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Biological and Sociocultural Differences in Perceived Barriers to Physical Activity

Amber Vermeesch
University of Portland, vermeesc@up.edu

Jiying Ling

Vicki R. Voskuil

Marion Bakhoya

Stacey M. Wesolek

See next page for additional authors

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Authors

Amber Vermeesch, Jiying Ling, Vicki R. Voskuil, Marion Bakhoya, Stacey M. Wesolek, Kelly A. Bourne, Karin A. Pfeiffer, and Lorraine B. Robbins

1   **Abstract**

2   **Background:** Inadequate physical activity (PA) contributes to the high prevalence of overweight

3   or obesity among U.S. adolescent girls, but barriers preventing adolescent girls from meeting PA

4   guidelines have not been thoroughly examined.

5   **Objectives:** The threefold purpose of this study was to: 1) determine pubertal stage,

6   racial/ethnic, and socioeconomic status (SES) differences in perceived barriers to PA; 2)

7   examine relationships between perceived barriers and age, body mass index (BMI), recreational

8   screen time, sedentary activity, and PA; and 3) identify girls' perceived barriers.

9   **Method:** Girls ($N = 509$) from eight Midwestern U.S. schools participated. Demographic,

10   pubertal stage, perceived barriers, and recreational screen time data were collected via surveys.

11   Height and weight were measured. Accelerometers measured sedentary activity, moderate-to-

12   vigorous PA (MVPA), and light PA plus MVPA (LMVPA).

13   **Results:** Girls of low SES reported greater perceived barriers to PA than those who were not of

14   low SES (1.16 vs. .97, $p = .013$). Girls in early/middle puberty had lower perceived barriers than

15   those in late puberty (1.03 vs. 1.24, $p < .001$). Girls' perceived barriers were negatively related to

16   MVPA ($r = -.10$, $p = .032$) and LMVPA ($r = -.11$, $p = .021$). Girls' perceived top five barriers

17   included lack of skills, hating to sweat, difficulty finding programs, being tired, and having pain.

18   **Discussion:** Innovative interventions, particularly focusing on skill development, are needed to

19   assist girls in overcoming their perceived barriers to PA.

20

21   **Key words:** Adolescent, Female, Exercise, Puberty

22

1   **Biological and Sociocultural Differences in Perceived Barriers to Physical Activity among**

2   **5th – 7th Grade Urban Girls**

3   Inadequate physical activity (PA) contributes to the high prevalence of obesity in 12-19

4   year-old U.S. girls (20.7%) (Ogden, Carroll, Kit, & Flegal, 2014). The pervasive negative effect

5   of inadequate PA participation on body weight status indicates an urgent need to reverse this

6   disconcerting behavioral trend (Kann et al., 2014). Only 17.7% of adolescent girls in the U.S.

7   report attaining recommendations proposed by both the U.S. Department of Health & Human

8   Services (2008) and World Health Organization (2010) that call for at least 60 minutes of

9   moderate-to-vigorous PA (MVPA) daily (State of Michigan, 2014). Consistently, studies support

10   a sharp decline in girls' PA from ages 9 to 12 (Dumith, Gigante, Domingues, & Kohl, 2011). The

11   decrease is particularly notable among urban-dwelling low socioeconomic status (SES) girls

12   (Wang et al., 2007). Based on 2013 U.S. Youth Risk Behavior Survey data, the prevalence of PA

13   participation for at least 60 minutes daily was higher among White (37.5%), Black (37.2%), and

14   Hispanic (33.9%) adolescent boys than among White (18.7%), Black (16.0%), and Hispanic

15   (17.4%) adolescent girls, respectively (Kann et al., 2014).

16   Attaining adequate PA during adolescence is critical for reducing risks associated with

17   elevated body mass index (BMI), including the development of type 2 diabetes and

18   cardiovascular disease (Belcher et al., 2010). Over a third (33.8%) of U.S. girls, 12-19 years old,

19   are overweight or obese, and over a fifth (20.7%) are obese (Ogden et al., 2014). Racial and

20   ethnic differences exist in weight status with more Black (22.8%) and Hispanic (19.2%) girls

21   being overweight than White girls (14.3%), and more Black girls (16.7%) than Hispanic (11.2%)

22   and White (9.7%) girls being obese (Kann et al., 2014). Because both PA and obesity can track

1   into adulthood, understanding perceived barriers that prevent girls from establishing a habit of

2   regular PA is vital (Clarke, O'Malley, Johnston, Schulenberg, & Lantz, 2009).

