

# Sedentary Behaviors in Fifth-Grade Boys and Girls: Where, with Whom, and Why?

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## Abstract

**Background:** An understanding of the context surrounding screen- and non-screen-based sedentary behavior would facilitate efforts to reduce children's overall sedentary behavior. This study examined the prevalence of specific types of sedentary behavior in children, the social and physical contexts surrounding these behaviors, and differences by gender.

**Methods:** Participants included 686 fifth graders participating in the Transitions and Activity Changes in Kids Study (TRACK). The Physical Activity Choices instrument measured child participation in seven sedentary behaviors, the social (i.e., with whom) and physical (i.e., where) contexts, and perceptions (i.e., why) of those behaviors. Analysis included mixed-model regression adjusted for race/ethnicity, BMI, and socioeconomic status.

**Results:** Children participated in both screen- and non-screen-based sedentary behaviors at very high frequencies. The most popular activities included watching television or videos, listening to music, playing video games (boys only), and talking on the phone or texting (girls only). Children engaged in sedentary behaviors most often at home, at school, or in their neighborhood. In general, the patterns of social context for the behaviors were similar for boys and girls, with the exception of video game playing. Girls perceived listening to music and talking on the phone or texting to be more fun than boys; children did not differ in their other perceptions (i.e., how much choice or how important) of the behaviors.

**Conclusions:** Multi-level interventions that target reducing sedentary behavior in the home, neighborhood, and school context may be most effective; however, the approach needed will likely differ by gender.

## Introduction

Excessive time spent in sedentary behavior has been associated with obesity,<sup>1,2</sup> unfavorable metabolic profiles,<sup>3,4</sup> and poorer physical fitness and psychosocial health in children.<sup>5,6</sup> According to a recent large, population-based report, American children and youth 8–18 years of age spend an average of 10.7 hours per day (11.2 hours per day for boys and 10.3 hours per day for girls) in various types of sedentary behavior, such as watching television (TV), playing video games, and listening to music.<sup>7</sup> The same report also indicated that children have increased the amount of time they spend in sedentary behavior by more than 3 hours per day over the past 10 years. Further, longitudinal evidence suggests that the prevalence of sedentary behavior in children increases over time.<sup>8–10</sup> These trends toward sedentariness are con-

cerning, given that behavior patterns formed in childhood will likely continue into adolescence and adulthood.<sup>10–12</sup>

Recent increases in sedentary behavior in children and youth may be attributable, in part, to an increase in behaviors such as talking on cell phones, listening to music with MP3 players, and reading on mobile computers.<sup>7</sup> However, the majority of studies examining sedentary behavior in children and youth have focused primarily on TV viewing<sup>5</sup> and have not accounted for other important behaviors that may contribute to overall time spent being sedentary. To date, no previous studies have examined both the social and physical contexts of a wide range of types of sedentary behavior in children.

Given the high and increasing prevalence of sedentariness in children, along with the associated health risks, effective interventions to reduce sedentary behavior are needed. Reviews of the literature have provided evidence

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of several successful interventions designed to reduce screen-based sedentary behavior in children<sup>13–15</sup>; however, interventions designed to reduce non-screen-based sedentary behavior are lacking. To optimize effectiveness, interventions should be guided by an understanding of the context of specific sedentary behaviors, including where, with whom, and why children are engaging in specific types of sedentary behavior. The aim of the present study was to determine the prevalence of specific types of sedentary behavior in children and the social and physical contexts surrounding these behaviors, as well as whether any differences exist by gender.

## Methods

### *Participants and Setting*

Data were drawn from the TRACK Study, a multi-level, longitudinal study of influences on the changes in children's physical activity as they transition from elementary to middle school. The present analyses include baseline data on a total of 686 fifth-grade students (308 boys and 378 girls).

Children were recruited from 21 public elementary schools in two school districts in South Carolina. District approval was obtained through meetings with district superintendents and administrators before soliciting school participation. All seven of the elementary schools in one district (site A) and 14 of the 17 elementary schools in the other district (site B) agreed to participate. Recruitment assemblies were held in all schools, during which fifth graders were invited to participate in the study and received information regarding the data collection procedures. Informed consent packets were sent home with the children for their parents to read, complete, and return. Children also gave their assent before beginning any study procedures. Sixty-four percent of recruited students at site A and 57% of recruited students at site B provided consent and assent. Consenting students were representative of age, gender, and race/ethnicity of the students attending schools in those districts. The institutional review board at the University of South Carolina (Columbia, SC) approved all protocols.

