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Physical Activity Disparities in Heterosexual and Sexual Minority Youth Ages 12-22 Years Old: Roles of Childhood Gender Nonconformity and Athletic Self-Esteem

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Abstract

Background—Physical activity is an important health determinant. Little is known about sexual orientation differences in physical activity and their psychosocial determinants.

Purpose—To examine adolescent and young adult hours/week of moderate/vigorous physical activity (MVPA) and team sports participation by sexual orientation and investigate contributions of gender nonconformity and low athletic self-esteem to possible sexual orientation differences.

Methods—Analysis of data from 5,272 males and 7,507 females from 1999-2005 waves of the US Growing Up Today Study (ages 12-22 years).

Results—Sexual minorities (i.e., lesbian, gay, bisexual, mostly heterosexual) reported 1.21-2.62 hours/week less MVPA (p 's<0.01) and were 46%-76% less likely to participate in team sports than same-gender heterosexuals. Gender nonconformity and athletic self-esteem accounted for 46%-100% of sexual orientation MVPA differences.

Conclusions—Physical activity contexts should be modified to welcome sexual minority males and females. Targeting intolerance of gender nonconformity and fostering athletic self-esteem may mitigate sexual orientation MVPA disparities.

Keywords

Gay; Lesbian; Bisexual; Physical Activity; Sports Involvement; Adolescence; Gender Nonconformity; Self-Esteem

In 2011, the Institute of Medicine defined research on health-promoting factors as a priority in the movement to understand and address sexual orientation health disparities (1). One

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health-enhancing behavior that may be patterned by sexual orientation and that may promote positive physical and mental health outcomes is physical activity. Engaging in moderate to vigorous physical activity (MVPA) has numerous physical and mental health benefits, including weight control, decreased risk of diabetes and cardiovascular disease, increased positive mood, and higher quality sleep (2). Moderate- to vigorous-intensity is defined as activities that require at least a moderate amount of effort and increase the heart rate; examples range from brisk walking and domestic chores to running, competitive sports, and heavy lifting (2). The World Health Organization recommends that children and adolescents engage in at least 1 hour/day of MVPA (2). However, physical activity generally declines across adolescence in both males and females, and approximately 71% of US high school students fail to engage in 1 hour/day of MVPA every day of the week (3-5). Being more physically active in adolescence is associated with smaller declines in MVPA in young adulthood; fostering healthy physical activity habits from an early age and throughout adolescence is paramount (5-7). MVPA is protective against multiple morbidities for which there are known adolescent and young adult sexual orientation health disparities, including overweight/obesity, stress, and depression (8-11). Yet, there is a surprising dearth of knowledge about physical activity among sexual minority populations (i.e., lesbian, gay, bisexual, mostly heterosexual) in general and in sexual minority youth specifically. Such data are critical to understand whether and to what degree sexual orientation disparities in physical activity exist.

Multiple factors shape adolescent and young adult physical activity. Although motivation to exercise or become involved in recreational or organized sports is an important determinant of physical activity (12, 13), so too are contextual factors that socialize interest in exercise and athletics and that determine the opportunities available for physical activity. Such contextual factors include family, peer, or other adult (i.e., coach or teacher) encouragement to be physically active, societal gender norms regarding physical activity and athleticism, and the availability of exercise opportunities (e.g., gyms, yoga classes, school- or community-based team sports) (14-16). Sexual minority youth may fear threats to safety in family, school, and community contexts due to the cultural stigma attached to their identity (17-19). As a result, sexual minority youth may engage in less MVPA than their heterosexual peers.

No research has compared heterosexual and sexual minority youth on overall physical activity, but research has explored homophobia in team sports contexts, particularly on all-male teams (20-22). Because team sports are a common means for adolescents to engage in MVPA (7, 23), focusing on sexual minority youth involvement in team sports can facilitate understanding of their engagement in MVPA overall. Team sports can be a major context for socializing and reinforcing homophobia due to Western cultural expectations related to athleticism, gender norms, and sexual orientation. The establishment of gender identity is a critical component of adolescence (24). For males especially, being involved in organized sports-- specifically contact and collision sports (e.g., football, basketball, soccer) rather than non-contact (e.g., tennis, swimming) and aesthetic sports (e.g., cheerleading, dance, gymnastics)-- is both a primary means of establishing oneself as being more masculine and a means of internalizing traditional gender role norms (25-27). From an early age, boys identify with athletes and immerse themselves in informal and formally-organized sports activities as a means of asserting their masculinity (25). Homophobia is often used to socialize and police conformity to traditional gender norms (28, 29). Coaches and male peers may view any deviation from traditional gender norms, such as perceived athletic incompetence, as an indicator of being less masculine and thus non-heterosexual (e.g., calling a boy who is not good at football a "fag") (28-30). Consistent with this finding, one study of high school males in urban Pennsylvania found that those who were engaged in competitive team sports were three times as likely as those not in team sports to express

homophobic beliefs (22). It is likely that homophobia operates in similar ways in other physical activity contexts, such as gyms and school physical education classes (21, 28, 31).

