

Title: Leisure-time sedentary behavior, alcohol consumption and sexual intercourse among adolescents aged 12-15 years in 19 countries from Africa, the Americas, and Asia

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Abstract

Background: The association between sedentary behavior and sexual behavior has not been investigated among adolescents, while the influential factors in this association are largely unknown.

Aim: To (i) investigate the association between leisure-time sedentary behavior and sexual intercourse, and (ii) test for mediation by alcohol consumption, drug use, physical activity, bullying victimization, parental support/monitoring, loneliness, and depressive symptoms, in a large global sample of young adolescents.

Methods: Data were analyzed from 34674 adolescents aged 12-15 years participating in the Global School-based Student Health Survey. Participants reported the number of hours spent in leisure-time sedentary behavior on a typical day (<1, 1-2, 3-4, 5-8, >8). Data on alcohol consumption, drug use, physical activity, bullying victimization, parental support/monitoring, loneliness, and depressive symptoms were considered as potential mediators.

Outcome: Participants reported whether or not they had sexual intercourse in the past 12 months (yes/no).

Results: The prevalence of past 12-month sexual intercourse was 11.9%, while the prevalence of <1, 1-2, 3-4, 5-8, and >8 hours per day of leisure-time sedentary behavior were 26.7%, 35.6%, 21.4%, 11.5%, and 4.9%, respectively. There was a dose-dependent relationship between sedentary behavior and odds of reporting sexual intercourse: compared with <1 hour/day of sedentary behavior, the OR (95%CI) of sexual intercourse associated with 1-2, 3-4, 5-8, and >8 hours/day of sedentary behavior were 1.12 (0.94-1.33), 1.22 (1.01-1.48), 1.34 (1.08-1.66), and 1.76 (1.37-2.27), respectively. There was no significant interaction by sex. The largest proportion of the association between sedentary behavior and sexual intercourse was explained by alcohol use (% mediated 21.2%), with other factors explaining an additional 11.2%.

Clinical Translation: Interventions to reduce leisure-time sedentary and/or alcohol consumption may contribute to a reduction in the proportion of adolescents engaging in sexual intercourse at a young age.

Strengths and Limitations: The strength of this study is the large, representative sample of adolescents from 19 countries. However, the cross-sectional design means causality or temporal associations could not be established.

Conclusions: In young adolescents, leisure-time sedentary behavior is positively associated with odds of having sexual intercourse in both boys and girls, in a dose-dependent manner. Alcohol consumption appears to be a key mediator of this relationship.

Key words: Sexual Intercourse, Adolescents, Sedentary Behavior, Alcohol, Global School-Based Student Health Survey

INTRODUCTION

The global prevalence of sexual intercourse among young adolescents is high. A recent study of 116820 adolescents across 28 countries found that more than one in eight (13.2%) 12-15 year olds (16.8% of boys, 9.5% of girls) had ever had sexual intercourse, of whom 52.4% (56.4% of boys, 44.0% of girls) reported having had more than one sexual partner (1). This is of concern given that exposure to sexual intercourse at a young age increases the risk of adolescent pregnancy, transmission of HIV, and other sexually transmitted infections (2,3). Moreover, whereas sexual activity appears to have benefits for mental health in adulthood (4,5), the opposite appears to be true in adolescence, with several studies linking early sexual activity with increased risk of mental disorders and suicide attempts (1,6–9). In order to develop targeted interventions to reduce the prevalence of sexual intercourse in early adolescence, there is a need to identify modifiable correlates.

The existing literature has identified several correlates of risky sexual behavior in young adolescents, including substance abuse (10), conduct problems (11), and depression (12). However, one overlooked potential correlate of risky sexual behavior in adolescents is sedentary behavior. Sedentary time may be defined as any waking behavior in a sitting, reclining or lying posture with an energy expenditure of ≤ 1.5 metabolic equivalents. It sits on the extreme end of the energy expenditure continuum with vigorous physical activity being the opposite extreme. Sedentary behavior may increase risky sexual behavior in young adolescents via several pathways. First, sedentary behavior per se has been shown to be associated with higher levels of conduct problems (14), and alcohol use (15), and depression (16), which are also associated with risky sexual behavior (10–12). Second, sedentary behavior may promote sexual intercourse per se by providing an opportunity for intimacy. Indeed, one large study among adults found that men who spent between 2 and 4 h a day sedentary had significantly higher odds of reporting any sexual activity (OR = 1.61, 95% CI:

