected to be more likely to exhibit body image concerns and disordered weight-related behaviors, particularly concerns and behaviors related to thinness and weight restriction.

Method

Participants and Procedure

The Growing Up Today Study (GUTS) began in 1996 and was designed to investigate the association of dietary intake and physical activity with weight change during adolescence. Participants were ages 9–14 years at baseline and were children of women in the Nurses' Health Study II. After receiving parental consent, children were invited to enroll in the GUTS cohort. Returning the baseline (1996) questionnaire was considered as assent to participate ($N = 7,843$ males, 94% White). Participants were sent questionnaires annually from 1996–2001 and every two years after 2001. The Brigham and Women's Hospital institutional review board approved this study.

Measures

Sexual orientation—Sexual orientation was assessed in 1999, 2001, 2003, and 2005 using an item adapted from the Minnesota Adolescent Health Survey (Remafedi, Resnick, Blum, & Harris, 1992). Participants selected a statement that best described their sexual feelings: (i) completely heterosexual (attracted to persons of the opposite sex); (ii) mostly heterosexual; (iii) bisexual (equally attracted to men and women); (iv) mostly homosexual; (v) completely homosexual (gay, attracted to persons of the same sex); (vi) not sure. Responses of “not sure” were coded as missing. Responses of “mostly homosexual,” “completely homosexual,” or “bisexual” were too few to analyze separately; therefore, these responses were recoded as “gay/bisexual.” In 2001, when participants were 14–21 years old, 68 (1.7%) self-identified as gay/bisexual, 168 (4.1%) as mostly heterosexual, and 3,659 (88.8%) as completely heterosexual. In 2005, when participants were 18–25 years old, 116 (3.0%) self-identified as gay or bisexual, 241 (6.2%) as mostly heterosexual, and 3,541 (90.4%) as completely heterosexual. However, due to small cell sizes in the sexual minority

categories within each year of age, minority sexual orientation was coded as 0 = “Completely heterosexual” and 1 = “Sexual minority” (i.e., mostly heterosexual, gay, and bisexual) for the longitudinal analysis.

Body mass index (BMI) and overweight/obese weight status—BMI (kg/m^2) was calculated at each wave using self-reported height and weight. Previous research on self-reported height and weight have found that although adolescents often under-report their weight, self-reported weight is generally accurate for ranking according to weight status categories (Goodman, Hinden, & Khandelwal, 2000). Participants were coded as overweight/obese BMI (i.e., BMI in 85th percentile for age and sex for participants younger than 18 years, and BMI ≥ 25 for participants ages 18 and older) using International Obesity Task Force standards (Cole, Bellizzi, Flegal, & Dietz, 2000).

Muscularity concern and concern with weight and shape—Items adapted from the McKnight Risk Factor Survey (MRFS) (Shisslak et al., 1999) measured concern with weight and shape. Participants indicated how often they experienced a particular concern in the past year on a 5-point scale (1 = “Never” to 5 = “Always”). The MRFS was developed for females. Since there are gender differences in ideal body physique, to make the questions suitable for use with males, a question on muscularity concern, which asked “In the past year, how often have you thought about wanting to have toned or defined muscles?” was added. Because reporting some desire for toned and defined muscles was normative in the sample, scores were dichotomized such that participants reporting “Never,” “A little,” or “Somewhat” concerned were scored as 0 (“Never to somewhat muscle concerned in the past year”) and participants reporting “A lot” to “Always” were scored as 1 (“Often muscle-concerned in the past year”).

Weight and shape concern was scored using three items with the initial stem “How often in the past year have you...”: (1) “thought about wanting to be thinner;” (2) “worried about having fat on your body;” and (3) “felt fat” (range of Cronbach α 's across waves = .80–.83). Because an affirmative response to any of these items was rare, responses to each item were first recoded such that scores < 2 were scored as 0 (“Never concerned”) and scores ≥ 2 were scored as 1 (“At least a little concerned in the past year”). The recoded values for each of the items were then summed, with summed scores dichotomized to form the indicator variable (scores of 0 were coded as 0, “Never concerned in the past year;” scores ≥ 1 were coded as 1, “at least somewhat concerned with weight and shape in the past year”).

Dieting—Past-year dieting behavior was assessed with the question, “During the past year, how often did you diet to lose weight or to keep from gaining weight?” The variable was dichotomized, such that scores of 0 (“Never”) were coded as 0 (“Never engaged in dieting in the past year”) and scores of 1 (“Less than once a month”) to 5 (“Every day”) were coded as 1 (“Engaged in dieting in the past year”).

Binge eating—Binge eating behavior is defined as overeating with a feeling of loss of control. Past-year binge eating behavior was thus assessed with two questions. Participants were first asked about overeating: “During the past year, how often have you eaten so much food in a short period of time that you would be embarrassed if others saw you?” If

participants engaged in overeating at least “A couple times” a year, they were then asked about loss of control: “Did you feel out of control, like you couldn’t stop eating even if you wanted to stop?” Participants were coded as 1 (“Engaged in binge eating in the past year”) if they indicated that they engaged in any overeating with loss of control in the past year, and 0 (“No binge eating in the past year”) if they did not overeat or if they engaged in overeating without loss of control.

Purging—Past-year purging behavior was assessed with two items assessing (1) whether participants made themselves throw up to lose weight or to keep from gaining weight and (2) whether participants took laxatives to lose weight or to keep from gaining weight. A response to either question of at least 1 (“Less than once a month”) was coded as 1 (“Purged in the past year”); participants who never engaged in either behavior were coded as 0.

