Gender Conformity and Use of Laxatives and Muscle-Building Products in Adolescents and Young Adults

Jerel P. Calzo, PhD, MPH,^{a,b} Kendrin R. Sonneville, ScD,^{a,b,c} Emily A. Scherer, PhD,^d Benita Jackson, PhD, MPH,^e S. Bryn Austin, ScD^{a,b,f,g}

abstract

BACKGROUND: Use of laxatives for weight loss and drugs or supplements to build muscle (eg, steroids) differs by gender and sexual orientation; little is known about factors contributing to these disparities. Conformity to gender norms concerning appearance could underlie these differences.

METHODS: This study examined associations between childhood gender conformity and laxative and muscle-building product use from ages 13 to 25 years in a sample of 13 683 males and females in the US prospective Growing Up Today Study. Adjusted multivariable logistic regression models of repeated measures estimated odds of past-year laxative and muscle-building product use by quartiles of greater childhood gender conformity in heterosexual and sexual minority (eg, bisexual, gay) participants.

RESULTS: By age 23 years, ~20% of sexual minority females reported past-year laxative use. By age 19 years, 12% of all males reported past-year muscle-building product use. Sexual minority females had twice the odds of heterosexual females of using laxatives ($P < .0001$). The most gender-conforming females had 50% greater odds than the least-conforming females of using laxatives ($P < .01$). Moderate (odds ratio, 2.09; 95% confidence interval, 1.58–2.75) and highly (odds ratio, 1.79; 95% confidence interval, 1.38–2.33) gender-conforming males had higher odds than gender-nonconforming males of using muscle-building products.

CONCLUSIONS: Sexual minority females are at high risk for laxative abuse. Regardless of sexual orientation, gender conformity increased the odds of laxative abuse among females and muscle-building product use among males. Findings can inform prevention efforts to target youth at risk for laxative or muscle-building product use.

^aDivision of Adolescent/Young Adult Medicine, Boston Children's Hospital, Boston, Massachusetts; ^bDepartment of Pediatrics, Harvard Medical School, Boston, Massachusetts; ^cDepartment of Nutritional Sciences, University of Michigan School of Public Health, Ann Arbor, Michigan; ^dDepartment of Data Science, Geisel School of Medicine, Dartmouth University, Hanover, New Hampshire; ^eDepartment of Psychology, Smith College, Northampton, Massachusetts; ^fDepartment of Social and Behavioral Sciences, Harvard T.H. Chan School of Public Health, Boston, Massachusetts; and ^gChanning Division of Network Medicine, The Brigham and Women's Hospital and Harvard Medical School, Boston, Massachusetts

Dr Calzo conceptualized and designed the study, carried out analyses, drafted the initial manuscript, and revised the manuscript; Dr Sonneville assisted in the conceptualization and design of the study, reviewed results, and critically reviewed the manuscript; Dr Scherer supervised analyses, reviewed results, and critically reviewed the manuscript; Dr Jackson assisted in the conceptualization of the study, reviewed results, and critically reviewed the

WHAT'S KNOWN ON THIS SUBJECT: Use of laxatives for weight loss or products to build muscle (eg, creatine, steroids) differs by gender and sexual orientation (ie, heterosexual versus sexual minority [eg, bisexual, lesbian, or gay]); little is known about factors contributing to these disparities.

WHAT THIS STUDY ADDS: By young adulthood, 1 in 5 sexual minority women used laxatives for weight control. Regardless of sexual orientation, increased gender conformity in childhood predicted greater risk for laxative abuse among females and muscle-building product use among males by young adulthood.

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Abuse of laxatives and use of muscle-building products are public health concerns. Laxatives are medically recommended for constipation only, so use for any other purpose, including weight loss, may constitute abuse.^{1,2} Despite their availability over the counter, laxatives are dangerous substances when abused and can lead to dehydration, dependence, and organ damage.² Muscle-building products include anabolic steroids, over-the-counter products such as creatine, and numerous dietary supplements that are marketed for increasing muscle growth, strength, recovery, and endurance.³ Although muscle-building products are easily acquired via online markets and through grocery, health, and nutrition stores, they are often identified by the Food and Drug Administration as being dangerous because of their underregulation and potential inclusion of dangerous or untested ingredients.^{4,5} Documentation of the dangers of muscle-building products has generally focused on the health consequences of steroids, but recent data indicate that products such as creatine are also associated with dependence, negative mood, cardiovascular health risks, acne, gynecomastia, testicular atrophy, and testicular cancer.^{3,6} Frequent contamination of muscle-building products with banned pharmaceutical ingredients may explain these associations.^{4,5} Identifying early patterns of laxative and muscle-building product use, populations vulnerable to their use, and risk mechanisms is essential to inform screening and prevention efforts.