### *Measures*

*Sedentary behaviors and context variables.* The Physical Activity Choices (PAC) instrument was used to measure participation in specific forms of activities, social and physical contexts, and perception of the behavior for those activities. The PAC was based on the Three Day Physical Activity Recall (3DPAR) instrument,<sup>16</sup> but instead of asking about the activity performed during specific time blocks, participants responded about *any* participation in the activity *over the past 5 days* (which may or may not have included any weekend days). Participants completed the PAC using a computer-assisted, self-administered protocol and were guided through a list of 56 activities (seven sedentary and 49 physical activities). If they responded “yes,” they were asked about the number of days

the activity occurred, how long they did the activity on each occasion (average minutes), and whether the activity occurred only at school, only outside of school, or both at school and outside of school. The present analyses focused only on participants' sedentary behaviors (i.e., homework, listening to music, music lessons or practicing an instrument, playing video games, reading, talking on the phone or texting, and watching TV or a movie). The underlying assumption in the methodology was that the activities selected for inclusion are often or typically engaged in as sedentary behavior according to the definition “any waking behavior characterized by an energy expenditure  $\leq 1.5$  METs while in a sitting or reclining posture.”<sup>17</sup>

Participants reported the location (physical context) where each sedentary behavior occurred, checking as many categories as applied (e.g., school, recreation center, park or playground, gym, neighborhood, home, car or bus, church, and other location). Participants also reported the social context for the behavior, including with whom the activity most often occurred (e.g., by oneself, with one other person, with several people, or with a class or team), and their perception of the behavior overall. Perception items were assessed on a 4-point Likert scale and included how important it was for them to do the activity (1 = not important; 4 = extremely important), how fun the activity was (1 = not fun at all; 4 = extremely fun), and how much choice they had in engaging in the activity (1 = not my choice at all; 4 = completely my choice).

*Sociodemographic variables.* Participants self-reported their age, gender, and race/ethnicity. For race, they were asked to check as many categories as applied (white, black/African American, Asian, American Indian/Alaskan Native, and other). They were also asked to identify whether they considered themselves Hispanic or Latino. Race/ethnicity responses were recoded as black, white, Hispanic, and other/mixed race. Highest level of parental education was reported on a parent survey and used as a proxy for socioeconomic status (SES); item responses were recoded to “high school or less” and “more than high school.” Participant height and weight were measured by trained staff at baseline using Seca 213 height boards and Seca model 869 scales (Seca, Hamburg, Germany). BMI was calculated using the standard equation: body weight (kg)/height (m<sup>2</sup>).

### *Statistical Analyses*

Descriptive statistics were calculated for the socio-demographic characteristics for the total sample and by gender. *T*-tests and chi-square analyses were used to determine whether there were differences in characteristics by gender. Unadjusted frequencies, average number of days, average minutes per day, and total accumulated minutes (average number of days \* average min/day) were calculated for the seven sedentary behaviors for boys and girls separately. Unadjusted frequencies also were calculated for the location where the sedentary behaviors occurred during the past 5 days. Because a total of nine

locations were possible and more than one could be reported for each activity, these frequencies were used for descriptive purposes only. For each sedentary behavior, frequencies for with whom the activity occurred, how important it was for them to do the activity, how fun the activity was, and how much choice they had in engaging in the activity were calculated by gender. Means (standard deviation; SD) were also calculated for the scaled responses to the three perception items (i.e., “how fun,” “how important,” and “how much choice”) for each sedentary activity.

Mixed-model regression (Proc Glimmix, with binomial or multinomial distribution) was used to determine gender differences in the prevalence of sedentary behavior, social and physical context, and perceptions. All analyses were adjusted for race/ethnicity, BMI, and SES. School nested within location (i.e., study site) was treated as a random effect. All analyses were conducted with SAS 9.2 statistical software (SAS Institute Inc., Cary, NC).