Much of the research on sexual orientation and sport has focused on the experiences of males. Emerging research also indicates that traditional femininity norms and homophobia may adversely affect sexual minority females' physical activity (32, 33), although sexual orientation differences among females may be smaller than among males (34). General social acceptance of sexual minority women is greater than it is for sexual minority men (35), but sexual minority women still face considerable social stigma (11). Because sexual minority females are expected to be gender nonconforming, athletic prowess is considered to be one of many stereotypical traits of lesbians (36, 37). For example, in Shakib's work with women's basketball players, the best athletes were often labeled as lesbians (38, 39). It is possible that some adolescent sexual minority females may avoid sports as a means of staying "closeted." Scant research has examined whether sexual minority individuals are actually less likely to pursue sports than their heterosexual peers, and whether differences vary by gender. One large study of adults in the Netherlands found that gay and bisexual men were less likely to participate in competitive team sports than heterosexual men; sexual orientation differences were less pronounced in women (34). Because there is more diversity in the types of sports accessible to women (i.e., opportunities to participate in traditionally masculine contact/collision sports, as well as non-contact, and aesthetic sports), heterosexual and sexual minority females may differentially pursue or avoid different types of sports (34). Thus, sexual orientation differences in overall MVPA may be less pronounced in females.

Actual or anticipated victimization within sports contexts may also impede the development of positive athletic self-esteem among sexual minority youth, which may deter future physical activity pursuits. Athletic self-esteem can be conceptualized as a personal sense of being physically and athletically competent, such as feeling that one does well in sports or is capable of engaging in sports and physical activities one has not tried before (40, 41). Prospective studies of adolescents indicate that higher self-esteem in general is associated with greater involvement in sports, which in turn predicts subsequent enjoyment of sports and physical activities and improved athletic self-concept (42, 43). Sexual minority adolescents generally report lower overall self-esteem and lower athletic self-esteem than their heterosexual peers (19, 44). Thus, low athletic self-esteem could be both a consequence of and barrier to physical activity in sexual minority adolescents.

To summarize, more research is required to investigate whether there are sexual orientation disparities in physical activity and team sports participation, and whether such disparities exist in adolescence and young adulthood. The interplay between homophobia and the policing of gender nonconformity may adversely impact sports involvement among sexual minority males. The associations between sexual orientation, team sports participation, and physical activity in females are less clear. However, because previous research indicates that sexual minority females exhibit lower athletic self-esteem than their same-gender heterosexual peers (44), it is possible that sexual minority females may also be at risk for low MVPA and low team sports participation.

The Current Study

Previous research on the links between sexual orientation and physical activity in adolescence has focused on examining homophobia in sports contexts. However, adolescents in general can fulfill daily-recommended levels of MVPA through multiple activities, not just team sports. The current study builds upon prior work by examining both physical activity overall and team sports participation in heterosexual and sexual minority youth from adolescence into young adulthood. Using data from the 1999-2005 waves of the

Growing Up Today Study (GUTS)—a US national epidemiologic cohort study—we examined how hours/week of overall MVPA change from ages 12 to 22 years old in heterosexual and sexual minority youth. In a secondary analyses we examined how the sexual orientation subgroups differ in weekly team sports engagement.

It is important to note that since the data were collected there has been a secular shift in cultural acceptance of sexual minorities. Current sexual minority youth in the US are developing in a culture in which the civil liberties of sexual minority populations are at the forefront of political and social discourse. It is possible, though not yet confirmed, that current sexual minority youth may experience less victimization in physical activity contexts as a result recent local, state, and federal-level protections for sexual minority and gender nonconforming individuals. Because no research has compared sexual orientation subgroups on physical activity and team sports participation on a national scale, the data analyzed in the current study provide an important baseline from which to compare future work.

Due to the intersections of athleticism, gender norms, and sexual orientation, we expected that associations between sexual orientation and MVPA would differ by gender. We hypothesized that sexual minority males would engage in lower levels of MVPA than heterosexual males across adolescence. Based on limited research comparing sexual minority and heterosexual adult females on athletic participation (34) and athletic self-esteem (44), we expected little or no difference in MVPA between heterosexual and sexual minority adolescent females. Sexual minority males were expected to engage in team sports less frequently than heterosexual males; no differences were expected between sexual minority and heterosexual females.

We also hypothesized that gender nonconformity and diminished athletic self-esteem would be key factors accounting for the association between sexual orientation and physical activity. Sexual minority individuals are generally more likely to be gender nonconforming than heterosexual individuals (45). Gender nonconforming expression may elicit victimization, and low athletic self-esteem may be both a cause and consequence of adverse experiences in physical activity contexts and diminished athletic involvement. Although information on homophobic victimization within physical activity contexts is not available in GUTS, gender nonconformity and athletic self-esteem were assessed, thus allowing us to examine these potential explanatory factors. Furthermore, the GUTS dataset permitted us to explore the associations between a wider array of sexual orientation subgroups and physical activity than has previously been considered in the sexual orientation and sports literature. Specifically, we examined whether individuals who identify as mostly heterosexual (i.e., neither completely heterosexual nor lesbian/gay or bisexual) differ from completely heterosexuals in their developmental trajectory of MVPA and level of team sports involvement. We had no explicit hypotheses for this large and understudied sexual minority subgroup, but expected that they may also be at risk for lower MVPA than heterosexuals due to their greater gender nonconformity (45).

Method

Participants

Participants were drawn from the Growing Up Today Study (GUTS), a US cohort study begun in 1996. Participants were ages 9-14 years ($N=16,882$; 9,039 females and 7,843 males) at baseline and were children of women in the Nurses' Health Study II. After receiving parental consent, we invited children to enroll; return of the 1996 baseline questionnaire indicated assent to participate. Participants were sent questionnaires annually from 1996-2001 and biennially after 2001. The Brigham and Women's Hospital institutional review board approved this study.