Comparing female and male participants in epidemiologic surveys indicates disparities in laxative and muscle-building product use. Approximately 4% of the US general population reports having used laxatives for weight loss in their lifetime,⁷ with adolescent and young

adult women being particularly vulnerable, possibly because of the prevalent developmental increase in thinness concerns.⁸ Epidemiologic data on muscle-building product use are sparse, with much of the surveillance focused on steroid use. General population data from studies such as the national Youth Risk Behavior Surveillance Survey and Monitoring the Future survey, and Minnesota's Project EAT find that 1% to 6% of adolescent males report using steroids in their lifetime.^{9,10} Project EAT data indicate that 10.5% of adolescent males and 5.5% of females report using other muscle-building products (eg, creatine, hydroxymethylbutyrate, dehydroepiandrosterone, or growth hormone).¹¹

Beyond gender differences in laxative and muscle-building product use, emerging epidemiologic data indicate disparities by sexual orientation identity (ie, heterosexual vs sexual minority [gay, lesbian, bisexual, mostly heterosexual]).^{11–14} Sexual minority females, particularly those who identify as bisexual or mostly heterosexual, report higher levels of laxative use than their heterosexual peers,^{14,15} a finding that runs counter to the popular misperception that sexual minority females are at lower risk for body dissatisfaction and eating disorders. Less is known about muscle-building product use among heterosexual and sexual minority females. Among males, sexual orientation differences in muscle-building product use are less consistent. Sexual minority adolescent males are more prone to engage in behaviors related to weight restriction, such as purging, and expressing concerns regarding leanness,^{12,13,16} yet they also may be more likely to try steroids than their heterosexual peers.⁹

Little research has examined the mechanisms contributing to gender and sexual orientation disparities in laxative abuse and muscle-building

product use. Although disparities have been noted by gender and sexual orientation, it is possible that these exposures are proxies for processes related to gender expression. For example, as a group, males are more likely than females to conform to traditional masculinity norms,¹⁷ and sexual minorities are generally more gender nonconforming than their heterosexual peers.^{18,19} Health behaviors, especially those related to appearance, may be a way of embodying or establishing adherence to gender norms.^{17,20,21} Because appearance ideals for girls and women center on thinness, whereas appearance ideals for boys and men focus on muscularity, the likelihood of using products to modify weight, shape, or appearance may be associated with overall gender differences in conformity to femininity and masculinity norms.^{22–24} Laxative use to maintain or lose weight, particularly among girls and women, may be connected to greater conformity to appearance norms associated with femininity, and muscle-building product use, particularly among boys and men, may be connected to greater conformity to appearance norms associated with masculinity.

How associations between gender conformity and product use interact with sexual orientation warrants additional examination. It may be that the greater engagement in weight restriction behaviors noted among sexual minority males relative to heterosexual males¹⁴ is tied to greater gender nonconformity (ie, greater conformity to femininity norms rather than masculinity norms) among sexual minority males.²³ Alternatively, sexual minority females are generally more gender nonconforming than heterosexual females,²⁵ yet sexual minority females have also been found to be more vulnerable to laxative use for weight loss.^{14,15}

Examining the unique and interactive effects of gender conformity and sexual orientation can help clarify previous findings.

The current study examined the associations between childhood gender conformity and laxative use and muscle-building product use, across adolescence and young adulthood, among heterosexual and sexual minority males and females. First, consistent with previous literature, we expected differences by gender and age.^{26–29} We expected that females overall would be more likely than males to use laxatives for weight loss, that males would be more likely to use products to try to achieve greater size, shape, and appearance of muscularity (ie, creatine, steroids), and that laxative and muscle-building product use would increase with age in the adolescent and young adult period. Second, we examined the effects of sexual orientation, expecting greater laxative use among sexual minority males and females relative to heterosexual males and females (as has been established in the literature)^{14,15} and exploring within-gender sexual orientation differences in use of muscle-building products. Third, we examined the effect of gender conformity, hypothesizing that females who were more gender conforming in childhood would be most likely to use laxatives and that males who were more gender conforming in childhood would be most likely to use muscle-building products. Finally, we explored whether the associations between childhood gender conformity and laxative use in females, and muscle-building product use in males, would be of different magnitude among heterosexuals compared with sexual minorities.