## Results

### *Sociodemographic Characteristics*

Descriptive statistics for sociodemographic characteristics of boys and girls by study site are presented in Table 1. The mean age of the total sample was 10.5 years (SD, 0.6). Approximately 37% of the children were categorized as black, 36% were white, 16% were other race/ethnicity, and 10% were Hispanic. Race/ethnicity differed significantly between study site and between genders at site B only. Further, significant differences in age and parent education were also present between study sites. Age differences are attributable to the sequential nature of data collection, first at site B then site A.

### *Prevalence of Sedentary Behavior*

Gender differences in the prevalence of types of sedentary behavior are shown in Table 2. The top three most-prevalent sedentary behaviors reported by girls were watching TV or a movie ( $389.0 \pm 428.9$  minutes), listening to music ( $388.2 \pm 508.2$  minutes), and talking on the phone or texting ( $375.7 \pm 509.0$  minutes). The three most-prevalent sedentary behaviors for boys were watching TV or a movie ( $510.8 \pm 555.3$  minutes), playing video games ( $347.1 \pm 284.9$  minutes), and listening to music ( $329.9 \pm 500.5$  minutes). Marked gender differences existed in the amount of time spent in the sedentary behaviors after adjusting for covariates (i.e., race/ethnicity, BMI, and SES). Boys were significantly more likely than girls to report watching TV or a movie ( $510.8 \pm 555.3$  vs.  $389.0 \pm 428.9$  minutes, respectively) and playing video games ( $347.1 \pm 284.9$  vs.  $253.7 \pm 214.4$  minutes, respectively). Meanwhile, girls were significantly more likely than boys to report talking on the phone or texting ( $375.7 \pm 509.0$  vs.  $280.3 \pm 213.2$  minutes, respectively) and doing homework ( $237.0 \pm 337.2$  vs.  $152.9 \pm 211.4$  minutes, respectively).

### *Physical Context of Sedentary Behavior*

The specific locations where children reported engaging in each sedentary behavior are presented for the total group and by gender in Table 3. The most popular locations where both girls and boys reported listening to music were at home (75.9 and 61.1%, respectively), in a car or bus (40.1 and 33.2%, respectively), and in their neighborhood (30.4 and 25.3%, respectively). Girls, compared to boys, reported talking on the phone or texting more often at home (90.0 and 76.4%, respectively), in their neighborhood (35.4 and 26.8%, respectively), in the car or bus (34.6 and 21.7%, respectively), or “other” location (28.1 and

**Table 1. Characteristics of the Fifth-Grade Participants by Study Site for the Total Group and by Gender**

Characteristics	Site A				Site B			
	Total (N=344)	Boys (N=158)	Girls (N=186)	p value <sup>a</sup>	Total (N=342)	Boys (N=150)	Girls (N=192)	p value <sup>a</sup>
Age (years) <sup>***</sup>	10.3±0.5	10.4±0.5	10.3±0.5	0.15	10.8±0.5	10.8±0.5	10.7±0.5	0.63
BMI (kg/m <sup>2</sup> )	21.1±4.9	20.7±4.9	21.4±4.8	0.15	21.0±5.1	20.7±5.1	21.2±5.0	0.34
Race/ethnicity (%) <sup>**</sup>				0.65				0.045
Black	40.7	44.3	37.6		33.9	34.7	33.3	
Hispanic	11.9	11.4	12.4		8.2	12.7	4.7	
White	30.2	27.9	32.3		42.7	38.0	46.4	
Other/mixed race	17.2	16.5	17.7		15.2	14.7	15.6	
Parent education (%) <sup>*</sup>				0.44				0.34
High school or less	36.3	34.2	38.2		28.7	26.0	30.7	

p values for the difference between total group at site A and site B: \*\*\*p < 0.0001; \*\*p < 0.01; \*p < 0.05.

<sup>a</sup>p values for the difference between boys and girls at each site.