Measures

Sexual orientation—Sexual orientation was assessed beginning in 1999 using a single item, “Which of the following best describes your feelings?” Response options were: completely heterosexual (attracted to persons of the opposite sex), mostly heterosexual, bisexual (equally attracted to men and women), mostly homosexual, completely homosexual (gay/lesbian, attracted to persons of the same sex), and not sure. Within each gender group, bisexual, mostly homosexual, and completely homosexual were combined due to the small number of responses in the bisexual and mostly homosexual categories. Respondents “not sure” of their sexual orientation were excluded. Sexual orientation was updated at each assessment (1999, 2001, 2003, 2005). At 1999 (ages 12-17 years old), 87.1% of participants identified as completely heterosexual, 4.9% identified as mostly heterosexual, 1% identified as lesbian, gay, or bisexual, and 7% identified as unsure or were missing a response. In 2005 (18-23 years old), 86.8% of participants identified as completely heterosexual, 9.6% as mostly heterosexual, 3.2% as lesbian, gay, or bisexual, and 0.4% identified as unsure or were missing a response.

Moderate to vigorous physical activity (MVPA)—Participants reported time spent in 14 to 16 different sports and activities (e.g., soccer, running, weight lifting) in each of four seasons in the past year in 1997-1999, 2001, and 2005. MVPA (hours/week) was calculated from the sum of participants' report for each wave. Scores were capped at 40 hours/week to exclude improbable responses.

Team sports participation—Participation in team sports was assessed in 2001 using a single item, “How many times per week do you participate in team sports?”, 0=“None” to 5=“5+ times. The variable was bimodally distributed at the “None” and “5+ times/week” response levels. The variable was thus categorized into 0=“None,” 1=“1-4 times/week,” and 2=“5+ times/week.” In 2001, 37% of males and 51% of females never engaged in team sports, 32.6% of males and 22.4% of females participated 1-4 times/week, and 30.3% of males and 26.6% of females participated 5+ times/week.

Athletic self-esteem—Athletic self-esteem was assessed annually from 1996 through 2001 using items adapted from the Harter Self-Perception Profile (40) that focused on participants' perceptions of their own athletic ability compared to same-aged peers. Participants were asked to rank how true five or six statements were of their athletic abilities (e.g. “feel that I am better than others my age at sports;” 0=“Not true of me” to 2=“Really true of me”). Items were summed to score participants' athletic self-esteem (α 's=.68-.88). Due to the varying number of items across questionnaire waves, the standardized score of athletic self-esteem was used in analyses.

Childhood gender nonconformity—Gender nonconformity in childhood was assessed in 2005 and 2007 using four items regarding gender expression prior to age 11 (Cronbach's α range=0.66-0.68) (46). Response options were coded for male and female participants such that higher scores indicated greater gender nonconformity. For example, participants were asked “When I was a child in pretend play I took the role of...” with response options of “1=Always boys/men” to “5=Always girls/women” for males and the reverse for females. We used the 2005 assessment because it was more proximal to childhood. For respondents missing 2005 data, we used the 2007 assessment. The mean of the four items was categorized into (1) below median (referent), (2) above median but below top decile, and (3) top decile childhood gender nonconformity ($M_{males}=1.45$, $SD=0.54$; $M_{females}=2.04$, $SD=0.68$) (21).

Covariates—Asthma and obese weight status were examined as potential covariates of MVPA and team sports participation because both may limit high MVPA (47, 48). Asthma was assessed every wave from 1999-2005 using a single item, “Has a doctor ever said you have asthma?” (1=“Yes,” 0=“No” or “I don't know”). Obese weight status was calculated every wave from 1999-2005 using self-reported height and weight data to calculate body mass index (BMI; kg/m²). For observations prior to age 18 years, obese weight status was defined as above the 95th BMI percentile for age and sex; for observations ages 18 years and older, obese weight status was defined as BMI scores ≥ 30 (22).

Analysis

Participants from the 1999-2005 waves with at least one report of sexual orientation and MVPA were included in the analysis. All analyses were run in SAS v.9.2. The central analyses of the study focused on change in MVPA from ages 12-22 years. The key study predictor was sexual orientation. Sexual orientation was entered as a three-level time-varying categorical variable (lesbian/bisexual or gay/bisexual, mostly heterosexual, and completely heterosexual [referent]). Preliminary analyses examined whether the analysis sample differed from the excluded GUTS participants on baseline MVPA (in 1997), whether there were overall gender differences in MVPA, and whether gender modified the associations between age and/or sexual orientation and MVPA. If gender-by-age or gender-by-sexual orientation effects were found to be significant, all subsequent analyses were stratified by gender. We also tested for the associations of the covariates (asthma and obese weight status, measured at same wave as MVPA), non-linear age terms, and sexual orientation-by-age interactions (to examine differential development of MVPA among the sexual orientation subgroups) and the outcome MVPA.