METHODS

Participants and Procedure

Participants from the Growing Up Today Study (GUTS) are children

of women in the Nurses' Health Study II and were 9 to 14 years old at baseline in 1996. After parental consent, children were invited to enroll in GUTS, with return of the baseline questionnaire considered as assent ($n_{\text{Males}} = 7842$, $n_{\text{Females}} = 9033$). Approximately 94% of GUTS participants self-identified as white. Participants completed questionnaires annually from 1996 to 2001 and biennially after 2001. The Brigham and Women's Hospital institutional review board approved this study. Data for the current study were from the 1999 to 2007 questionnaires, spanning ages 13 to 25 years.

Measures

Sexual Orientation

Repeated measures of participants' sexual orientation were assessed via self-report on each GUTS questionnaire between 1999 and 2007 through a single item that assesses identity and attractions.³⁰ Because of limited power to detect sexual minority orientation subgroup differences in product use, participants who endorsed the responses "mostly heterosexual," "bisexual (equally attracted to men and women)," "mostly homosexual," and "completely homosexual (gay/lesbian), attracted to persons of the same sex" were coded as sexual minorities. Participants who responded "completely heterosexual (attracted to persons of the opposite sex)" were coded as the referent.

Childhood Gender Conformity

Gender conformity in childhood was assessed in 2005 and 2007 on a 4-item scale that retrospectively assessed gender expression (eg, imitation of characters on TV or movies; toy and game preferences) up to age 11 (eg, "When I was a child, my favorite toys and games were . . ."; response options ranged from 1 = always "masculine" to 5 = always "feminine," with response options

scored accordingly within gender such that higher scores indicate greater gender conformity). Within gender, means for the 4 items were calculated and converted to quartiles in SAS PROC RANK (SAS Institute, Inc, Cary, NC), ranging from least gender conforming (referent) to most gender conforming in childhood. The 2005 assessment was used in analyses because it is more proximal to childhood. When available, the 2007 response was used if the 2005 assessment was missing.

Laxatives

At every wave from 1999 to 2007 participants indicated the frequency with which they had used laxatives in the past year to lose or keep from gaining weight (response options ranged from 0 = never to 5 = every day). Based on the distribution of use in the sample, past year laxative use was coded as 0 = never use or 1 = any past year use.

Muscle-Building Product Use

At every wave from 1999 to 2007 participants indicated the frequency of past-year use of creatine; anabolic steroids; and dehydroepiandrosterone, hydroxymethylbutyrate, growth hormone, or amino acids (response options ranged from 0 = never to 4 = daily). Based on the distribution of use of these different products, responses to the individual items were summed into a single aggregate use variable and coded as 0 = never use or 1 = any past year use of any muscle-building product.

Weight Status

The covariate weight status was calculated at each wave from 1999 to 2007 based on BMI, which was derived from self-reported height and weight. BMIs for observations before age 18 years were coded as underweight, overweight, or obese according to International Obesity Task Force cutoffs.³¹ BMIs for observations at ages ≥ 18 years were

coded as underweight if BMI was <18.5, overweight if BMI was ≥ 25 and <30, and obese if BMI was ≥ 30 .

Asthma

To account for use of steroids to manage asthma, analyses of muscle-building product use adjusted for baseline asthma status. Participants reported their asthma status in 1999 by responding to the question “Has a doctor ever said you have asthma?” with responses of No or I don’t know = 0 (referent) and Yes = 1.