**Table 2. Participation in Specific Sedentary Behaviors for Fifth-Grade Boys and Girls**

Sedentary behavior	Frequency (%)	Average no. of days	Average minutes per day	Total accumulated minutes
Homework (N=671)				
Boys (N=300)	74.3***	2.6 ± 1.4**	59.3 ± 67.8*	152.9 ± 211.4**
Girls (N=371)	74.7	3.0 ± 1.6	71.6 ± 73.0	237.0 ± 337.2
Listening to music (N=673)				
Boys (N=301)	76.1	3.4 ± 2.1*	87.2 ± 96.2	329.9 ± 500.5
Girls (N=372)	89.3	3.8 ± 3.5	92.5 ± 90.5	388.2 ± 508.2
Music lessons, practicing instrument (N=667)				
Boys (N=297)	28.0	2.2 ± 1.6	63.0 ± 63.6	162.3 ± 269.1
Girls (N=370)	26.8	2.3 ± 1.5	76.5 ± 66.8	184.1 ± 206.8
Playing video games (N=663)				
Boys (N=299)	76.9*	2.8 ± 1.8	110.8 ± 97.1**	347.1 ± 284.9*
Girls (N=364)	68.9	2.7 ± 1.7	85.7 ± 75.8	253.7 ± 214.4
Reading (N=597)				
Boys (N=263)	67.6***	2.9 ± 1.8	64.5 ± 62.9	210.5 ± 298.9
Girls (N=334)	80.4	3.2 ± 1.8	71.8 ± 73.5	246.0 ± 338.6
Talking on the phone or texting (N=675)				
Boys (N=303)	51.8	3.3 ± 2.0	75.9 ± 89.5*	280.3 ± 213.2*
Girls (N=372)	69.9	3.4 ± 2.0	95.6 ± 106.7	375.7 ± 509.0
Watching TV or a movie (N=671)				
Boys (N=301)	81.4***	3.5 ± 2.1	137.3 ± 105.7**	510.8 ± 555.3**
Girls (N=370)	87.3	3.3 ± 2.0	112.5 ± 84.6	389.0 ± 428.9

Sample sizes vary as a result of child report of whether or not they participated in the activity in the past 5 days.

*p* values for the difference between boys and girls adjusted for race/ethnicity, socioeconomic status, BMI, school, and study site:

\*\*\**p* < 0.0001; \*\**p* < 0.01; \**p* < 0.05.

17.8%, respectively). Overall, with the exception of music lessons or practicing an instrument, home was the most popular location where both girls and boys reported engaging in sedentary behaviors.

### *Social Context of Sedentary Behavior*

Figure 1 presents the social context (i.e., “with whom”) of the reported sedentary behaviors by gender. Boys were significantly more likely to report playing video games with other people, whereas girls were more likely to report playing video games by themselves (*p* < 0.05). There were no other significant gender differences in the social context of sedentary behavior.

### *Perceptions of Sedentary Behavior*

Mean scores for children’s perceptions of each sedentary behavior are included in Table 4. Girls perceived listening to music to be more fun than boys (*p* < 0.01). Girls also

perceived talking on the phone or texting to be more fun than boys (*p* < 0.05). Girls and boys did not differ in their mean scores of “how important” they perceived each activity to be. Likewise, there were no differences in the mean scores between boys’ and girls’ perceptions of “how much choice” they believed that they had regarding engaging in each sedentary behavior. With the exception of homework, the majority of both boys and girls reported that participating in the activity was either completely or partly their choice (results not shown).

## Discussion

In the past few years, Australia, Canada, and the UK have released sedentary behavior guidelines for children that recommend limiting daily sedentary (sitting) time.<sup>18–20</sup> Though the United States has not released any comparable sedentary behavior guidelines for children and youth, the

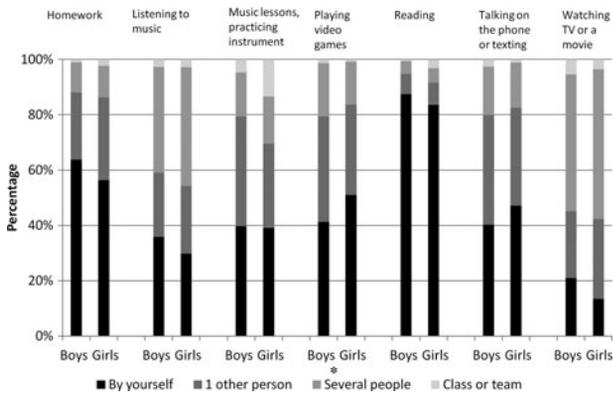
**Table 3. Locations Where Children Reported Engaging in Sedentary Behavior for Total Group (N = 686) and by Gender (N = 308 Boys; N = 378 Girls)**