Product use—Use of muscle-building products was assessed as an aggregate of responses to three items that measured past-year use of (1) creatine, (2) amino acids and/or DHEA, and (3) growth hormone and/or anabolic/injectable steroids. Indicating a score of at least 1 (“Less than monthly”) on any of the three items was coded as 1 (“Product use in the past year”); scores of 0 (“Never”) on all three of the items were coded as 0 (“No past-year product use”).

Analysis

In this present analysis we used data from the 2001, 2003, and 2005 waves of GUTS and restricted the analysis to male participants who provided at least one wave of data about their sexual orientation and one wave of data for each of the key muscularity, weight concern, and disordered weight-related behaviors variables. Baseline sexual orientation (1999) was not associated with being included in the analysis ($p = 0.07$), nor were number of waves of participation ($p = 0.08$), or missing data on body image concern and weight- and shape-related behaviors ($p = 0.07$). The sample included in the LCA consisted of 5,388 males (68.7% of the original male cohort). Approximately 77% of participants provided at least two of the three waves of data analyzed.

To examine developmental patterns with regards to year of age, rather than wave of assessment, the dataset was first converted from a person-level data file to a person-period data file whereby each participant contributed a person-period observation for the age they were at the time they completed each questionnaire in 2001, 2003, and 2005 (Singer & Willett, 2003). Observations were grouped into the following three age periods: 15–16 years old, 17–18 years old, and 19–20 years old. As in prior research, missing data on sexual orientation identity were accounted for using single imputation (last-observation carried forward; data from 1999 were carried forward to 2001) (Calzo et al., 2013). Missing data on latent variable indicators (body image concerns and disordered weight-related behaviors) were accounted for using full-information maximum likelihood using Mplus statistical software.

To identify groupings of individuals with similar body image concerns and disordered weight-related behaviors across adolescence, separate LCA models were estimated in Mplus using observations in the 15–16-year-old age period, 17–18-year-old age period, and 19–20-

year-old age period. Two- to five-latent class solutions were estimated during the class enumeration process to determine the optimal number of classes in each age period. LCA provides fit indices to evaluate the fit of different solutions to the data, including the log-likelihood (LL) value, the Bayesian Information Criterion (BIC), the model χ^2 goodness-of-fit test, the Lo-Mendell-Rubin likelihood ratio test (LMR-LRT), and the bootstrap likelihood ratio test (BLRT). BIC values can be used to calculate the Bayes Factor (BF) and correct model probability (cmP) values, which also facilitate comparisons of relative fit between models (Kass & Wasserman, 1995). Lower LL and BIC values, non-significant χ^2 goodness-of-fit test statistics, and significant LMR-LRT and BLRT values are indicative of better model fit (Henson, Reise, & Kim, 2007; Lo, Mendell, & Rubin, 2001; McLachlan & Peel, 2000). BF values >10 indicate strong evidence in support of one model vs. a successive model and cmP values closer to 1 indicate greater likelihood of correct model specification relative to all other models estimated (Kass & Wasserman, 1995). However, because previous research cautions against the use of goodness-of-fit indices alone to determine the appropriate number of subgroups (Marsh, Hau, & Grayson, 2005; Nylund, Asparouhov, & Muthen, 2007), the final number of classes identified at each age period was also guided by theoretical relevance, homogeneity and separation. Homogeneity refers to the property in which a particular item response characterizes individuals in a subgroup (e.g., high muscularity concern); separation is the property by which an item distinguishes individuals across at least one pair of subgroups (Collins & Lanza, 2010).

Although sexual orientation was expected to be associated with class membership, class enumeration was based on an unconditional model because any misspecification of the relationship between the predictor, the latent class variable, and the indicators of the latent class variable can lead to an over-extraction of classes; the unconditional model does not run this risk (Masyn, 2013). Before testing whether sexual orientation predicted class membership, modification indices were requested in Mplus to identify whether model fit would improve by freely estimating the direct associations between the single latent class variables indicators and the main predictor (sexual orientation) and the covariate (weight status), which would provide evidence of potential differential item functioning (DIF; i.e., heterosexuals and sexual minorities or participants with different weight statuses may differ in their probability of endorsing a latent class variable indicator within each class) (Masyn & Nylund-Gibson, 2012). We freely estimated associations between latent class variable indicators and sexual orientation and/or weight status if DIF was detected.

Because we had no explicit hypotheses regarding the number or expression of classes at each age point across adolescence, we did not conduct tests of longitudinal invariance for the classes at each age point in the study. After class enumeration, latent transition analysis (LTA) in Mplus was then utilized to examine patterns of transitioning between the identified classes across the three age periods. The LTA analysis included a moderation analysis to examine whether sexual orientation moderated transition probabilities between age periods. In the moderation model the effect of sexual orientation on class membership at each proceeding age period was allowed to vary across classes at the preceding age period. Although the moderation model differs from moderation tests in traditional regression frameworks, within a finite mixture modeling framework this moderation model yields a global Wald χ^2 difference test of significance to reject the null hypothesis that transition

probabilities are equivalent across sexual orientation subgroups. Upon detecting evidence of significant effect modification by sexual orientation, parameter estimates of the effect of sexual orientation on class membership were then used to calculate sexual orientation subgroup-specific transition probabilities to better visualize sexual orientation differences in movement between classes across adolescence.