1.08–2.41), thinking about sex frequently (OR = 1.75, 95% CI: 1.16–2.63) and frequent sexual intercourse (OR = 1.44, 95% CI: 1.08–1.93) than those who spent less than <2 h a day (13). Furthermore, higher levels of moderate or vigorous physical activity have been shown to be associated with higher levels of sexual activity among adults (13). However, to date, the association between sedentary behavior and sexual behavior has not been investigated among adolescents, while the influential factors in this association are largely unknown.

The present study therefore aimed to (i) investigate the association between leisure-time sedentary behavior and sexual intercourse, and (ii) test for mediation by alcohol consumption, drug use, physical activity, bullying victimization, parental support/monitoring, loneliness, and depressive symptoms.

METHODS

The survey

Publicly available data from the GSHS were analyzed. Details on this survey can be found at <http://www.who.int/chp/gshs> and <http://www.cdc.gov/gshs>. Briefly, the GSHS was jointly developed by the WHO and the US Centers for Disease Control and Prevention (CDC), and other UN allies. The core aim of this survey was to assess and quantify risk and protective factors of major non-communicable diseases. The survey draws content from the CDC Youth Risk Behavior Survey (YRBS) for which test-retest reliability has been established (17). The survey used a standardized two-stage probability sampling design for the selection process within each participating country. For the first stage, schools were selected with probability proportional to size sampling. The second stage involved the random selection of classrooms which included students aged 13-15 years within each selected school. All students in the selected classrooms were eligible to participate in the survey regardless of age. Data collection was performed during one regular class period. The questionnaire was translated

into the local language in each country and consisted of multiple choice response options; students recorded their response on computer scannable sheets. All GSHS surveys were approved, in each country, by both a national government administration (most often the Ministry of Health or Education) and an institutional review board or ethics committee. Student privacy was protected through anonymous and voluntary participation, and informed consent was completed by students, parent, and schools' representatives. Data were weighted for non-response and probability selection.

From all publicly available data, we selected all datasets that included the variables used in the current analysis. A total of 19 countries were included in the current study. The characteristics of each country or survey are provided in **Table 1**. For the included countries, the survey was conducted between 2003 and 2008, and consisted of 4 low-income, 4 lower middle-income, 9 upper middle-income, and 2 high-income countries based on the World Bank classification at the time of the survey. These corresponded to 6, 11, and 2 countries from African Region (AFR), Region of the Americas (AMR), and South-East Asia Region (SEAR), respectively. Data were nationally representative for all countries with the exception of Chile (Metropolitan), Ecuador (Quito), Tanzania (Dar Es Salaam), and Venezuela (Lara).

Sexual intercourse (outcome)

This was assessed with the question “During the past 12 months, have you had sexual intercourse?” with ‘yes’ and ‘no’ response options.

Leisure-time sedentary behavior (exposure)

Leisure-time sedentary behavior was assessed with the question “How much time do you spend during a typical or usual day sitting and watching television, playing computer games, talking with friends, or doing other sitting activities?” with six response options: <1, 1-2, 3-4, 5-6, 7-8, and >8 hours/day. This excluded time at school and when doing homework. This

variable was used as a five-category variable (5-6 and 7-8 hours/day were merged as the proportion of those who replied 7-8 hours/day was small). This question was based on the National Health and Nutrition Examination Survey (NHANES) questionnaire from 1999-2000, and modified for use in children.