3   Acquiring a comprehensive understanding of perceived barriers to PA can be challenging

4   due to differences in noted among various subgroups of girls. For example, difficulty accessing

5   PA programs or classes, is a noted perceived barrier for low SES youth (Humbert et al., 2006).

6   Cultural considerations and peer opinion must be considered in perceived barriers to PA among

7   various subgroups. Black and Hispanic girls are more accepting of larger body size than White

8   girls, as evidenced by White girls with a BMI closer to obese were found to have less social

9   desirability than White girls with a BMI closer to normal weight by their peers (Boyington et al.,

10   2008; Lanza, Echols, & Graham, 2013). Peer social environment, including peer PA levels,

11   especially among female friends, is another perceived barrier to PA for adolescent girls (Larson,

12   Wall, Story, & Neumark-Sztainer, 2013). Kelly et al. (2010) reported that perceived barriers to

13   PA were negatively associated with accelerometer-measured PA for White, but not Black, girls.

14   Dishman, Dunn, Sallis, Vandenberg, and Pratt (2010) found that perceived barriers to PA were

15   correlated inversely with accelerometer-measured PA for girls in 8th grade, but not 6th grade. One

16   quantitative study with girls identified barriers to PA based on academic grade (6th, 7th & 8th) and

17   race (Black and White; Robbins, Pender, & Kazanis, 2003). Although some differences were

18   evident, the sample size was too small to draw any definitive conclusions (N = 77; Robbins et al.

19   (2003)). These findings indicate that understanding the relationship between perceived barriers to

20   PA and the behavior itself and identifying specific barriers to PA require subgroup analysis.

21   Despite a strong likelihood of increasing PA when relevant barriers are effectively

22   targeted, gaps in the literature remain regarding the influence of biological and sociocultural

23   factors on girls' perceived barriers to PA and the relationship between barriers and PA, as well as

1   sedentary activity (Camacho-Minano, LaVoi, & Barr-Anderson, 2011). Interventions designed to

2   overcome perceived barriers to PA by providing access to PA programs or including strategies

3   for promoting positive perceptions regarding PA have shown limited success, indicating that

4   continued investigation of biological and sociocultural differences may offer important insights

5   for tailoring interventions to address the unique needs of varied population subgroups (Camacho-

6   Minano et al., 2011; Van Der Horst, Paw, Twisk, & Van Mechelen, 2007). Because physical

7   transformation of the body during adolescence can modify adolescents' self-perceptions,

8   attitudes, and behavior, examination of pubertal stage differences in perceived barriers to PA is

9   warranted (Waylen & Wolke, 2004). For example, White girls have identified embarrassment or

10   self-consciousness as a barrier more than other races (Robbins et al., 2003). A thorough

11   investigation of the barriers that may underlie the decline in girls' PA that begins around the

12   onset of adolescence, particularly among adolescent girls of low SES and minority backgrounds,

13   is also necessary to understand existing disparities. Therefore, the threefold purpose of this study

14   was to: 1) determine pubertal stage, racial/ethnic, and SES differences in perceived barriers to

15   PA; 2) examine relationships between perceived barriers and age, body mass index (BMI),

16   recreational screen time, sedentary activity, and PA; and 3) identify girls' perceived barriers of

17   the total sample and by pubertal stage, race, and SES.

18   **METHODS**

19   **Study Design, Participants, and Setting**

20   In the first intervention year (2012-2013) of a group randomized controlled trial (2011-

21   2016), eight Midwestern U.S. schools were randomly assigned to either receive a multi-

22   component PA intervention called "Girls on the Move" or serve as a control (Robbins et al.,

23   2013). The trial was based on the Health Promotion Model and Self-Determination Theory

1   (Pender, Murdaugh, & Parsons, 2011; Ryan & Deci, 2000). The trial protocol is described

2   elsewhere (Robbins et al., 2013). Girls meeting the following inclusion criteria were selected for

3   participation on a first come first serve basis: (1) 5th-7th-grade girls; (2) available and willing to

4   participate in the PA club 3 days/week for 17 weeks; (3) available for 9-month follow-up after

5   intervention ends; and (4) able to read, understand, and speak English. Exclusion criteria

6   included: (1) involved in or planning to be involved in school or community sports or other

7   organized PAs that require participation 3 or more days/week after school; and (2) having a

8   health condition precluding safe MVPA (Robbins et al., 2013).