Results

Class Enumeration and Tests of DIF at Each Age Period

Table 1 displays descriptive statistics for the indicators (body image concerns and disordered weight-related behaviors) and covariate (weight status) by the predictor (sexual orientation identity) for each of the three age periods. Table 2 displays the fit statistics for the two- to five-class latent class solutions for each of the three age periods. Fit statistics generally support the selection of the two-class solution at ages 15–16 years old and the three-class solution at ages 17–18 and 19–20 years old. Modification indices statistics indicated that potential DIF existed in the 15–16-year-old and 17–18-year-old age periods. The model fit at ages 15–16 years old significantly improved by allowing purging and dieting to vary across sexual orientation subgroups and muscle concern and dieting to vary across weight status. The model fit at ages 17–18 years old significantly improved by allowing purging to vary across sexual orientation and weight status subgroups.

The Figure displays the classes identified at each age period and the proportion of observations at each age period modally assigned to each class after taking into account DIF. There was little separation of the classes based on the purging indicator, but as reflected in Table 1 vomiting and laxative use were rare in the sample. As depicted in each of the charts in Figure 1, the largest of the classes at each age period was the Healthy class (low concerns and disordered weight-related behaviors relative to the other classes). At ages 15–16 years old, the second class to emerge was the Lean-Concerned class, which was characterized by moderate levels of muscularity concern and dieting, and high levels of concern with weight and shape. At ages 17–18 and 19–20 years, a third Muscle-Concerned class emerged, which was characterized by a high probability relative to the other two classes of reporting desire for toned and defined muscles and a higher probability of reporting use of products to increase size and muscle mass. In the 17–18-year-old and 19–20-year-old age periods, 20%–30% of Muscle-Concerned youth used products such as steroids, DHEA, and creatine in the past year. The smallest class at ages 17–18 and 19–20 years was Lean-Concerned and was characterized by high probability of reporting concern with weight and shape and dieting, as well as higher levels of binge-eating relative to the Healthy and Muscle-Concerned classes.

The high percentage of participants in the Muscle-Concerned group who reported use of products was alarming. To better understand the associations between desire for toned and defined muscles and product use in the sample, an ancillary analysis was performed using all participants and examining the association between modest increases in muscularity concern (i.e., a one-unit increase in desire for toned and defined muscles on a continuous scale) and odds of using products in the past year. Adjusting for age and weight status, results revealed that each unit increase in muscularity concern doubled the odds of any past-year product use (odds ratio [OR]= 2.26, 95% confidence interval [CI]= 2.05, 2.49, $p < 0.0001$).

Differences in Class Membership and Transitions by Sexual Orientation

Although there were no sexual orientation subgroup differences in the proportion of observations assigned to each class at ages 15–16 years, sexual minority males were significantly more likely to be Lean-Concerned at ages 17–18 years (OR= 3.35, 95% CI= 1.79, 4.91, $p < .0001$) and at ages 19–20 years (OR= 5.01, 95% CI= 3.49, 6.54, $p < .0001$) relative to heterosexuals. There were no sexual orientation differences in the likelihood of being in the Muscle-Concerned class at ages 17–18 years old or 19–20 years old.

The moderation model test indicated that sexual orientation moderated the transition probabilities from one class to another between the age periods (Wald Test p 's $< .0001$). Transition probabilities from one class to another between each age period were thus calculated for heterosexual and sexual minority participants separately. As displayed in Table 3, there were notable sexual orientation differences in the likelihood of transitioning to different classes at subsequent age periods depending on class of origin.

Males in the Lean-Concerned Class at ages 15–16 were more likely to transition to the Lean-Concerned class at ages 17–18 years, although the probability was greater among sexual minorities (89% chance). Whereas heterosexual males in the Lean-Concerned Class at ages 15–16 years had a 15% chance of transitioning to the Muscle-Concerned Class at ages 17–18 years, sexual minority males had 0% chance of making the same transition. Most males in the Lean-Concerned class at ages 17–18 years old were likely to remain Lean-Concerned at ages 19–20 years old (87% probability for heterosexuals and 94% probability for sexual minorities). However, in comparing the transition probabilities from the Muscle-Concerned class at ages 17–18 years old to other classes at 19–20 years old, heterosexual males generally became Healthy (34% chance) or remained Muscle-Concerned (59% chance). Sexual minority males had 6 times the probability of heterosexual males of transitioning from Muscle-Concerned to Lean-Concerned between ages 17–18 and 19–20 years old (38% chance). The results from the LTA indicate that although heterosexual and sexual minority male adolescents did not differ in their likelihood of being in the Muscle-Concerned class, heterosexual males who transitioned out of the Muscle-Concerned class were likely to move to the Healthy Class, whereas sexual minority males were likely to move to the Lean-Concerned class.

With regards to participants who were in the Healthy class at a previous age period, sexual minority males had consistently higher chances of transitioning to the Lean-Concerned class at subsequent age periods. After multiplying transition matrices to calculate 19–20-year-old class probabilities given class membership at ages 15–16 years old, sexual minorities who were in the Lean-Concerned class at ages 15–16 years old had nearly 30% greater probability of being Lean-Concerned at ages 19–20 years old and much lower probability of being in the Healthy Class at 19–20 years compared to heterosexual males. Sexual minorities who were in the Healthy Class at ages 15–16 had approximately 5 times the probability of heterosexual males of being Lean-Concerned at ages 19–20 years old.