Influential factors

The selection of the influential factors was based on the previous literature (18–21). Factors that have been reported to be associated with both sedentary behavior and sexual activity were chosen. These included alcohol consumption, drug use, physical activity, bullying victimization, parental support/monitoring, loneliness, and depression symptoms. Alcohol consumption was defined as having had one drink containing alcohol for at least one day in the past 30 days. Drug use referred to having used drug at least once in lifetime. To assess levels of physical activity, questions that represented the PACE+ Adolescent Physical Activity Measure (22) were asked. This measure has been tested for validity and reliability (22). The questions asked about the number of days with physical activity of at least 60 minutes during a typical week. This did not include physical activity during physical education or gym classes. Bullying victimization was defined as being bullied on at least one day during the last 30 days. Low parental involvement and support was defined as answering ‘rarely’ or ‘never’ to all of the following three questions: (a) ‘during the past 30 days, how often did your parents or guardians check to see if your homework was done?’; (b) ‘during the past 30 days, how often did your parents or guardians understand your problems and worries?’; and (c) ‘during the past 30 days, how often did your parents or guardians really know what you were doing with your free time?’ (23). Loneliness was assessed with the question “During the past 12 months, how often have you felt lonely?” with answer options “never”, “rarely”, “sometimes”, “most of the time”, and “always”. As in a previous GSHS

publication, this variable was dichotomized as never, rarely, sometimes (coded=0) and most of the time, always (coded=1) (24). Those who answered affirmatively to the question “During the past 12 months, did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing your usual activities?” were considered to have depressive symptoms (19).

Control variables

Control variables included age, sex, and food insecurity. Food insecurity was used as a proxy for socioeconomic status as there were no variables on socioeconomic status in the GSHS, and was assessed by the question “During the past 30 days, how often did you go hungry because there was not enough food in your home?” Response options were “never”, “rarely/sometimes”, and “most of the time/always” (25). We did not assess the influence of these factors in the association between sedentary behavior and sexual intercourse as these sociodemographic characteristics are broadly considered to be non-modifiable.

Statistical analysis

Statistical analyses were performed with Stata 14.1 (Stata Corp LP, College station, Texas). The analysis was restricted to those aged 12-15 years as most students were within this age range and the exact age outside of this age range was not provided. The difference in sample characteristics by presence or absence of sexual intercourse or sedentary behavior (i.e., ≥ 3 hours/day) was tested with Chi-squared tests and Student’s *t*-tests for categorical and continuous variables, respectively. We used the three hour cut-off for sedentary behavior in this descriptive analysis as this cut-off has been used in a previous publication (26).

Using the overall sample, we conducted multivariable logistic regression analysis to assess the association between sedentary behavior (exposure) and sexual intercourse (outcome) while adjusting for age, sex, food insecurity, and country. The five-category sedentary behavior variable was included in the model as a categorical variable for this analysis. We also assessed whether the association differs by sex by including an interaction term (sex X sedentary behavior) in the model. Furthermore, country-wise analyses were also conducted with the five-category sedentary behavior variable as a continuous variable being the exposure variable, while adjusting for age, sex, and food insecurity.

Next, using the overall and sex-stratified samples, we conducted mediation analysis to gain an understanding of the extent to which various factors may explain the relation between sedentary behavior and sexual intercourse. Alcohol consumption, drug use, physical activity, bullying victimization, parental support/monitoring, loneliness, and depressive symptoms were considered to be potentially influential factors. We used the *kmb* (Karlson Holm Breen) command in Stata (27) for this purpose. This method can be applied in logistic regression models and decomposes the total effect of a variable into direct and indirect effects (i.e., the mediation effect). Using this method, the percentage of the main association explained by the mediator can also be calculated (mediated percentage). Each potential influential factor was included in the model individually apart from an analysis where all factors were included simultaneously in the model. The five-category sedentary behavior variable was included as a continuous variable in the model for the mediation analysis. The mediation analyses were adjusted for age, sex, food insecurity, and country, with the exception of the sex-stratified analysis, which was not adjusted for sex.

Adjustment for country was done by using fixed effects models as in previous GSHS studies (19,25). All covariates were included in the regression analysis as categorical variables with the exception of age and physical activity (continuous variables). Sampling

weights and the clustered sampling design of the surveys were taken into account. Results from the logistic regression analyses are presented as odds ratios (ORs) with 95% confidence intervals (CIs). The level of statistical significance was set at $p < 0.05$.