9   Baseline data collected during fall 2012 from 5th-7th grade girls ($N = 509$) in the eight

10   schools were used for this comparative and correlational study. The schools were located in four

11   cities with 39.7%, 20.2%, 36.8%, and 27.1% of the population being below poverty level

12   compared to 16.3% in the state, and the annual income per capita ranged from $14,454 to

13   $20,891 compared to the state level of $25,547 (U.S. Census Bureau, 2014). Approximately 3.0-

14   14.3% of the population was Hispanic, and 23.7-56.6% was Black (U.S. Census Bureau, 2014).

15   The proportion of students involved in free or reduced-price lunch programs (financially

16   disadvantaged) ranged from 59.7% to 95.0% ($M = 74.0\%$; State of Michigan, 2014). On average,

17   30.3% of the students were White (min-max: 1.2-49.2%), 58.4% were Black (min-max: 23.2-

18   100%), and 9.2% were Hispanic (min-max: 2.9-18.7%; State of Michigan, 2014) .

19   **Measures**

20   **Demographic survey.** The demographic survey had questions that addressed age,

21   academic grade, race, ethnicity, and SES. Enrollment in the free or reduced-price lunch program

22   served as a proxy for SES. Parents/guardians completed the survey in collaboration with their

23   daughters.

1   **Pubertal stage**. Pubertal stage was categorized as early, middle, and late puberty, and

2   was assessed by the Pubertal Development Scale (Peterson, Crockett, Richards, & Boxer, 1988).

3   Validity and reliability have been established with girls as young as those in the 5th and 6th

4   grade (Carskadon & Acebo, 1993; Peterson et al., 1988). Pubertal stage was computed by

5   summing self-reported scores for underarm hair growth, breast development, and menarche.

6   Response choices to measure hair and breast development included: (1) no; (2) yes, barely; (3)

7   yes, definitely; and (4) development complete. For menarche, girls reported either: no

8   menstruation (indicating early or middle puberty) or yes, menstruation started (indicating late

9   puberty; Carskadon & Acebo, 1993). Girls reporting no menstruation with summed scores ≤ 3

10   for underarm hair growth and breast development were considered to be in early puberty,

11   whereas those having summed scores > 3 were categorized as being in middle puberty

12   (Carskadon & Acebo, 1993).

13   **Body mass index (BMI).** BMI was calculated with girls' height and weight (kg/m^2)

14   without shoes using standardized procedures described elsewhere (Robbins et al., 2013).

15   **Recreational screen time, sedentary activity, and physical activity.** Recreational

16   screen time was calculated as the amount of time spent viewing television (TV), talking on the

17   phone or sending messages, and playing video games or using the computer or Internet for non-

18   school-related work (Costigan, Barnett, Plotnikoff, & Lubans, 2013). Girls responded to six

19   items when reporting number of hours that they spent engaging in each activity on a typical

20   school day and weekend-day. Response choices ranged from 0 = *I do not* (the specific behavior)

21   to 5 = *5 or more hours per day*. For this study, Cronbach's alpha was .82 with item-total

22   correlation coefficients ranging from .52 to .63.

1   To assess minutes per hour of sedentary activity, MVPA, and light plus MVPA

2   (LMVPA), the ActiGraph® GT3X-plus accelerometer was used. Girls were asked to wear

3   accelerometers seven consecutive days except when showering, swimming, and sleeping at

4   night. Data generated for at least eight hours daily on at least three weekdays and one weekend

5   day were considered adequate for analysis (Patnode et al., 2011). Investigators downloaded and

6   processed the data using the ActiLife® software program. Evenson, Catellier, Gill, Ondrak, and

7   McMurray (2008) cut points for children were used to analyze data. Trost, Loprinzi, Moore, and

8   Pfeiffer (2011) found Evenson et al. (2008) cut points to be acceptable among 5- to 15-year-old

9   children and adolescents. Average minutes per hour were determined to account for variable

10   wear time.

11   **Perceived barriers to physical activity.** A 9-item Perceived Barriers Scale was

12   previously developed to measure perceptions of obstacles interfering with PA (Robbins, Wu,

13   Sikorski, & Marley, 2008). Response choices included: 0 = *not at all true;* 1 = *not very true;* 2 =

14   *somewhat true;* and 3 = *very true.* Higher scores indicated a more negative perception.