Analyses to answer the primary research questions examined the effect of sexual orientation on MVPA. Significant covariates, non-linear age effects, and interaction terms were included in these multivariable analyses. The hypothesized mediators-- athletic self-esteem (time-varying continuous variable, using measures at same time point as MVPA) and childhood gender nonconformity (static categorical variable)--were tested in separate models. Analyses to examine mediation by gender nonconformity were restricted to the subsample of participants with childhood gender nonconformity data (67.2% of males; 83.1% of females). All analyses of MVPA used linear multivariable regression in generalized estimating equations (GEE) (49) combining data across five waves. GEE analyses accounted for clustering of siblings in the GUTS dataset and the correlation of repeated measures within individuals. The publicly available SAS *MEDIATE* macro was utilized to calculate the percentage of the sexual orientation effect on MVPA mediated by athletic self-esteem and childhood gender nonconformity (50).

For the secondary analyses comparing sexual orientation groups on team sports participation, we focused on data collected in 2001 (when participants were ages 15-19 years old). Preliminary models tested the association between team sports participation (ordinal categorical variable) and the potential covariates of age, obese weight status, and asthma. To examine sexual orientation differences in team sports participation in males and females, multivariable ordered logistic regression models were performed via GEE and significant covariates were included. Results from these ordered logistic regression models compare the odds of sexual minorities and heterosexuals of reporting participation in team sports at least once/week (the 1-4 times/week and 5+ times/week categories are estimated together) versus never (referent).

Results

Preliminary Analyses

The analysis sample consisted of 7,507 females and 5,272 males (75.7% of the original GUTS cohort). Participants were from all regions of the US and 93% self-identified as White. Some evidence of potential selection bias was detected in comparing the analysis sample and excluded participants, and participants included in the gender nonconformity mediation analysis (81.6% of analysis sample) and those not included in that mediation analysis. On average, participants who were excluded from the overall analysis sample engaged in 1.85 more hours/week MVPA than the analysis sample (95% confidence interval [CI]= 1.41, 2.30, $p < .0001$), thus indicating that the overall analysis sample may be less physically active than excluded participants. Being more physically active in 1997 (odds ratio [OR]= 0.99, 95% CI= 0.98, 1.00, $p < 0.01$) and being male (OR= 0.40, 95% CI= 0.36, 0.45, $p < 0.0001$) were associated with a lower likelihood of being included in the gender nonconformity mediation analysis. Sexual orientation was not associated with likelihood of being in the gender nonconformity mediation analysis.

Descriptive statistics for key variables summarized into age groups in adolescence are provided in Table 1. Males engaged in more hours/week MVPA than females ($\beta = 1.95$, 95% CI= 1.66, 2.23, $p < 0.0001$). In addition, a marginally significant gender-by-age interaction was detected in mean hours/week of MVPA ($p = 0.05$), with males displaying a larger initial increase in MVPA with age than females. Thus, subsequent analyses were run separately in males and females. Analyses to identify covariates of MVPA found that obesity was associated with less MVPA in males ($\beta = -1.57$, 95% CI= -2.48, -0.67, $p < 0.001$) and in females ($\beta = -2.50$, 95% CI= -3.20, -1.79, $p < 0.0001$). Being diagnosed with asthma was modestly associated with greater MVPA in females ($\beta = 0.57$, 95% CI= 0.19, 0.95, $p < 0.01$). A significant association between cubic age and physical activity was also detected for both males and females (males: $df = 1$, $\chi^2 = 4.91$, $p < 0.05$; females: $df = 1$, $\chi^2 = 13.87$, $p < 0.001$). There was no significant interaction between age and sexual orientation in either males or females, indicating that sexual orientation differences in MVPA do not change during the observed age period (12-22 years old).

Associations Between Sexual Orientation and MVPA

Figure 1 displays the estimated average level of MVPA for each year of age for each sexual orientation subgroup from ages 12-22 years. In both males and females there was a general increase in physical activity from ages 12-15 years, followed by a decrease to age 22 years. Our hypothesis that sexual minority males would engage in less MVPA across adolescence than heterosexual males and that sexual minority females would not differ from heterosexual females in their MVPA received partial support. After adjusting for obesity, gay and bisexual males were found to engage in 2.62 fewer hours/week MVPA than completely heterosexual males (Table 2). Mostly heterosexual males did not differ significantly in MVPA from completely heterosexual males. Contrary to expectations, lesbian and bisexual females and mostly heterosexual females engaged in 1.21-1.77 fewer hours/week MVPA than completely heterosexual females (after adjusting for asthma and obesity; Table 2).

Testing Mediation of Sexual Orientation Effect on MVPA by Gender Nonconformity

Sexual minority males and females report greater gender nonconformity than completely heterosexual participants (51). After adjusting for obesity, gender nonconforming males engaged in less MVPA than males below the median (above median gender nonconformity: $\beta = -0.93$, 95% CI= -1.49, -0.38, $p < 0.001$; top decile gender nonconformity $\beta = -2.49$, 95% CI= -3.44, -1.55, $p < 0.0001$). By contrast, females who were above the median and in the top decile of childhood gender nonconformity engaged in *more* MVPA than females who were

below the median (above median gender nonconformity: $\beta=0.56$, 95% CI=0.18, 0.94, $p<0.01$; top decile gender nonconformity: $\beta=1.80$, 95% CI= 1.21, 2.39, $p<0.0001$).

After adjusting for gender nonconformity, there were no significant sexual orientation differences in adolescent male MVPA (Table 2, Figure 1). Childhood gender nonconformity accounted for 45.9% of the difference between gay and bisexual males and completely heterosexual males (95% CI=11.9%, 79.8%, $p<0.01$). After adjusting for childhood gender nonconformity in females, however, sexual minority females were still found to engage in less MVPA than completely heterosexual females, indicating that childhood gender nonconformity does not mediate the association between sexual orientation and MVPA in females.