Discussion

This study is the first of its kind to identify patterns of body image concerns and disordered weight- and shape-related behaviors in heterosexual and sexual minority males across adolescence. We detected three patterns of concerns and behaviors. Although participants were most likely to present the Healthy pattern across adolescence (low muscularity and weight and shape concerns, low engagement in disordered weight and shape-related behaviors), an estimated 18%–21% of males exhibited the Muscle-Concerned pattern (greater desire for toned and defined muscles and greater use of muscle-building products relative to the other patterns) and 19%–28% of males exhibited the Lean-Concerned pattern (greater concern with weight and shape, and greater binge eating and restrictive dieting behavior relative to the other patterns). Consistent with findings that body image concerns and disordered weight- and shape-related behaviors may increase with age, the proportion of males who were either Muscle- or Lean-Concerned increased with age. With regards to sexual orientation, early research has highlighted greater risk among sexual minority males compared to heterosexual males for anorexia and bulimia nervosa (Andersen, 1999; Carlat et al., 1997; Kane, 2010). We expected that sexual minority males would be more likely to express concerns with weight and shape and to engage in weight-restrictive behaviors. As hypothesized, gay, bisexual, and mostly heterosexual males were more likely to be Lean-Concerned and to transition to the Lean-Concerned pattern from the Healthy or Muscle-Concerned patterns across adolescence. However, sexual minority and heterosexual males were equally likely to be Muscle-Concerned, thus indicating that being heterosexual is not entirely protective against body image concerns and behaviors.

Previous research indicates that concerns with leanness and muscularity may create dual pathways to body dissatisfaction and eating disorder risk in males (Jones & Crawford, 2005). The results from the current study build upon previous work by detecting early evidence (as young as age 15 years) of patterns of concerns and behaviors consistent the leanness and muscularity pathways. In particular, males in the Lean-Concerned pattern at ages 15–16 were more likely to stay Lean-Concerned, or become Muscle-Concerned than males who displayed the Healthy pattern. The pattern of concerns males transitioned to was influenced by sexual orientation, such that sexual minority males were more likely to transition to the Lean-Concerned pattern than their heterosexual peers. The longitudinal, repeated measures design also revealed that muscle-building product use appears to become more common by age 17 with the emergence of the Muscle-Concerned group. The results help clarify the etiology and composition of eating disorder risk in heterosexual and sexual minority males, which may help direct efforts to time and tailor preventive interventions.

Whether eating disorder diagnostic criteria should be revised in order to better capture the body image concerns and associated behaviors more typical of males is a topic of ongoing debate (Darcy & Lin, 2012; Pope et al., 2000). The findings from this study indicate that although a small number of males fit a pattern consistent with anorexia and bulimia nervosa risk (concern with weight and shape, binge eating, and restrictive dieting), a notable number also exhibit a pattern consistent with concerns with muscularity and behaviors to increase size. Among the males who were often concerned with muscularity, 20% had used a product at least once in the past year to increase size or strength. Clinical eating disorder criteria

generally use stricter and more extreme thresholds for the duration and severity of concerns and behaviors than were used in this study. Importantly, however, sub-clinical presentations of body image concerns and disordered weight- and shape-related behaviors are both debilitating and increase risk for the development of future eating disorders or adverse physical and mental health conditions (e.g., depression, substance use, obesity) (Cafri et al., 2005; Neumark-Sztainer et al., 2006; Stice, Burton, & Shaw, 2004). An ancillary analysis of all participants in this study found that modest increases in muscularity concern were associated with greater risk of past-year product use. Additional research should verify the clinical significance of the Lean- and Muscle-Concerned patterns by examining associations with other comorbid risk behaviors.

There were several limitations to the study that future research should address. The participants were children of nurses and were predominantly White. It is possible that the results will not generalize to the experiences of adolescent and young adult males of different socioeconomic or racial/ethnic backgrounds. Although gay, bisexual, and mostly heterosexual males often differ from heterosexual males, and sometimes from each other, regarding body image and eating disorder risk behaviors (Austin et al., 2004; Calzo et al., 2013), sexual minority subgroups were aggregated in this study in order to achieve adequate power for longitudinal heterosexual vs. sexual minority comparisons. Larger sample sizes within each sexual orientation subgroup would have allowed us to tease apart potential heterogeneity in the development of body image concerns and behaviors among sexual minority subgroups. Because the variables analyzed were part of a larger epidemiologic study investigating a range of topics, it was not possible to assess each of the body image and disordered weight and shape-related behaviors in greater depth. In particular, concerns about muscularity encompass more than muscle tone and definition, and it is possible that better separation of the latent classes detected could be achieved by including measures of desire for bigger muscles or weight gain attempts (McCreary & Sasse, 2000; Tylka, Bergeron, & Schwartz, 2005)-- aspects of the muscularity ideal that were not captured in single item used to assess muscularity concerns in this study. Future studies should include items from scales that assess the nuances of muscularity concerns (e.g., Drive for Muscularity Scale, McCreary & Sasse, 2000) or of male body image overall (e.g., Male Body Attitudes Scale, Tylka et al., 2005) in greater depth. Despite these limitations, the study had several notable strengths, including the prospective assessment of diverse body image concerns and behaviors from ages 15–20 years, data from sexual minority males who were not recruited on the basis of sexual orientation or from clinical samples, and the use of advanced analytic techniques (i.e., latent transition analysis) to study developmental phenomena.