15   Acceptable face, content, and construct validity, and reliability estimated by Cronbach's alpha of

16   .78 have been reported (Robbins, Sikorskii, Hamel, Wu, & Wilbur, 2009; Robbins et al., 2008).

17   Prior to this study, seven new items were added to the scale based on recommendations from

18   6th-8th grade girls ($N = 25$) participating in focus groups conducted by one of the authors

19   (Robbins et al., 2013). Examples of items include: "I have some pain from activity", "The

20   weather is bad", and "I am too busy". Additional items enhanced the comprehensiveness of the

21   scale in this study, resulting in an increased Cronbach's alpha of .85 with item-total correlation

22   coefficients ranging from .35 to .57.

23   **Procedures**

1   The University Institutional Review Board (IRB) and school district administrators

2   approved the study. Recruitment procedures and response rates have been reported (Ling,

3   Robbins, Resnicow, & Bakhoya, 2014; Robbins et al., 2013). During data collection, girls

4   completed an iPad-delivered survey that included the perceived barriers to PA and recreational

5   screen time measures. Data collectors measured height and weight to calculate BMI. Each girl

6   completed the Pubertal Development Scale behind a privacy screen. Afterwards, girls watched

7   an instructional video on wearing the accelerometer and received an accelerometer, along with

8   written instructions to share with parents/guardians. Additional details are described elsewhere

9   (Robbins et al., 2013).

10   **Data Analysis**

11   Data were analyzed using the Statistical Package for the Social Sciences (SPSS 21.0).

12   Independent samples t-tests and one-way ANOVA examined biological (e.g. pubertal stage) and

13   sociocultural (e.g. race/ethnicity, SES) differences in BMI, recreational screen time, sedentary

14   activity, PA, and perceived barriers. Pearson product-moment bivariate correlations were

15   calculated to examine the associations among age, BMI, recreational screen time, sedentary

16   activity, PA, and perceived barriers. Four-hundred-sixty-two (90.8%) girls provided acceptable

17   accelerometer data for analysis. On average, they girls wore the accelerometer for about 14 hours

18   per day ($SD = 1.81$, min-max: 10.25-23.29). Identification of the top five perceived barriers was

19   based on percentages of girls selecting "somewhat true" or "very true." A mixed effects model

20   was applied to examine the random nested effects of school and fixed effects of age, ethnicity,

21   race, age, SES, puberty stage, BMI z score, and perceived barriers on MVPA.

22   **RESULTS**

23   **Demographics**

1   Almost four-fifths of the girls were 11-12 years old ($n = 404$, 79.4%), and slightly over

2   half were in the 6th grade. Greater than half were Black, and the majority participated in the free

3   or reduced-price lunch program. Due to the small number of girls in early puberty ($n = 15$,

4   2.9%), early and middle puberty were collapsed into a new category called early/middle puberty

5   ($n = 300$, 58.9%). The remaining girls were in late puberty. All girls in late puberty, but none in

6   early/middle puberty, had started menstruation. Table 1 presents additional sample

7   characteristics.

8   **BMI, Recreational Screen Time, Sedentary Activity, and Physical Activity**

9   Over half of the girls were overweight (21.5%) or obese (32.3%). Significant racial

10   differences in BMI [$F_{(504,2)} = 6.55$, $p = .002$] and BMI z-score [$F_{(504,2)} = 3.77$, $p = .024$] occurred.

11   Specifically, Black girls had higher BMI ($M = 23.55$, $SD = 5.64$ vs. $M = 21.39$, $SD = 4.45$) and

12   BMI z-score ($M = 1.08$, $SD = 1.02$ vs. $M = .79$, $SD = .85$) than White girls. Girls in late puberty

13   had a higher BMI z-score than those in early/middle puberty (see Table 2). No SES differences

14   in BMI occurred. BMI was positively correlated with age ($r = .16$, $p < .001$) and self-reported

15   recreational screen time ($r = .11$, $p = .014$), but negatively correlated with MVPA ($r = -.12$, $p =$

16   .012).

17   Girls reported an average of 6.21 hours of total daily recreational screen time, with a

18   mean of 5.70 hours ($SD = 3.44$) on school days and 6.72 hours ($SD = 3.64$) on weekend-days.