RESULTS

A total of 34674 adolescents aged 12-15 years were included in the analysis [mean (SD) age 13.8 (0.9); females 51.8%]. The prevalence of past 12-month sexual intercourse was 11.9%, while the prevalence of <1, 1-2, 3-4, 5-8, and >8 hours per day of leisure-time sedentary behavior were 26.7%, 35.6%, 21.4%, 11.5%, and 4.9%, respectively. Older age, alcohol and drug use, low parental support/involvement, loneliness, and depressive symptoms were significantly more frequent among those who had a sexual intercourse and were sedentary ≥ 3 hours/day (**Table 2**). The results when restricted to boys (Appendix Table S1) or girls (Appendix Table S2) were similar but there were some differences. For example, bullying victimization and loneliness were significantly more frequent among those who had sexual intercourse only among girls.

The proportion of adolescents who had sexual intercourse increased with increasing time spent sedentary, overall and among both sexes (**Figure 1**). For example, in the overall sample, the prevalence of sexual intercourse was 9.9% among those who were sedentary for <1 hour/day but increased to 18% for >8 hours/day. This dose-dependent association was also observed after adjustment for age, sex, food insecurity, and country (**Figure 2**). Specifically, compared with <1 hour/day of sedentary behavior, the OR (95%CI) of sexual intercourse associated with 1-2, 3-4, 5-8, and >8 hours/day of sedentary behavior were 1.12 (0.94-1.33), 1.22 (1.01-1.48), 1.34 (1.08-1.66), and 1.76 (1.37-2.27), respectively. There was no significant interaction by sex. The results of the country-wise analyses are shown in Figure S1 (Appendix). Particularly strong associations were observed in countries such as Guyana, Venezuela, and Kenya.

The results of the mediation analysis are shown in **Table 3**. Based on the overall sample, the largest proportion of the association between sedentary behavior and sexual intercourse was explained by alcohol use (% mediated 21.2%). Other factors explained the association to a lesser extent [drug use (9.9%), bullying victimization (7.7%), depressive symptoms (7.2%), loneliness (4.2%), parental support/involvement (2.7%)]. Physical activity was not a significant mediator. When all the seven factors were included simultaneously in the model, they collectively explained 32.4% of the association. The analyses based on the sex-stratified samples showed that only alcohol use and drug use were significant mediators among boys, while for girls, all factors apart from physical activity were significant mediators. A larger proportion of the association was explained by alcohol use among boys than girls (28.0% vs. 17.1%).

DISCUSSION

In this large representative sample of 34674 adolescents aged 12-15 from 19 countries, the proportion of boys and girls who had sexual intercourse in the past 12 months increased in a dose-dependent manner with increasing leisure-time spent sedentary. A substantial proportion (21.2%) of this association was explained by alcohol use, and a further 11.2% by other factors. Country-wise analyses showed that there were some between-country differences in the strength of the association and this may be related with different cultural and socioeconomic factors.

The present findings support a large body of literature that has shown sedentary behavior to be associated with other unfavorable behaviors. For example, a review of observational studies found that young people who watched less TV (i.e. were less sedentary) were more emotionally stable, sensitive, imaginative, outgoing, self-controlled, intelligent, moralistic, college bound and less likely to be aggressive, behave badly, or to engage in less

risk behavior (14). The present study adds to the findings from this review by showing for the first time that leisure-time sedentary behavior is also associated with sexual intercourse at a young age.

Importantly, the present study found that alcohol use explained more than a fifth of the variation in the association between sedentary time and sexual intercourse. Previous studies have documented a positive association between sedentary time and alcohol consumption (15). Alcohol is typically consumed while sitting, for example, with friends, watching TV, or playing computer games. Previous research has also shown that alcohol consumption can lead to risky sexual behavior, such as sexual intercourse at a young age (28). Adolescence is usually the time when individuals first drink alcohol and this has been associated with relatively weak or immature inhibitory control (28). Alcohol consumption per se may alter or interrupt the proper development of inhibitory control (28) which may lead to an increased chance of engaging in sexual intercourse at a young age. The present results build on previous research by showing an indirect effect of sedentary behavior via alcohol consumption on sexual behavior.