Analysis

Data were analyzed with generalized estimating equations (GEEs)^{32,33} to account for repeated measures within individuals in GUTS and the clustering of siblings in the data set. Participants were included in the analysis if they provided ≥ 1 report of sexual orientation, laxative use, and muscle-building product use between the 1999 to 2007 questionnaire cycles and reported childhood gender expression in either 2005 or 2007. Because of the repeated-measures design, sexual orientation, laxative use, and muscle-building product use were modeled as time-varying variables. For example, if a participant indicated sexual minority identity in 1 survey and also provided data on laxative or muscle-building product use, that observation would be included in the analysis. If on a later survey the same participant identified as heterosexual and also provided data on laxative or muscle-building product use, that observation would also be included in the analysis. Participants were not required to provide the same number of waves of data to be included in GEE analysis.^{32,33}

From 1999 to 2007, the number of GUTS participants who provided ≥ 1 report of the inclusion variables was as follows: sexual orientation $n = 14\,134$, childhood gender conformity $n = 10\,904$, laxative use $n = 12\,965$, and muscle-building product use

$n = 13\,629$. Based on the inclusion criteria, the analysis sample included 6743 females and 4149 males (65% of the baseline GUTS sample; 93.6% white), yielding a total of 17 364 and 10 063 repeated-measures observations, respectively, across the 5 survey waves.

Multivariable logistic regression GEE models estimated the odds of past-year laxative and muscle-building product use by simultaneously entering age, gender, sexual orientation, and quartiles of childhood gender conformity into the model while adjusting for the covariates of race or ethnicity, asthma status, and weight status. Interactions between sexual orientation and gender conformity were also examined to test whether the effect of gender conformity on product use varied by sexual orientation.

RESULTS

Table 1 provides the prevalence of sexual orientation, childhood gender conformity, weight status, laxative use, and muscle-building product use by gender and age. In 1999, 18.7% of participants reported that their doctor had ever told them they have asthma.

Product Use by Gender and Age

As displayed in Table 1, <1% of females used muscle-building products at each age period. However, their laxative use increased with age. By ages 23 to 25 years, 10.5% of females reported using laxatives in the past year for weight loss, representing a 15-fold increase in the odds of using laxatives relative to use at 13 to 15 years old (Table 2). Males reported virtually no laxative use. By young adulthood, ~12% of men reported past year use of muscle-building products (Table 1), with the odds of use being >3 times greater between ages 16 and 25 years relative to at ages 13

to 15 years (Table 2). Because of the low estimated prevalence of muscle-building products among adolescent and young adult females and laxative use among adolescent and young adult males, subsequent analyses to examine the effects of childhood gender conformity and sexual orientation on laxative use were restricted to females. Analyses to examine the effects of childhood gender conformity and sexual orientation on muscle-building product use were restricted to males.

Laxative Use in Females by Sexual Orientation and Childhood Gender Conformity

Consistent with our hypothesis and previous research, sexual minority females had more than twice the odds compared with heterosexual females of using laxatives for weight loss in the past year (Table 2). Ancillary cross-tabulations indicated that by ages 23 to 25, 19.7% of sexual minority females reported past-year laxative use. Females in the top quartile of conformity had 50% greater odds of using laxatives relative to females who were the least conforming quartile. The lack of a significant sexual orientation by gender conformity interaction ($P = .61$) suggested that the effect of childhood gender conformity on laxative use did not vary by sexual orientation.

Muscle-Building Product Use in Males by Sexual Orientation and Childhood Gender Conformity

In contrast to the disparity in laxative use by sexual orientation found in females, there was no sexual orientation difference in muscle-building product use in males ($P = .70$). As displayed in Table 2, males who were more gender conforming had 1.41 to 2.09 times the odds of males who were least gender conforming of using muscle-building products. No significant sexual orientation by childhood gender conformity interaction was detected

TABLE 1 Prevalence of Childhood Gender Conformity, Sexual Orientation, Laxative Use, and Muscle-Building Product Use by Gender and Age in the GUTS