19   Average time in sedentary activity was 38.24 minutes/hour. Girls participated in 3.07

20   minutes/hour of MVPA with a maximum of 8.56 minutes/hour. Significant racial differences in

21   recreational screen time emerged [$F_{(503,2)} = 6.90$, $p = .001$] with Black girls reporting more

22   recreational screen time than White girls ($M = 6.64$, $SD = 3.40$ vs. $M = 5.35$, $SD = 3.06$, $p =$

23   .002). Early/middle puberty girls participated in more LMVPA and MVPA and had less

1   recreational screen time and sedentary activity than those in late puberty (see Table 2). Age was

2   positively correlated with sedentary activity ($r = .25$, $p < .001$) and recreational screen time ($r =$

3    $.25$, $p < .001$), but negatively correlated with MVPA ($r = -.21$, $p < .001$) and LMVPA ($r = -.25$, p

4    $< .001$).

5   Table 3 presents the random and fixed effects of school, age, ethnicity, race, age, SES,

6   puberty stage, BMI z score, and perceived barriers on MVPA. The two significant predictors for

7   MVPA were puberty stage and age. Specifically, girls in early/middle puberty participated in an

8   average of .47 minutes/hour higher of MVPA than peers in late puberty. With girls age

9   increasing by one year, their MVPA decreased by .26 minutes/hour. The nested effects of school

10   only accounted for about 2.9% of the variance in random effects, thus, the nested effect of school

11   is not a concern in this study.

12   **Perceived Barriers to Physical Activity**

13   Low SES girls reported significantly greater perceived barriers to PA ($M = 1.16$, $SD =$

14   $.58$) than those who were not of low SES [$M = .97$, $SD = .57$; $p = .013$]. Perceived barriers to PA

15   were lower among early/middle pubertal girls than late pubertal girls (see Table 2). Age was

16   positively correlated with perceived barriers to PA ($r = .12$, $p = .008$). No significant racial or

17   ethnic differences emerged in perceived barriers. Perceived barriers were negatively related to

18   LMVPA ($r = -.11$, $p = .021$) and MVPA ($r = -.10$, $p = .032$), but positively correlated with

19   sedentary activity ($r = .11$, $p = .021$) and recreational screen time ($r = .22$, $p < .001$).

20   Table 4 presents the top five perceived barriers for the total sample and for each pubertal

21   stage, race, and SES. The only barrier identified by over half of all girls (51.5%) was lack of

22   skills. The majority of girls in late puberty (56.9%) also indicated that lack of skills was a major

23   barrier followed by hating to sweat during the school day (56.5%) and difficulty finding PA

1 programs or classes they like (53.6%). The majority of Black girls (54.6%) considered hating to

2 sweat during the school day as a barrier followed by lack of skills (51.0%). For low SES girls,

3 the majority indicated that hating to sweat during the school day (54.2%) followed by lack of

4 skills (52.5%) were major barriers. In contrast, percentages related to each barrier were all under

5 50% for girls in early/middle puberty, girls who were White or mixed race, and girls who were

6 not of low SES.

7 **DISCUSSION**

8 This comparative and correlational study including 5th-7th grade urban Midwestern U.S.

9 girls examined pubertal stage, racial/ethnic, and SES differences in perceived barriers to PA and

10 the relationships among the following variables: age, BMI, recreational screen time, sedentary

11 activity, PA, and perceived barriers to PA. Pubertal stage, racial/ethnic, and SES differences in

12 girls' top perceived barriers to PA were also identified. A broad understanding of biological and

13 sociocultural differences in perceived barriers to PA can be instrumental in designing

14 interventions using systematic and meaningful personalized strategies to assist diverse groups of

15 urban girls to overcome their perceived barriers to PA.

16 **BMI, Recreational Screen Time, Sedentary Activity, and Physical Activity**

17 The prevalence of girls who were overweight or obese in this study was 53.8%, higher

18 than the U.S. percentage of approximately 33.8% reported for 12- to 19-year-old girls (Ogden et

19 al., 2014). In addition, the study's urban sample was mainly comprised of girls of low SES.

20 Consistent with previous research, Black girls had a higher BMI and reported more recreational

21 screen time than White girls (Kann et al., 2014). Thus, effective interventions are urgently

22 needed to control the obesity crisis in urban adolescent girls, especially among Black girls of low

23 SES.

1   Findings that girls in late puberty had higher BMI and more recreational screen time and

2   sedentary activities than those in early/middle puberty are comparable to other results noted in

3   the literature. Brodersen, Steptoe, Boniface, and Wardle (2007) reported that as girls age, their

4   sedentary behavior increases. Additionally, strong evidence indicates a positive association

5   between recreational screen time and weight status, and a negative association between

6   recreational screen time and participation in PA (Costigan et al., 2013).