This study represents the largest longitudinal analysis of eating disorder symptom patterns in heterosexual and sexual minority males across adolescence. The findings from this study provide new avenues for research on male eating disorder risk and potential guidance for prevention. The presence of the Lean-Concerned pattern as early as age 15 years old suggest the need for research earlier in adolescence. The use of muscle-building products appears to increase after age 15. To assist prevention efforts, future research can examine the unique individual- and contextual-level factors that motivate product use at such early ages (e.g., messages received in the media or sports contexts). Sexual orientation may pattern the

manifestation of body image concerns and behaviors, with sexual minority males having greater risk for being Lean-Concerned. However, the findings regarding the Muscle-Concerned pattern indicate that being heterosexual does not necessarily afford males protection against presenting body image concerns and behaviors that may have health consequences. Contrary to popular perceptions that male eating disorder risk is limited to sexual minority males, both heterosexual and sexual minority adolescent males are at risk for body image concerns and behaviors.

Acknowledgements

The Growing Up Today Study (GUTS) was funded by National Institutes of Health (NIH) grants HD045763, HD057368, DK46834, HL03533, and MH087786. Dr. Calzo was supported by K01DA034753 from the National Institute on Drug Abuse (NIDA). Additional support came from the Leadership Education in Adolescent Health project, Maternal and Child Health Bureau (MCHB) HRSA grants 6T71-MC00009 (Corliss and Austin) and MC00001 (Austin). Dr. Corliss was also supported by K01DA023610. The content is solely the responsibility of the authors and does not necessarily represent the official views of NIH, NICHD, or NIDA. The authors would like to thank Nicholas Horton, Donna Spiegelman, and Najat Ziyadeh for their guidance on programming and analyses, the GUTS team of investigators and staff, and the thousands of young people across the country participating in GUTS.

References

- Andersen AE. Eating disorders in gay males. *Psychiatric Annals*. 1999; 29:206–212.
- Austin SB, Haines J, Veugelers PJ. Body satisfaction and body weight: gender differences and sociodemographic determinants. *BMC Public Health*. 2009; 9(1):313. [PubMed: 19712443]
- Austin SB, Ziyadeh N, Kahn JA, Camargo CA, Colditz GA, Field AE. Sexual Orientation, Weight Concerns, and Eating-Disordered Behaviors in Adolescent Girls and Boys. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2004; 43(9):1115–1123. [PubMed: 15322415]
- Austin SB, Ziyadeh NJ, Corliss HL, Haines J, Rockett HR, Wypij D, Field AE. Sexual Orientation Disparities in Weight Status in Adolescence: Findings From a Prospective Study. *Obesity*. 2009; 17(9):1776–1782. [PubMed: 19300430]
- Bell A, Dorsch KD, McCreary DR, Hovey R. A look at nutritional supplement use in adolescents. *J Adolesc Health*. 2004; 34(6):508–516. [PubMed: 15145408]
- Blashill AJ. Elements of male body image: Prediction of depression, eating pathology and social sensitivity among gay men. *Body Image*. 2010; 7(4):310–316. [PubMed: 20813600]
- Blashill AJ. Gender roles, eating pathology, and body dissatisfaction in men: A meta-analysis. *Body Image*. 2011; 8(1):1–11. [PubMed: 20952263]
- Blashill AJ, Vander Wal JS. Mediation of gender role conflict and eating pathology in gay men. *Psychology of Men & Masculinity*. 2009; 10(3):204–217.
- Bruce D, Harper GW. Operating without a safety net: gay male adolescents and emerging adults' experiences of marginalization and migration and implications for theory of syndemic production of health disparities. *Health Education & Behavior*. 2011; 38(4):367–378. [PubMed: 21398621]
- Cafri G, Thompson J, Ricciardelli L, McCabe M, Smolak L, Yesalis C. Pursuit of the muscular ideal: Physical and psychological consequences and putative risk factors. *Clinical Psychology Review*. 2005; 25(2):215–239. [PubMed: 15642647]
- Cafri G, Thompson JK. Measuring Male Body Image: A Review of the Current Methodology. *Psychology of Men & Masculinity*. 2004; 5(1):18–29.
- Calzo JP, Corliss HL, Blood EA, Field AE, Austin SB. Development of muscularity and weight concerns in heterosexual and sexual minority males. *Health Psychology*. 2013; 32(1):42–51. [PubMed: 23316852]
- Calzo JP, Sonnevile KR, Haines J, Blood EA, Field AE, Austin SB. The development of associations among body mass index, body dissatisfaction, and weight and shape concern in adolescent boys and girls. *J Adolesc Health*. 2012; 51(5):517–523. [PubMed: 23084175]