Testing Attenuation of Sexual Orientation Effect on MVPA by Athletic Self-Esteem

Consistent with earlier studies in GUTS (44), sexual minority males reported lower athletic self-esteem than completely heterosexual males (gay/bisexual: $\beta= -0.92$, 95% CI= -1.12,-0.71, $p<0.0001$; mostly heterosexual: $\beta= -0.45$, 95% CI= -0.58,-0.32, $p<0.0001$). Lesbian and bisexual females and mostly heterosexual females reported lower athletic self-esteem than their completely heterosexual peers (lesbian/bisexual: $\beta= -0.31$, 95% CI= -0.45,-0.17, $p<0.0001$; mostly heterosexual: $\beta= -0.24$, 95% CI= -0.30,-0.17, $p<0.0001$). Athletic self-esteem was a strong predictor of MVPA (males: $\beta= 3.36$, 95% CI= 3.17, 3.55, $p<0.0001$; females: $\beta= 3.04$, 95% CI= 2.91, 3.18, $p<0.0001$).

Analyses examining athletic self-esteem as a mediator of sexual orientation differences in MVPA yielded intriguing results. As displayed in Figure 1, at comparable levels of athletic self-esteem, gay/bisexual and mostly heterosexual males did not differ from their heterosexual peers on MVPA. Athletic self-esteem accounted for 99.95% of the difference between gay and bisexual males and completely heterosexual males ($p<0.0001$). Adjusting for athletic self-esteem in females significantly attenuated the effect of sexual orientation on MVPA. Although mostly heterosexual females still engaged in 0.59 fewer hours/week MVPA than completely heterosexuals, lesbian and bisexual females did not differ from completely heterosexual females after adjusting for athletic self-esteem (Table 2). Athletic self-esteem accounted for 73.5% of the variance of the MVPA difference between lesbian and bisexual females and completely heterosexual females ($p<0.0001$), and 62.7% of the variance of the MVPA difference between mostly heterosexual females and completely heterosexual females ($p<0.0001$).

Sexual Orientation and Team Sports Participation

A secondary analysis examined whether male and female sexual minority subgroups differed from their same-gender heterosexual peers on weekly team sports participation. Analyses adjusted for age (males and females) and asthma (females only). Consistent with our hypotheses, gay/bisexual and mostly heterosexual males were much less likely than heterosexual males to report any weekly team sports participation (gay/bisexual: OR= 0.28, 95% CI= 0.15, 0.52, $p<0.0001$; mostly heterosexual: OR= 0.52, 95% CI= 0.36, 0.76, $p<0.001$). As was the case with the MVPA results, lesbian/bisexual and mostly heterosexual females were also less likely than heterosexual females to report any weekly team sports participation (lesbian/bisexual: OR= 0.39, 95% CI= 0.25, 0.62, $p<0.0001$; mostly heterosexual: OR= 0.54, 95% CI= 0.44, 0.66, $p<0.0001$).

Discussion

This study examined sexual orientation differences in physical activity across adolescence in males and females. As hypothesized, gay and bisexual adolescent males engaged in less

MVPA and played team sports less frequently than heterosexual males. Our results support previous work suggesting that sexual minority adult males are less likely to engage in physical activity or team sports than their heterosexual peers (34). Contrary to expectations, lesbian, bisexual, and mostly heterosexual females engaged in less MVPA and team sports than heterosexual females. The findings challenge common perceptions that sexual minority females may be more athletic than their heterosexual peers, or are overrepresented in sports (37, 52). The results bolster other research that has also challenged the “athletic lesbian” stereotype (34, 37).

Whereas previous research almost exclusively focused on the experiences of adult sexual minority populations, the findings from the current study examined sexual orientation differences in physical activity beginning in early adolescence. Although the rate of change in MVPA did not differ by sexual orientation, sexual minority adolescents consistently report lower MVPA starting in early adolescence. Interventions to promote physical activity among sexual minorities should be targeted in early adolescence as sexual minority identities emerge (53). The results from the mediation analysis of gender expression further indicate that interventions to support physical activity in sexual minority youth, especially boys, could begin even in childhood. Gender nonconforming expression prior to 11 years old accounted for 46% of male sexual orientation differences in physical activity. The effect is consistent with previous work linking engagement in sports and physical activity in males to notions of traditional masculinity (21, 34, 36, 54). Gender nonconformity did not account for female sexual orientation differences. It is possible that gender nonconformity did not attenuate sexual orientation differences among females because gender nonconforming expression in girls may be more socially accepted than it is in boys, and thus less likely to elicit victimization (e.g., greater social acceptance of masculine girls, or “tomboys,” versus feminine boys) (55). However, females overall were less physically active than males. Creating physical activity and sport settings that protect gender nonconforming boys and girls overall may help to diminish or eliminate male sexual orientation and overall gender MVPA disparities.