7   Although this study demonstrated that girls in late puberty participated in less MVPA

8   than those in early/middle puberty, conflicting findings concerning the relationship between

9   pubertal stage and PA exist (Finne, Bucksch, Lampert, & Kolip, 2011; Smart et al., 2012). In a

10   study involving 6813 adolescents, aged 11-17 years, pubertal stage correlated with boys', but not

11   girls', self-reported PA (Finne et al., 2011). Another study with 222 adolescent girls

12   demonstrated pubertal stage had a negative and indirect effect on self-reported PA through

13   perceptions of sports competence, body attractiveness, and physical condition (Smart et al.,

14   2012). Even though positive correlations between adolescent self-report of PA and accelerometer

15   data have been noted, self-report of PA may be one explanation for the inconsistent findings

16   concerning girls' pubertal stage and their PA (Chinapaw, Lidwine, van Poppel, van Mechelen, &

17   Terwee, 2010). Reliable and valid measurements of PA are important for examining the

18   relationship between pubertal stage and PA.

19   **Perceived Barriers to Physical Activity**

20   Findings that perceived barriers were negatively and weakly correlated with both

21   LMVPA and MVPA are both similar and contradictory to results of other studies. Similar to this

22   study's findings, Young et al. (2014) found a negative relationship between barriers to PA and

23   accelerometer-measured MVPA among girls in 6th, 8th, and 11th grades. Although significant, the

1   low correlation of -.10 between perceived barriers and MVPA in this study may be due to the

2   bias resulting from a common method artifact of self-report. Dishman et al. (2010) explains that

3   low correlations are not surprising when a subjective and objective measure are employed

4   because use of self-report to measure both girls' beliefs and their PA may lead to inflated

5   relations between the two. Taking a different approach, Kelly et al. (2010) reported racial

6   differences in the correlation between barriers to PA and accelerometer-measured MVPA,

7   whereas Dishman et al. (2010) noted perceived barriers did not differ among girls of varied racial

8   and ethnic backgrounds. Racial and ethnic influences on the relationship between perceived

9   barriers and PA may need further investigation.

10   Consistent with previous studies, lack of skills followed by intrapersonal factors such as

11   hating to sweat emerged as the most frequently reported perceived barriers among girls (Kelly et

12   al., 2010; Rees et al., 2006). Similarly, among Canadian and Spanish adolescent girls, perceived

13   incompetence in sports was found to be one of the top two barriers to PA (Bélanger et al., 2011;

14   Zaragoza, Generelo, Julián, & Abarca-Sos, 2011). Interventions focused on skill development

15   may be essential for girls to enhance their PA self-efficacy and other related factors to promote

16   continued PA engagement (Humbert et al., 2006). Expressions of not being good enough to

17   participate in PA figured prominently in previously conducted focus group discussions among

18   Australian adolescent girls and face-to-face interviews among British adolescent girls (Stanley,

19   Boshoff, & Dollman, 2013; Wetton, Radley, Jones, & Pearce, 2013). In the current study,

20   because over 50% of the girls who were Black, in late puberty, and of low SES reported lack of

21   skills as a barrier, identifying ways to help girls, particularly those in these three subgroups,

22   increase their PA skills is important for assisting them to achieve PA recommendations.

1   Several studies support that embarrassment, body image concerns, and physical

2   discomfort, including sweating or fatigue, are barriers frequently reported by girls (Kelly et al.,

3   2010; Wetton et al., 2013). Rees et al. (2006) found that barriers, such as body insecurity, were

4   more concerning for girls than boys. Despite conflicting prior reports, racial or ethnic differences

5   were evident in this study with the majority of Black girls, but not White girls, reporting

6   sweating, as well as lack of skills, as barriers (Dishman et al., 2010; Kelly et al., 2010). Similar

7   to findings reported by Robbins et al. (2003), the highest percentage of White girls in this study

8   (46.9%) identified embarrassment or self-consciousness as a barrier. Consistent with these

9   results, hating to sweat during the school day emerged as the second most prevalent barrier in

10 our study. This information underscores the importance of assisting girls to avoid negative body

11 image and self-esteem issues, while simultaneously helping them to attain adequate PA,

12 particularly as they progress through puberty.