	Age, % (<i>n</i> Repeated-Measures Observations)			
	13–15 y	16–18 y	19–22 y	23–25 y
Females (<i>n</i> = 6743 Participants; 17 364 Repeated-Measures Observations)				
Sexual orientation				
Heterosexual	93.6 (3656)	89.0 (6903)	84.4 (9948)	79.8 (3111)
Sexual minority	6.4 (249)	11.0 (851)	15.7 (1846)	20.2 (786)
Childhood gender conformity				
Least feminine quartile	29.6 (1281)	30.0 (2435)	29.5 (3525)	27.9 (1109)
2nd quartile	12.3 (533)	13.0 (1053)	13.4 (1597)	14.3 (570)
3rd quartile	30.1 (1305)	30.3 (2463)	30.5 (3645)	31.3 (1245)
Most feminine quartile	28.0 (1213)	26.8 (2180)	26.7 (3186)	26.5 (1056)
Wt status				
Underweight	8.5 (363)	7.9 (632)	5.4 (636)	3.7 (145)
Overweight	15.4 (644)	12.9 (1011)	17.0 (1981)	18.7 (733)
Obese	3.0 (127)	3.0 (236)	8.0 (940)	10.9 (425)
Laxatives				
Any past year use	0.7 (30)	2.9 (191)	4.7 (327)	10.2 (85)
Muscle-building products				
Any past year use	0.9 (37)	0.9 (67)	0.9 (96)	0.6 (22)
Males (<i>n</i> = 4149 Participants; 10 063 Repeated-Measures Observations)				
Sexual orientation				
Heterosexual	95.5 (2164)	93.5 (4105)	90.4 (5969)	87.6 (1846)
Sexual minority	4.5 (101)	6.5 (286)	9.6 (634)	12.4 (261)
Childhood gender conformity				
Least masculine quartile	19.1 (512)	20.1 (940)	19.8 (1336)	20.7 (451)
2nd quartile	31.6 (848)	31.4 (1472)	32.8 (2219)	32.3 (702)
3rd quartile	17.6 (473)	18.3 (858)	18.0 (1214)	18.7 (407)
Most masculine quartile	31.7 (849)	30.2 (1416)	29.5 (1995)	28.3 (615)
Wt status				
Underweight	8.9 (234)	5.5 (249)	2.7 (178)	1.3 (27)
Overweight	18.5 (451)	18.5 (678)	27.4 (1507)	36.3 (731)
Obese	5.5 (135)	4.5 (163)	9.4 (517)	12.5 (252)
Laxatives				
Any past year use	0.2 (4)	0.5 (15)	0.8 (17)	1.2 (3)
Muscle-building products				
Any past year use	3.2 (76)	9.5 (375)	11.6 (677)	11.7 (229)

The denominators used to calculate percentages for age-specific prevalence vary because of the repeated-measures design and missing data on survey waves. The number of participants and repeated-measures observations refer to the data included in the analysis sample.

($P = .46$), suggesting that the effect of childhood gender conformity on muscle-building product use did not vary by sexual orientation.

DISCUSSION

Sexual orientation disparities in laxative use in the current study were stark, with 1 in 5 young adult sexual minority women reporting past-year laxative use for weight loss. Overall, being more feminine in childhood, regardless of sexual orientation, was associated with elevated odds of laxative use in adolescence and young adulthood among females. We found no differences in

muscle-building product use between heterosexual and sexual minority boys and men. Males who reported being more masculine in childhood were at greater odds for muscle-building product use in adolescence and young adulthood than males who were gender nonconforming in childhood. The overall gender differences and age trends detected in this study were consistent with previous US epidemiologic data on the prevalence of laxative use and muscle-building product use in adolescent and young adult females and males.^{7,9,11,15} The results build on previous research on gender and sexual orientation

disparities in laxative and muscle-building product use by highlighting the unique, independent effect of gender conformity in patterning weight control and muscle-building behaviors in heterosexual and sexual minority adolescents and young adults.

Gender nonconformity, rather than conformity, is often characterized as a mechanism patterning sexual orientation disparities. For example, gender nonconformity among sexual minority youth may elicit homophobic victimization, which may then mediate negative health outcomes and behaviors (eg, depression or maladaptive coping).^{21,34–36} In the current study,

TABLE 2 Multivariable Logistic Regression Models Estimating the Odds of Past-Year Laxative Use in Females and Muscle-Building Product Use in Males Predicted by Age, Sexual Orientation, and Childhood Gender Conformity in the GUTS

	Past-Year Laxative Use		Past-Year Muscle-Building Product Use	
	OR	95% CI	OR	95% CI
Females (<i>n</i> = 6743, Participants <i>n</i> = 17 364 Repeated-Measures Observations)				
Age, y				
13–15 (reference)	—	—	—	—
16–18	4.55***	2.85–7.26	—	—
19–22	7.18***	4.50–11.45	—	—
23–25	14.96***	8.99–24.92	—	—
Sexual orientation				
Heterosexual (reference)	—	—	—	—
Sexual minority	2.10***	1.66–2.66	—	—
Childhood gender conformity quartile				
Least feminine (reference)	—	—	—	—
2nd	1.08	0.76–1.53	—	—
3rd	1.19	0.89–1.58	—	—
Most feminine	1.51**	1.14–2.01	—	—
Males (<i>n</i> = 4149, Participants; <i>n</i> = 10 063 Repeated-Measures Observations)				
Age, y				
13–15 (reference)	—	—	—	—
16–18	—	—	3.03***	2.33–3.94
19–22	—	—	3.66***	2.82–4.72
23–25	—	—	3.36***	2.50–4.51
Sexual orientation				
Heterosexual (reference)	—	—	—	—
Sexual minority	—	—	1.05	0.81–1.36
Childhood gender conformity quartile				
Least masculine (reference)	—	—	—	—
2nd	—	—	1.41**	1.09–1.83
3rd	—	—	2.09***	1.58–2.75
Most masculine	—	—	1.79***	1.38–2.33