Athletic self-esteem played a substantial role in explaining sexual orientation MVPA differences. Sexual minorities of both genders reported less positive views on their own athletic ability than heterosexuals. We found that athletic self-esteem accounted for up to 74% of female sexual orientation MVPA differences and nearly 100% of male sexual orientation MVPA differences. In fact, at comparable levels of athletic self-esteem, sexual minority males engaged in greater levels of physical activity than heterosexual males, although this difference was not statistically significant. It is possible that the associations between physical activity and athletic self-esteem are bidirectional, with engagement in physical activity resulting in the cultivation of athletic self-esteem and vice versa (42, 43). Involvement in team sports can be a powerful predictor of developing a sense of athletic self-competence (42, 43). Given prior research indicating that adolescent team sports contexts may be hostile to sexual minority youth, it is not surprising that sexual minority youth in the current study were 46%-72% less likely to participate in team sports each week than heterosexual youth. Making adolescent team sports contexts safer for sexual minority youth may reduce sexual orientation disparities in MVPA by increasing opportunities to participate in team sports and promoting the development of positive athletic self-esteem. In addition, interventions to increase MVPA in sexual minority youth (and perhaps youth in general) could also focus on deconstructing the link between competitive team sports participation, perceived athletic competence, and the capacity to be physically active. For example, providing adolescents in physical education classes with greater capacity to choose from a range of activities (e.g., football, distance running, dance, self-defense class) may enable youth to find physical activities that they enjoy and to develop greater athletic self-esteem.

Strengths of the current study include that participants were not recruited on the basis of sexual orientation, thus the study sample may not present some of the biases concomitant in research with samples recruited through clinical settings, drop-in centers, or sexual minority youth community venues (19). The percentage of youth in the GUTS sample who identified as sexual minorities by young adulthood is consistent with other US national epidemiologic data of adults who endorse sexual minority identities (56). The repeated measures design of GUTS increased the power to detect sexual orientation differences among heterosexual, lesbian/gay and bisexual, and mostly heterosexual adolescents. There are several limitations to this study that future research can address. The GUTS sample is predominantly White and is comprised of children of nurses, therefore the results may not generalize to youth of different racial/ethnic or socioeconomic backgrounds. The average hours/week of MVPA in the GUTS sample generally met or exceeded World Health Organization recommendations (2). Comparisons with US national data on adolescent MVPA, such as that provided by the Youth Risk Behavior Surveillance System (3), indicate that GUTS participants may be more physically active than adolescents in other US samples. However, the percentage of GUTS participants who do not participate in team sports and the pattern of changes in MVPA across adolescence match the age patterns detected in national data (3, 7, 57, 58). Despite the overall high levels of physical activity in the GUTS cohort, sexual minority youth were still found to engage in lower levels of physical activity than heterosexual youth. Beyond overall levels of MVPA, future research should also examine how sexual orientation patterns the types of physical activities sexual minority youth engage in. Knowing whether sexual minority youth are more likely to engage in some physical activities over others may help to guide intervention efforts to increase physical activity. Our measure of gender nonconformity focused on childhood expression. Information on gender expression throughout adolescence may yield information about cross-sectional associations between gender nonconformity and MVPA, as well as permit testing of models examining the joint mediation effects of gender nonconformity and athletic self-esteem.

Data for the current study were collected between 1999-2005. Secular changes in the cultural climate regarding sexual minority individuals in sports may result in smaller sexual orientation differences in physical activity among today's adolescents. Although the recent "coming out" of professional athletes (e.g., Megan Rapinoe of the National Women's Soccer League in 2012, and Jason Collins of the National Basketball Association in 2013) may indicate that current team sports contexts are potentially more welcoming to sexual minorities, it is important to note that these are adult athletes who have reached elite levels of status within their sports. Whether these cultural shifts are also occurring in the physical activity contexts of gender nonconforming and sexual minority youth remains to be examined. One recent qualitative study of 16-18-year-old male soccer players in the United Kingdom found near universal acceptance of homosexuality, with the only reservation being that having sexual minority teammates may impact the language used in sports contexts in order to avoid offending the teammates (30). Such findings are promising and will hopefully motivate additional research to identify factors that promote acceptance for sexual minority youth in competitive and noncompetitive physical activity contexts.

The results have several implications for interventions to increase physical activity among sexual minority adolescents. The GUTS dataset primarily focused on individual-level factors associated with physical activity, but the findings build from a rich literature documenting the intersections of identity, physical activity, gender norms, and homophobia. Public health intervention efforts to promote MVPA among sexual minorities should focus on creating safe spaces for these youth to participate and develop a sense of competence in competitive and noncompetitive sports and physical activities. Such work can draw from state and federal policy developments for stopping school-based bullying, and from anti-bullying curricula and policy recommendations prepared by advocacy organizations, such as the Gay,

Lesbian & Straight Education Network (www.glsen.org). Parents, teachers, and coaches can either mitigate or contribute to the homophobic culture of some youth physical activity and sports contexts. Adults who administer physical education and athletic programs to children and adolescents should enforce policies that promote acceptance of gender nonconformity and zero tolerance of homophobia. Such policies may not only promote physical activity for youth with developing sexual minority identities, but also promote physical activity in the much larger population of heterosexual youth who are also gender nonconforming (51).

Portraying sexual minority male and female athletes as role models may help to inspire physical activity in sexual minority youth, however, also engaging professional athletes who are heterosexual allies of sexual minorities may have a substantial effect on making physical activity contexts more supportive of sexual minority youth. Role modeling by professional adult athletes can shape the attitudes and health behaviors of adolescents (59, 60). Thus, public health campaigns that pair high profile professional athletes with a message of acceptance for sexual minority athletes may help to discourage homophobia and intolerance of gender nonconformity in adolescent physical activity spaces. Such efforts are currently underway by organizations such as Athlete Ally (www.athleteally.org) and You Can Play (youcanplayproject.org), which are dedicated to eliminating homophobia in high school, college, and professional sports contexts. Future research should evaluate the impact of such programs on homophobia, on the number of sexual minorities in sports, and on their success in promoting physical activity and sports in younger adolescents.