13   Although finding PA programs or classes did not emerge as a major problem for girls

14 who were not of low SES, 49.0% of low SES girls reported difficulty in this area. Though

15 research examining SES and perceived barriers to PA among girls is limited, access issues, such

16 as lack of PA facilities and cost of programs, have previously been reported as barriers to PA

17 participation for youth of low SES (Humbert et al., 2006). Lack of access is also a major barrier

18 to PA for Canadian adolescent girls (Bélanger et al., 2011). McCarron et al. (2010) found that

19 across demographics, community members identified the need for external sources, such as

20 schools, to contribute to a built environment that is supportive of PA for adolescents, especially

21 girls, through collaborative partnerships with the community. Therefore, assisting girls of low

22 SES to access PA programs or classes that they like should be a primary focus of future

23 interventions.

1   Although lack of time for PA, often resulting from school-related academic

2   responsibilities, emerged as a major barrier to PA among British girls participating in a prior

3   study, the majority of girls in either the total sample or any subgroup in this study (e.g., pubertal

4   stage, race, or SES) did not identify lack of time as a barrier to PA (Wetton et al., 2013). A high

5   percentage of girls in late puberty (46.4%), however, did report that others want them to do tasks

6   other than PA with their time, perhaps resulting from having greater family obligations than

7   those of early/middle pubertal girls. This barrier, identified in low SES adolescents, presumably

8   increases with advancing maturity, and increased ability to participate in family obligations

9   (Humbert et al., 2006). Researchers may need to consider unique family responsibilities and

10   ways to improve time management skills when aiming to improve the PA of late pubertal girls.

11   Similar to lack of time, lack of motivation is consistently identified in the literature as a

12   perceived barrier to PA among girls, indicating that interventions focused on enhancing

13   motivation may lead to increased PA (Robbins et al., 2003; Robbins et al., 2009). Contrary to

14   this information, lack of motivation was not reported by the majority of girls in this study.

15   Consistent with prior studies showing that being tired interferes with PA among both male and

16   female adolescents, ages 11 to 14, all subgroups in this study, except for those in late puberty,

17   identified this barrier as a major problem (Robbins et al., 2009). Qualitative research may be

18   needed with urban adolescent girls, particularly those in early or middle puberty, to explore

19   reasons underlying this barrier as well as social determinants of PA so that they can be

20   adequately addressed in interventions.

21   **Implications**

22   Future research is needed to design and test interventions that are specifically tailored to

23   meet the needs of various subgroups of girls to target their perceived barriers to PA (Camacho-

1   Minano et al., 2011; Robbins et al., 2003; Robbins et al., 2009). Tailoring interventions based on

2   biological and sociocultural characteristics, particularly pubertal stage and SES, may be a

3   promising approach. Interventions that focus on skill development, offer some measure of

4   privacy for PA, provide access to showers and personal hygiene products, and include activities

5   not likely to induce profuse sweating (i.e. brisk walking), may be more appealing to girls and

6   efficacious in increasing their PA.

7   Adolescents in general and adolescent girls in particular, need to be presented with

8   opportunities to provide input regarding the design of programs to increase their PA (Stanley et

9   al., 2013). This approach may help uncover unique barriers and assist girls in being more

10   invested in PA programs (Humbert et al., 2006; Stanley et al., 2013). Allowing girls to provide

11   input regarding their PA programs may also lead to an increase in activities being offered that

12   they find enjoyable and a decrease in those in which girls feel unskilled. This effort may result in

13   a reduction of several major perceived barriers, including lack of skills, sweating during the

14   school day, and an inability to find enjoyable PA programs. Humbert et al.(2006) suggest that, in

15   interventions for low-SES youth in particular, emphasis needs to be placed on offering enjoyable

16   PA and increasing students' skill development and confidence, while considering environmental

17   factors. Girls of low SES may not have the resources, financial or otherwise, associated with PA

18   participation away from the school venue; thus, physical education, after-school PA programs

19   with transportation home afterward, and other school-based approaches (e.g., before-school PA

20   programs, recess, class breaks for PA) are critical for assisting them to attain adequate PA.

21   Perhaps, increasing parental support for PA by assisting parents to encourage and monitor their

22   daughter's PA throughout the adolescent period may be one solution to overcoming some

23   perceived barriers. Although increasing girls' PA continues to represent a major challenge for

1   researchers, assisting girls to reduce their perceived PA barriers certainly can aid in overcoming

2   this challenge.

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