Interestingly, other variables of interest – including drug use, bullying victimization, depressive symptoms, loneliness, and parental support/involvement – were only able to explain a further 11.2% of the association between leisure-time sedentary behavior and sexual intercourse, leaving a large part unexplained. Other variables that may explain a proportion of the variation include self-esteem and personality traits. Indeed, both sedentary behavior and risky sexual behavior have been shown to be associated with low self-esteem (29,30) and some aspects of personality (14,31). There may also be direct effects of leisure-time sedentary behavior on sexual activity by sedentary activities providing a setting for intimacy, for example, watching TV. Further research is required to provide insight into these hypotheses.

A clear strength of this study is the large, representative sample of adolescents from 19 countries. However, the present study was not without limitations. First, the cross-sectional design means causality or temporal associations could not be established. Future research utilizing a longitudinal design is needed to shed light on the direction of causation. Relatedly, the present study attempted to explain the degree to which potentially influential factors explained the association between sedentary behavior and sexual intercourse, without differentiating the factors as mediators or confounders. Mediation and confounding are identical statistically and can only be distinguished on conceptual grounds [12]. Second, we relied on self-reported data, which may have been affected by factors such as recall and social desirability bias. Moreover, since the survey item did not collate data on the domain of leisure-time sedentary behavior, it is plausible that certain domains are driving the observed association. Future work is now needed utilizing more precise measures of sedentary time. The measure of sexuality included in the present study was relatively simplistic and asked only about sexual intercourse over the past 12 months. This presents a limitation as the measure does not specifically ask for different types of sexual activities (such as petting, fondling or oral sex) that may be more common in this population. Moreover, given the implicit heteronormative way the question is posed, it may lead non-heterosexual and non-cisgender participants to falsely report, leading to some reporting bias and data distortion. Moreover, it is plausible that other types of sexual activity are also associated with sedentary behaviour and alcohol consumption. Future research should use more comprehensive measures of sexuality to explore such associations. Next, there were some differences in the time frames used for the assessment of the variables used in the current study. For example, alcohol consumption referred to consumption in the past 30 days but the time frame for sexual activity was past 12 months. Thus, it is possible that alcohol consumption and sexual activity did not take place at the same time, and that the association may be driven by other

common underlying factors such as personality traits. Finally, the study was based on adolescents attending school. Thus, the study results may not be generalizable to adolescents who do not attend school.

In conclusion, in a large global sample of young adolescents, we observed a positive direct association between leisure-time sedentary behavior and alcohol consumption; and an indirect positive association between leisure-time sedentary behavior and sexual intercourse, with alcohol consumption identified as a key mediator of this relationship. The relationship between girls and boys were similar although alcohol consumption explained a larger proportion of the association among boys. Given the risks early sexual intercourse carries in terms of adolescent pregnancy, and transmission of HIV and other STIs, it may be prudent to target young adolescents with high levels of sedentary behavior with interventions to reduce sedentary time, or educate them on the potential harmful effects of sexual intercourse at a young age or inform them on safe sex practices. Interventions to reduce alcohol consumption in adolescents may also contribute to a reduction in the proportion of adolescents engaging in sexual intercourse at a young age.

AUTHOR CONTRIBUTIONS

LS and AK conceived the idea. AK ran the analyses. LS and AK interpreted the data. LS and SEJ drafted the manuscript. All authors provided critical revisions to the draft manuscript and approved the final manuscript before submission.

DECLARATIONS OF INTEREST

All authors declare no conflicts of interest.

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Table 1 Characteristics of the surveys

Country	Region	Country income	Year	Response rate (%)	N ^a
Argentina	AMR	UM	2007	77	1,537
Botswana	AFR	UM	2005	95	1,397
Cayman Islands	AMR	H	2007	79	1,147
Chile (Metropolitan)	AMR	UM	2004	85	1,972
Ecuador (Quito)	AMR	LM	2007	86	1,842
Grenada	AMR	UM	2008	78	1,299
Guyana	AMR	LM	2004	80	1,070
Indonesia	SEAR	LM	2007	93	3,022
Kenya	AFR	L	2003	84	2,971
Seychelles	AFR	UM	2007	82	1,154
St. Lucia	AMR	UM	2007	82	1,072
St. Vincent & the Grenadines	AMR	UM	2007	84	1,188
Tanzania (Dar Es Salaam)	AFR	L	2006	87	1,757
Thailand	SEAR	LM	2008	93	2,675
Trinidad & Tobago	AMR	H	2007	78	2,450
Uganda	AFR	L	2003	69	1,904
Uruguay	AMR	UM	2006	71	2,882
Venezuela (Lara)	AMR	UM	2003	86	1,970
Zambia	AFR	L	2004	70	1,365

^a Based on sample aged 12-15 years.