The findings from the current study break new ground by documenting physical activity from adolescence to young adulthood in sexual minority and heterosexual males and females. The results provide a baseline about the connections between sexual orientation and physical activity from which to compare future research. Sexual orientation disparities in physical activity were evident in males and females as early as age 12 years old and persist to young adulthood. The findings indicate the need for early, multi-context (e.g., school, community), and multi-level (e.g., within-team, broader sport-community) interventions to eliminate barriers to physical activity among sexual minority youth throughout adolescence and young adulthood. Introducing policies in school and other youth-serving sports programs to protect gender nonconforming youth—particularly males—and increasing access to supportive physical activity environments for sexual minority males and females may foster the development of athletic self-esteem and substantially reduce sexual orientation MVPA disparities. Conflict of Interest Statement: The authors have no conflict of interest to disclose.

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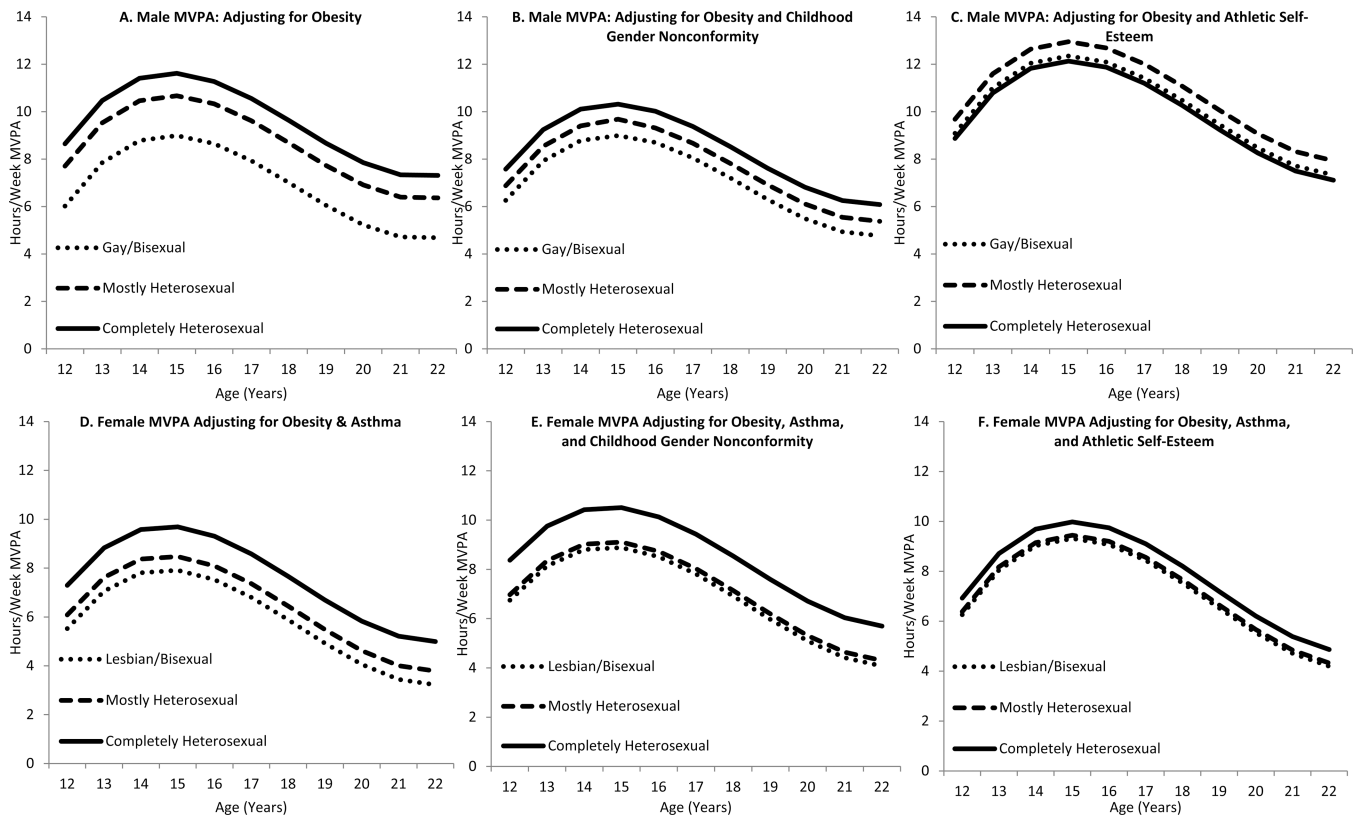


Figure 1. Estimated hours/week of moderate/vigorous physical activity (MVPA) by age and sexual orientation from multivariable generalized estimating equations in male and female participants from the Growing Up Today Study. Plots A, B, and C correspond to Table 2, Models 2, 3, and 4 for males, respectively. Plots D, E, and F correspond to Table 2, Models 2, 3, and 4 for females, respectively.