- Carlat DJ, Camargo CA, Herzog DB. Eating disorders in males: A report on 135 patients. *American Journal of Psychiatry*. 1997; 154:1127–1132. [PubMed: 9247400]
- Cohen PA, Maller G, DeSouza R, Neal-Kababick J. Presence of banned drugs in dietary supplements following FDA recalls. *JAMA*. 2014; 312(16):1691–1692. [PubMed: 25335153]
- Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *British Medical Journal*. 2000; 320:1240–1243. [PubMed: 10797032]
- Collins, L.; Lanza, S. *Latent Class and Latent Transition Analysis*. Hoboken, NJ: John Wiley & Sons; 2010.
- Darcy AM, Lin IH-J. Are We Asking the Right Questions? A Review of Assessment of Males With Eating Disorders. *Eating Disorders*. 2012; 20(5):416–426. [PubMed: 22985238]
- Eisenberg ME, Wall M, Neumark-Sztainer D. Muscle-enhancing Behaviors Among Adolescent Girls and Boys. *Pediatrics*. 2012; 130(6):1019–1026. [PubMed: 23166333]
- Field AE, Camargo CA, Taylor CB, Berkey CS, Colditz GA. Relation of Peer and Media Influences to the Development of Purging Behaviors Among Preadolescent and Adolescent Girls. *Archives of Pediatrics and Adolescent Medicine*. 1999; 153:1184–1189. [PubMed: 10555723]
- Goodman E, Hinden BR, Khandelwal S. Accuracy of teen and parental reports of obesity and body mass index. *Pediatrics*. 2000; 106(1):52–58. [PubMed: 10878149]
- Henson J, Reise S, Kim K. Detecting mixtures from structural model differences using latent variable mixture modeling: a comparison of relative model fit statistics. *Structural Equation Modeling: A Multidisciplinary Journal*. 2007; 14:202–226.
- Johnston, LD.; O'Malley, PM.; Bachman, JG.; Schulenberg, JE. *Monitoring the Future national survey results on drug use, 1975–2009: Volume 1, Secondary school students (NIH Publication No. 10–7584)*. Bethesda, MD: National Institute on Drug Abuse; 2010.
- Jones DC, Bain N, King S. Weight and muscularity concerns as longitudinal predictors of body image among early adolescent boys: A test of the dual pathways model. *Body Image*. 2008; 5(2):195–204. [PubMed: 18458006]
- Jones DC, Crawford JK. Adolescent boys and body image: Weight and muscularity concerns as dual pathways to body dissatisfaction. *Journal of Youth and Adolescence*. 2005; 34(6):629–636.
- Kaminski P, Chapman B, Haynes S, Own L. Body image, eating behaviors, and attitudes toward exercise among gay and straight men. *Eating Behaviors*. 2005; 6(3):179–187. [PubMed: 15854864]
- Kane GD. Revisiting gay men's body image issues: exposing the fault lines. *Review of General Psychology*. 2010; 14(4):311–317.
- Kass RE, Wasserman L. A reference Bayesian test for nested hypotheses and its relationship to the Schwarz criterion. *Journal of the American Statistical Association*. 1995; 90(434):928–934.
- Kostanski M, Fisher A, Gullone E. Current conceptualisation of body image dissatisfaction: have we got it wrong? *Journal of Child Psychology and Psychiatry*. 2004; 45(7):1317–1325. [PubMed: 15335351]
- Lo Y, Mendell N, Rubin DB. Testing the number of components in a normal mixture. *Biometrika*. 2001; 88:767–778.
- Marsh, H.; Hau, K.; Grayson, D. Goodness of fit evaluation in structural equation modeling. In: Maydeu-Olivares; McArdle, J., editors. *Contemporary Psychometrics*. Mahway, NJ: Lawrence Erlbaum Associates, Inc; 2005.
- Masyn, KE. Latent class analysis and finite mixture modeling. In: Little, TD., editor. *The Oxford Handbook of Quantitative Methods in Psychology*. Vol. 2. New York, NY: Oxford University Press; 2013. p. 551–611.
- Masyn, KE.; Nylund-Gibson, KL. The impact of differential item functioning on finite mixture models; Paper presented at the Society for Research in Child Development: Developmental Methodology Conference; Tampa, FL. 2012.
- McCabe M, Ricciardelli L. Body image dissatisfaction among males across the lifespan: a review of past literature. *Journal of Psychosomatic Research*. 2004; 56:675–685. [PubMed: 15193964]