With regards to empty cells (—), muscle-building product use (e.g., creatine, steroids) was not estimated in females and laxative use was not estimated in males because of low prevalence. Models simultaneously test the effects of age, sexual orientation, and childhood gender conformity and adjust for race or ethnicity, asthma status, and wt status.

*** *P* < .001.

** *P* < .01.

gender conformity in childhood, regardless of sexual orientation, increased the odds of adolescent and young adult laxative use among females and muscle-building product use among males. Previous research has demonstrated that gender conformity patterns other risk behaviors youth may display to embody or adhere to gendered appearance ideals (eg, tanning bed use among girls and cigar smoking among boys).²⁰ Results from the current study bolster other work indicating that social pressure to conform to gender norms, including those concerning appearance, may increase adoption of deleterious weight management and muscle-building behaviors among

heterosexual and sexual minority youth alike.

Although this is the largest study of its kind to examine the contributions of gender conformity to sex and sexual orientation disparities in early laxative and muscle-building product use, there are some limitations. First, this study relied on a retrospective measure of childhood gender conformity that assessed degree of femininity and masculinity as opposite poles of a single continuum. Although the measure is validated, future research should assess gender expression prospectively and include a measure of current gender expression. Minority sexual orientation subgroups were collapsed for statistical power, preventing examination of

heterogeneity in product use among subgroups (eg, lesbian vs bisexual). However, previous research on sexual orientation differences in disordered eating behaviors has indicated that sexual minority subgroups are similar with regard to their overall greater prevalence of disordered eating behaviors relative to heterosexuals.^{14,15} The prevalence of laxative use in GUTS is probably underestimated, given that the survey item may not have cued participants to report on products marketed as dietary supplements or healthy “cleanses” that actually contain potent laxative ingredients (eg, senna, psyllium, polyethylene glycol).^{1,2,5} Additionally, muscle-building products were studied in aggregate to preserve

statistical power, preventing examination of specific types of product use. Lastly, the GUTS sample is restricted in variability along various demographic dimensions (eg, race, income), limiting generalizability of results.

CONCLUSIONS

These findings have implications for research, clinical, and public health practice. Laxative use and muscle-building product use increase with age for females and males, respectively, suggesting the need for greater regulation of the sale of such products to adolescents. Beyond providing converging

evidence with findings of other studies documenting the elevated risk of laxative use among sexual minority females, the current analyses indicated that conformity to femininity norms is associated with a higher risk for laxative use among girls and women, regardless of sexual orientation. Furthermore, conformity to masculinity norms is associated with a higher risk for muscle-building product use among boys and men, regardless of sexual orientation. These results were detected on a measure of childhood gender expression. More research is needed to examine the contributions of current gender expression and measures of gender that assess conformity to both masculinity and

femininity norms. Given the unique contributions of gender expression and sexual orientation to patterns of laxative and muscle-building product use, efforts to prevent laxative use among girls and women and muscle-building product use among boys and men should be targeted at youth who are gender conforming as well as those who identify as sexual minorities.

ABBREVIATIONS

CI: confidence interval

GEE: generalized estimating equation

GUTS: Growing Up Today Study

OR: odds ratio

manuscript; Dr Austin supervised the conceptualization and design of the study, reviewed the results, and critically reviewed the manuscript; and all authors approved the final manuscript as submitted.

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Address correspondence to Jerel P. Calzo, PhD, Division of Adolescent/Young Adult Medicine, Boston Children's Hospital, 300 Longwood Ave, AU-Box 17, BCH3189, Boston, MA 02115. E-mail: jerel.calzo@childrens.harvard.edu

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