Table 1
Descriptive Statistics for Key Time-Varying Variables Summarized in Age Groups in the Growing Up Today Study (n Represents Person-Period Observations)*

MALES	% (n) or M(SD)		
	13-14 Years Old (n=2121)	16-17 Years Old (n=3840)	19-20 Years Old (n=3504)
Sexual Orientation (%[n])			
Gay/Bisexual	0.6% (11)	1.7% (62)	3.0% (102)
Mostly Heterosexual	2.9% (53)	4.1% (145)	5.2% (178)
Completely Heterosexual	96.5% (1743)	94.2% (3372)	91.9% (3163)
Hours/Week MVPA (M[SD])	11.93 (8.06)	11.15 (8.10)	8.26 (7.52)
Athletic Self-Esteem (M[SD])	1.33 (0.44)	1.26 (0.52)	1.24 (0.59)
Asthma (%[n])	20.8% (403)	21.3% (749)	20.9% (694)
Obesity (%[n])	5.3% (105)	5.1% (155)	7.8% (208)
FEMALES	% (n) or M(SD)		
	13-14 Years Old (n=2756)	16-17 Years Old (n=5761)	19-20 Years Old (n=6044)
Sexual Orientation (%[n])			
Lesbian/Bisexual	0.8% (20)	1.9% (106)	2.9% (172)
Mostly Heterosexual	4.7% (114)	8.6% (467)	10.1% (606)
Completely Heterosexual	94.5% (2316)	89.5% (4891)	87.0% (5215)
Hours/Week MVPA (M[SD])	9.97 (7.12)	9.09 (7.07)	6.31 (6.14)
Athletic Self-Esteem (M[SD])	1.17 (0.46)	1.02 (0.55)	.94 (0.60)
Asthma (%[n])	17.8% (455)	21.8% (1136)	22.8% (1276)
Obesity (%[n])	3.1% (82)	3.1% (171)	7.1% (421)

* Note: Variable n's might not sum to total person-period observations in each age range due to varying waves of assessments of variables and missing values. M(SD): Mean(Standard Deviation)

Table 2
Results from Linear Multivariable Generalized Estimating Equations to Examine Hours/Week of Moderate/Vigorous Physical Activity (MVPA) by Sexual Orientation from Ages 12-22 Years in the Growing Up Today Study

	β (95% Confidence Interval)			
	Model 1 Base Model	Model 2 Adjusting for Covariates	Model 3 Adjusting for Covariates and Gender Nonconformity	Model 4 Adjusting for Covariates and Athletic Self-Esteem
MALES (observations n=6,689)				
Sexual Orientation				
Gay/Bisexual	-3.26 (-4.75, -1.76)****	-2.62 (-4.32, -0.93)**	-1.32 (-3.31, 0.67)	0.22 (-1.31, 1.75)
Mostly Heterosexual	-1.33 (-2.29, -0.36)**	-0.94 (-2.01, 0.13)	-0.70 (-1.83, .42)	0.82 (-.11, 1.74)
Age	17.62 (5.47, 29.76)**	27.49 (9.72, 45.27)**	24.29 (4.45, 44.13)*	26.20 (8.96, 43.45)**
Age ²	-0.97 (-1.72, -0.22)*	-1.56 (-2.64, -0.49)**	-1.37 (-2.57, -.18)**	-1.46 (-2.50, -0.42)**
Age ³	0.02 (0.00, 0.03)*	0.03 (0.01, 0.05)**	0.02 (.00, 0.05)*	0.03 (0.01, 0.05)*
Gender Nonconformity (GNC)				
Top Decile GNC			-2.49 (-3.47, -1.51)****	
Above Median GNC			-0.93 (-1.50, -0.36)**	
Athletic Self-Esteem				3.41 (3.21, 3.60)****
Covariates				
Obesity		-1.67 (-2.54, -0.80)***	-1.58 (-2.59, -0.58)**	-0.25 (-1.05, .54)
FEMALES (observations n=10,778)				
Sexual Orientation				
Lesbian/Bisexual	-1.33 (-2.40, -0.25)*	-1.77 (-2.92, -0.62)**	-1.62 (-2.79, -0.45)**	-.67 (-1.71, 0.38)
Mostly Heterosexual	-1.22 (-1.69, -0.74)****	-1.21 (-1.70, -0.72)****	-1.40 (-1.89, -0.91)****	-0.54 (-0.98, -0.10)**
Age	17.34 (9.29, 25.39)****	23.87 (12.99, 34.75)****	21.49 (10.23, 32.76)****	23.84 (13.15, 34.54)****
Age ²	-0.97 (-1.46, -0.48)***	-1.36 (-2.01, -0.70)****	-1.22 (-1.89, -0.54)***	-1.32 (-1.96, -0.68)****
Age ³	.02 (0.01, 0.03)***	0.02 (0.01, 0.04)***	0.02 (0.01, 0.04)**	0.02 (0.01, 0.04)***
Gender Nonconformity (GNC)				
Top Decile GNC			1.88 (1.29, 2.47)****	
Above Median GNC			.65 (.27, 1.02)***	
Athletic Self-Esteem				3.01 (2.87, 3.14)****
Covariates				
Obesity		-2.04 (-2.75, -1.34)****	-1.89 (-2.64, -1.15)****	-0.92 (-1.55, -0.29)**
Asthma		0.67 (0.29, 1.05)***	0.76 (0.36, 1.16)***	0.49 (0.16, 0.83)*

Note:

* $p < .05$,

**
 $p < .01,$

 $p < .001,$

 $p < .0001$