- McCreary DR, Hildebrandt TB, Heinberg LJ, Boroughs M, Thompson JK. A Review of Body Image Influences on Men's Fitness Goals and Supplement Use. *American Journal of Men's Health*. 2007; 1(4):307–316.
- McCreary DR, Sasse DK. An exploration of the drive for muscularity in adolescent boys and girls. *Journal of American College Health*. 2000; 48:297–304. [PubMed: 10863873]
- McLachlan, G.; Peel, D. *Finite Mixture Models*. New York: Wiley; 2000.
- Meyer IH. Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: conceptual issues and research evidence. *Psychol Bull*. 2003; 129(5):674–697. [PubMed: 12956539]
- Muth JL, Cash TF. Body image attitudes: what difference does gender make? *Journal of Applied Social Psychology*. 1997; 27:1438–1452.
- Muthen B, Muthen LK. Integrating Person-Centered and Variable-Centered Analyses: Growth Mixture Modeling With Latent Trajectory Classes. *ALCOHOLISM: CLINICAL AND EXPERIMENTAL RESEARCH*. 2000; 24(6):882–891.
- Neumark-Sztainer D, Paxton S, Hannan P, Haines J, Story M. Does Body Satisfaction Matter? Five-year Longitudinal Associations between Body Satisfaction and Health Behaviors in Adolescent Females and Males. *Journal of Adolescent Health*. 2006; 39(2):244–251. [PubMed: 16857537]
- Nylund K, Asparouhov T, Muthen B. Deciding on the number of classes in latent class analysis and growth mixture modeling: a Monte Carlo simulation study. *Structural Equation Modeling: A Multidisciplinary Journal*. 2007; 14:535–569.
- Pope, H.; Phillips, KA.; Olivardia, R. *The Adonis Complex: The Secret Crisis of Male Body Obsession*. New York: Free; 2000.
- Remafedi G, Resnick M, Blum R, Harris L. Demography of sexual orientation in adolescents. *Pediatrics*. 1992; 89:714–721. [PubMed: 1557267]
- Rodgers RF, Ganchou C, Franko DL, Chabrol H. Drive for muscularity and disordered eating among French adolescent boys: a sociocultural model. *Body Image*. 2012; 9(3):318–323. [PubMed: 22494958]
- Shisslak CM, Renger R, Sharpe T, Crago M, McKnight KM, Gray N, Taylor CB. Development and evaluation of the McKnight Risk Factor Survey for assessing potential risk and protective factors for disordered eating in preadolescent and adolescent girls. *International Journal of Eating Disorders*. 1999; 25:195–214. [PubMed: 10065397]
- Singer, JD.; Willett, JB. *Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence*. New York, NY: Oxford University Press; 2003.
- Smolak L, Murnen SK. Drive for leanness: assessment and relationship to gender, gender role and objectification. *Body Image*. 2008; 5(3):251–260. [PubMed: 18585105]
- Smolak L, Murnen SK, Thompson JK. Sociocultural Influences and Muscle Building in Adolescent Boys. *Psychology of Men & Masculinity*. 2005; 6(4):227–239.
- Stice E. Modeling of eating pathology and social reinforcement of the thin-ideal predict onset of bulimic symptoms. *Behaviour Research and Therapy*. 1998; 36(10):931–944. [PubMed: 9714944]
- Stice E, Burton EM, Shaw H. Prospective relations between bulimic pathology, depression, and substance abuse: unpacking comorbidity in adolescent girls. *J Consult Clin Psychol*. 2004; 72:62–71. [PubMed: 14756615]
- Swanson SA, Crow SJ, Le Grange D, Swendsen J, Merikangas KR. Prevalence and Correlates of Eating Disorders in Adolescents: Results From the National Comorbidity Survey Replication Adolescent Supplement. *Archives of General Psychiatry*. 2011; 68(7):714–723. [PubMed: 21383252]
- Thompson, JK.; Cafri, G. *The Muscular Ideal: Psychological, Social, and Medical Perspectives*. Washington, DC: American Psychological Association; 2007.
- Tylka TL, Bergeron D, Schwartz JP. Development and psychometric evaluation of the Male Body Attitudes Scale (MBAS). *Body Image*. 2005; 2(2):161–175. doi: <http://dx.doi.org/10.1016/j.bodyim.2005.03.001>. [PubMed: 18089184]