Activity	Percent reporting where activity was performed								
	School	Recreation center	Park/playground	Gym	Neighborhood	Home	Car/bus	Church	Other
Homework									
Total	21.6	4.4	6.6	4.4	11.8	69.6	9.6	2.2	8.8
Boys	20.6	4.9	5.8	4.0	10.3	67.7	9.9	1.0	7.2
Girls	22.4	4.0	7.2	4.7	13.0	71.1	9.4	3.2	10.1
Listening to music									
Total	9.8	4.1	13.4	10.3	28.3	69.9	37.3	13.9	18.9
Boys	5.7	4.4	10.9	10.5	25.3	61.1	33.2	10.9	15.3
Girls	12.7	3.9	15.1	10.2	30.4	75.9	40.1	16.0	21.4
Music lessons, practicing instrument									
Total	11.8	4.9	7.1	3.3	7.7	47.3	1.6	12.1	17.0
Boys	6.0	3.6	3.6	4.8	7.2	42.2	2.4	4.8	18.0
Girls	15.2	6.1	10.1	2.0	8.1	51.5	1.0	18.2	16.2
Playing video games									
Total	8.1	3.5	5.0	1.0	10.6	86.3	8.9	1.9	13.7
Boys	7.4	3.0	3.9	1.7	10.0	83.9	7.4	2.2	12.2
Girls	8.8	4.0	6.0	0.4	11.2	88.4	10.4	2.0	15.1
Reading									
Total	44.6	3.1	7.6	1.8	10.5	66.8	18.4	9.0	16.6
Boys	41.6	4.5	5.6	1.1	7.3	60.7	16.9	5.6	14.6
Girls	46.6	2.2	9.0	2.2	12.7	70.9	19.4	11.2	17.9
Talking on the phone or texting									
Total	4.6	4.1	18.7	5.5	32.1	84.7	29.7	7.4	24.2
Boys	3.2	5.1	18.5	5.1	26.8	76.4	21.7	3.8	17.8
Girls	5.4	3.5	18.8	5.8	35.4	90.0	34.6	9.6	28.1
Watching TV or a movie									
Total	14.1	1.9	2.8	1.4	10.6	87.5	7.4	3.2	16.7
Boys	13.9	1.6	2.0	1.2	10.2	89.0	5.3	2.0	15.5
Girls	14.2	2.2	3.4	1.5	10.8	86.4	9.0	4.0	17.6

Children could report more than one location for where they did each activity.

American Academy of Pediatrics recommends that parents limit children's screen-viewing time to no more 2 hours per day.<sup>21</sup> Further, Tremblay and colleagues conducted a systematic review of sedentary behavior and health indicators in 5- to 17-year-old children and concluded that "children and youth should watch less than 2 hours of TV per day" and "should try to minimize the time they spend engaging in other sedentary pursuits throughout the day (e.g., playing video games, using the computer for nonschool work, or prolonged sitting)."<sup>5</sup>

The present study found that fifth-grade boys and girls participated in sedentary behaviors, both screen- and non-screen-based behaviors, at very high frequencies. The most popular activities included watching TV or videos, listening to music, playing video games (boys only), and talking on the phone or texting (girls only). Children reported engaging in sedentary behaviors in a variety of locations (i.e., home, school, and neighborhood); however, home was the most popular location reported for sedentary behavior. In general, the patterns of social context for the



**Figure 1. Gender difference in “with whom” children reported engaging in sedentary behavior. Adjusted for race/ethnicity, socioeconomic status, BMI, school, and study site using Proc Glimmix (gender as fixed effect). \*Difference between boys and girls:  $p < 0.05$ .**

behaviors were similar between boys and girls, with the exception of video games.

Given the current findings, recommendations for children and youth to reduce daily screen time and limit prolonged time spent sitting are appropriate. These recommendations should encompass both screen- and non-screen-based sedentary behaviors, which were popular among the children in the present study. Because these behaviors occurred in many locations, a comprehensive effort across environments is necessary. Interventions should target the home environment as well as schools and communities to reduce children’s sedentary behavior. Parents, teachers, community members, and policy makers must all do their part to foster an environment that encourages and supports children to be more active and spend less time in sedentary pursuits to promote lifelong health.