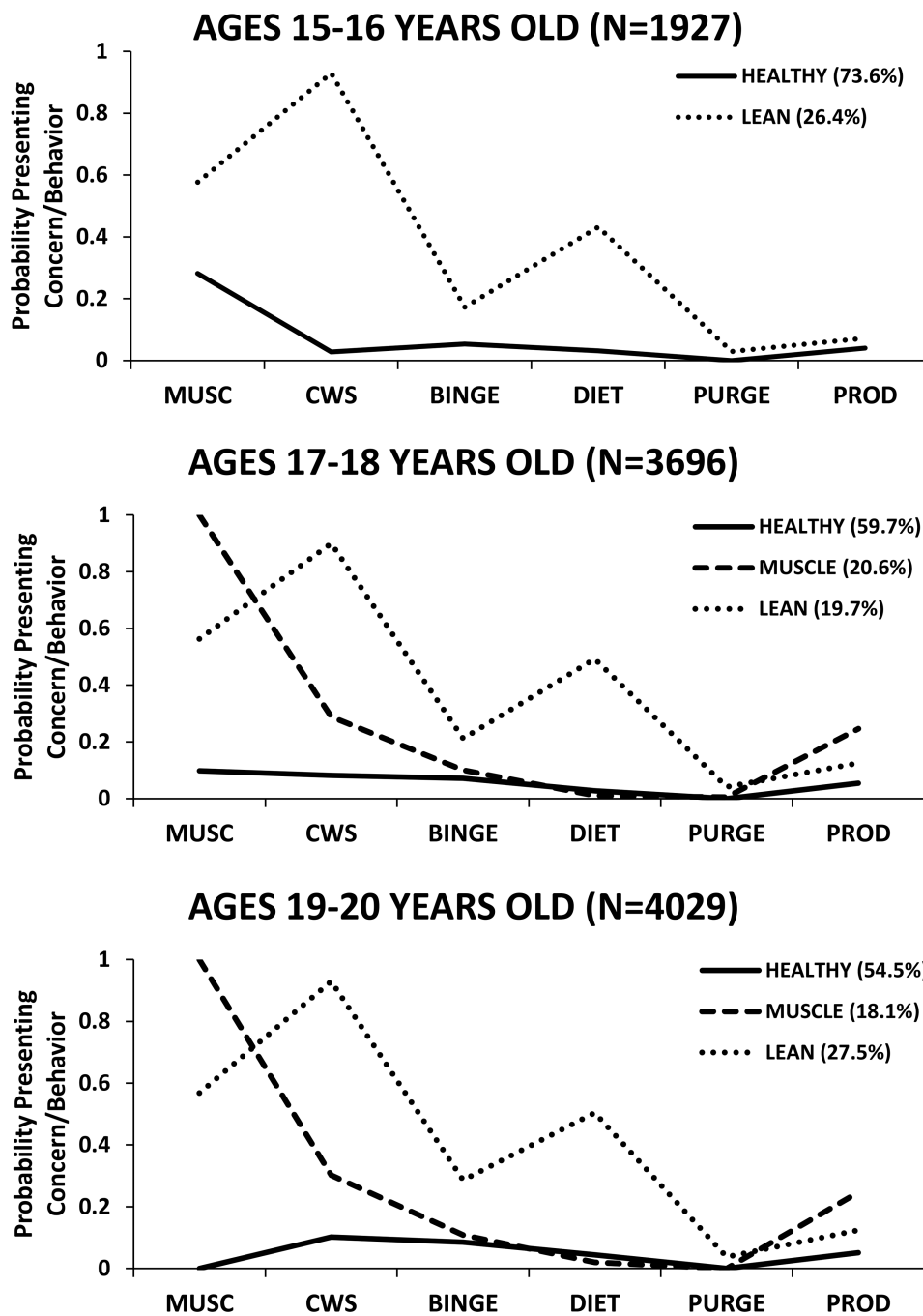


Figure 1. Class-specific item probability profile plots for the latent classes at each age period in the latent transition analysis of adolescent males in the Growing Up Today Study. Indicators: MUSC= desire for toned/defined muscles; CWS= concern with weight and shape; BINGE= binge eating; DIET= restrictive dieting; PURGE= vomiting and laxative use; PROD= use of products to increase size/muscle mass. Classes: HEALTHY= Healthy Class; MUSCLE= Muscle-Concerned Class; LEAN= Lean-Concerned Class.

Table 1
 Weight Status, Body Image Concerns, and Disordered Weight- and Shape- Behaviors in Adolescent Males by Sexual Orientation in the Growing Up Today Study

Covariate	Observations at Ages 15–16 Years		Observations at Ages 17–18 Years		Observations at Ages 19–20 Years	
	Old n = 1927 % (n)	Sexual Minority n = 95	Old n = 3696 % (n)	Sexual Minority n = 247	Old n = 4029 % (n)	Sexual Minority n = 315
Overweight/Obese	23.4% (420)	32.6% (31)	24.3% (832)	27.1% (67)	33.1% (1226)	23.5% (74)
Latent Variable Indicators						
Desired Toned/Defined Muscles	31.8% (572)	40.0% (38)	29.1% (996)	37.3% (92)	29.5% (1092)	41.6% (131)
Concerned with Weight & Shape	22.9% (412)	36.8% (35)	23.2% (794)	39.3% (97)	29.6% (1094)	45.7% (144)
Binge Eating	8.1% (146)	13.7% (13)	9.6% (330)	22.7% (56)	13.1% (486)	27.6% (87)
Dieting	10.4% (187)	17.9% (17)	9.7% (331)	15.4% (38)	13.0% (479)	22.5% (71)
Purging	0.5% (9)	4.2% (4)	0.5% (17)	5.7% (14)	0.6% (23)	3.5% (11)
Product Use	4.3% (77)	5.3% (5)	8.5% (293)	4.9% (12)	9.3% (343)	7.3% (23)

Note: Sexual minority is defined as identifying as gay, bisexual, or mostly heterosexual. Number of observations varies due to missing data at waves of assessment.

Table 2

Class Enumeration Fit Statistics (Chosen solution in bold)

Classes	Free parameters	LL	BIC	χ^2 Goodness-of-Fit Test (df)	$\chi^2 p$	Bayes Factor	cmP	LMR-LRT <i>p</i>
<u>Ages 15–16</u>								
1	6	-3710.75	7433.88	270.21 (55)	0.00	<1	0.000	--
2	13	-3471.20	7040.72	87.53 (50)	0.00	>10	1.000	0.00
3	20	-3451.84	7054.95	51.34 (43)	0.15	>10	0.001	0.00
4	27	-3439.03	7082.28	31.66 (36)	0.68	>10	0.000	0.32
5	34	-3432.33	7121.81	19.09 (29)	0.92	--	0.000	0.04
<u>Ages 17–18</u>								
1	6	-7389.13	14845.54	365.63 (55)	0.00	<1	0.000	--
2	13	-6993.06	14092.90	182.16 (50)	0.00	<1	0.000	0.00
3	20	-6931.79	14027.85	74.41 (43)	0.00	>10	1.000	0.00
4	27	-6914.40	14050.58	43.76 (36)	0.18	>10	0.000	0.05
5	34	-6902.86	14084.99	23.36 (29)	0.76	--	0.000	0.21
<u>Ages 19–20</u>								
1	6	-8914.59	17878.97	339.63 (55)	0.00	<1	0.000	--
2	13	-8376.22	16860.34	241.26 (50)	0.00	<1	0.000	0.00
3	20	-8274.55	16715.10	57.15 (43)	0.07	>10	1.000	0.00
4	27	-8260.00	16744.10	30.73 (36)	0.72	>10	0.000	0.86
5	34	-8250.69	16783.59	13.80 (29)	0.99	--	0.000	0.00

Note: LL= Log-Likelihood, BIC= Bayesian Information Criterion, cmP= Correct Model Probability, LMR-LRT= Lo-Mendell-Rubin Likelihood Ratio Test
 Bootstrap likelihood ratio test is not reported because values were never non-significant.