**Table 4. Means (SD) for Three Perception Items for Specific Sedentary Behaviors by Gender**

Sedentary behavior	Mean (SD)		
	“How fun”	“How important”	“How much choice”
Homework			
Boys	2.02 (1.0)	3.35 (0.8)	2.64 (1.3)
Girls	2.06 (1.0)	3.35 (0.8)	2.62 (1.3)
Listening to music			
Boys	3.07 (0.8)**	2.31 (1.0)	3.47 (0.8)
Girls	3.29 (0.7)	2.44 (1.0)	3.55 (0.8)
Music lessons, practicing instrument			
Boys	3.00 (0.8)	2.90 (0.9)	3.31 (0.9)
Girls	3.18 (0.7)	2.86 (0.9)	3.41 (0.9)
Playing video games			
Boys	3.35 (0.7)	2.14 (1.0)	3.61 (0.7)
Girls	3.21 (0.8)	2.08 (0.9)	3.51 (0.8)
Reading			
Boys	2.72 (0.8)	3.32 (0.9)	3.50 (0.8)
Girls	2.93 (0.9)	3.34 (0.82)	3.54 (0.8)
Talking on the phone or texting			
Boys	2.93 (0.9)*	2.37 (1.1)	3.52 (0.9)
Girls	3.11 (0.9)	2.51 (1.0)	3.62 (0.7)
Watching TV or a movie			
Boys	2.93 (0.8)	2.07 (1.0)	3.37 (0.9)
Girls	2.86 (0.9)	2.04 (1.0)	3.29 (0.9)

Items scored on 4-point Likert scale (1 = not fun at all, 4 = extremely fun; 1 = not important, 4 = extremely important; 1 = not my choice at all, 4 = completely my choice).

$p$  values for the difference between boys and girls adjusted for race/ethnicity, socioeconomic status, BMI, school, and study site: \*\* $p < 0.01$ ; \* $p < 0.05$ .

SD, standard deviation.

It is important to note that the health impact of various forms of sedentary behavior may not be identical.<sup>22,23</sup> In order for interventions to have the most public health impact, they should target those behaviors that have consistent associations with negative health consequences. As a result, more research is needed to determine the health impact of specific non-screen-based behaviors.

In addition to limiting screen time, interventions could promote physical activity in combination with traditionally sedentary behaviors: for example, encouraging children to walk or climb the stairs while talking on the phone, dance while listening to music, or participate in active, rather than seated, video games. Further, physical activity breaks during TV commercials or while reading could improve health by decreasing prolonged periods of sitting and sedentary behavior.

Girls in this study reported engaging in many of the sedentary behaviors more often than boys. Other studies using objective measures of sedentary behavior have found that girls are more sedentary than boys.<sup>24,25</sup> The activities that were perceived to be more fun by girls than boys (e.g., listening to music and talking on the phone or texting) were also those behaviors that girls engaged in at the highest levels. This implies that for the girls in this study, fun was an important determinant of the sedentary behaviors they engaged in. Intervention program planners should take care to integrate activities that are fun and attractive for all children, which will very likely differ between the genders.

Strengths of this study include the assessment of a variety of sedentary behaviors and their contexts in a racially/ethnically diverse sample of children. To date, this is the first study to report detailed information surrounding the social (i.e., with whom) and physical (i.e., where) contexts of specific types of sedentary behavior in children. One limitation of the current study design is that the “where” and “with whom” data reported by the child could not be verified, and the report of duration was based on the child’s perception of the average time spent in those activities. Whereas this study is a first step to understanding the role of context of children’s sedentary behavior, real-time objective assessment, coupled with self-report, would provide richer, more detailed information. The perception items were limited in that they were assessed by a single question answered by the child and potentially subject to response bias. Further, because children’s behavior may change over time as they mature, longitudinal study of their sedentary behavior is warranted.

## Conclusion

In conclusion, this study helps researchers and practitioners better understand the social and physical context of specific types of sedentary behavior in fifth-grade boys and girls. The present study suggests that health promotion interventions in elementary school-age children should target a range of sedentary behaviors that both boys and girls engage in, including both screen- (e.g., watching TV

or videos and playing video games) and non-screen-based (e.g., talking on the phone or texting and listening to music) behaviors. Further, multi-level interventions that target reducing sedentary behavior in the home, neighborhood, and school context may be most effective; however, the approach needed will likely differ by gender.

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## Author Disclosure Statement

No competing financial interests exist.

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