Abbreviation: AFR African Region; AMR Region of the Americas; SEAR South-East Asia Region; L Low-income; LM Lower middle-income; UM Upper middle-income; H High-income.

Table 2 Sample characteristics (overall and by sexual intercourse and sedentary behavior)

Characteristic		Overall	Sexual intercourse ^a			Sedentary behavior ^b		
			No	Yes	P-value ^c	No	Yes	P-value ^c
Age (years)	12	9.0	9.3	5.4	<0.001	10.0	7.4	<0.001
	13	28.4	29.8	20.3		30.0	26.2	
	14	36.0	36.7	33.0		34.9	37.8	
	15	26.6	24.3	41.3		25.2	28.6	
Sex	Male	48.2	46.0	60.1	<0.001	48.7	46.9	0.180
	Female	51.8	54.0	39.9		51.3	53.1	
Hunger	Never	46.7	46.8	50.9	0.005	45.5	49.3	0.004
	Rarely/sometimes	47.1	47.9	42.3		48.0	45.4	
	Most of the time/always	6.2	5.3	6.8		6.5	5.4	
Alcohol use	No	82.5	87.1	55.1	<0.001	86.4	76.4	<0.001
	Yes	17.5	12.9	44.9		13.6	23.6	
Drug use	No	93.5	96.4	83.7	<0.001	94.7	91.8	<0.001
	Yes	6.5	3.6	16.3		5.3	8.2	
Physical activity ^d	Mean (SD)	3.5 (2.4)	3.5 (2.2)	3.6 (2.6)	0.053	3.4 (2.2)	3.6 (2.3)	<0.001
Bullying victimization	No	59.9	61.1	59.9	0.469	61.9	57.2	<0.001
	Yes	40.1	38.9	40.1		38.1	42.8	
Low parental support/involvement	No	88.6	89.3	83.4	<0.001	89.1	87.6	0.036
	Yes	11.4	10.7	16.6		10.9	12.4	
Loneliness	No	89.5	90.7	86.6	<0.001	90.9	87.7	<0.001
	Yes	10.5	9.3	13.4		9.1	12.3	
Depression	No	74.0	76.6	64.5	<0.001	75.9	71.7	<0.001
	Yes	26.0	23.4	35.5		24.1	28.3	

Abbreviation: SD Standard deviation

^aSexual intercourse in past 12 months.^b≥3 hours/day of leisure-time sedentary behavior per day.^cP-value was based on Chi-squared tests for all variables with the exception of physical activity (Student's *t*-test).^dNumber of days with physical activity of at least 60 minutes during a typical week.

Table 3 Lifestyle, bullying victimization, parental support/involvement, and psychological factors as mediators in the association between increasing time spent in leisure-time sedentary behavior and sexual intercourse

(a) Overall

Mediator	Total effect		Direct effect		Indirect effect		% Mediated ^a
	OR [95% CI]	P-value	OR [95% CI]	P-value	OR [95% CI]	P-value	
Alcohol use	1.14 [1.07,1.22]	<0.001	1.11 [1.04,1.18]	0.001	1.03 [1.02,1.04]	<0.001	21.2
Drug use	1.13 [1.06,1.19]	<0.001	1.11 [1.05,1.18]	<0.001	1.01 [1.01,1.02]	<0.001	9.9
Physical activity	1.12 [1.06,1.19]	<0.001	1.12 [1.06,1.19]	<0.001	1.00 [1.00,1.00]	0.871	NA
Bullying victimization	1.12 [1.05,1.18]	<0.001	1.11 [1.04,1.18]	0.001	1.01 [1.00,1.01]	0.001	7.7
Parental support/involvement	1.13 [1.07,1.20]	<0.001	1.13 [1.06,1.19]	<0.001	1.00 [1.00,1.01]	0.044	2.7
Loneliness	1.12 [1.06,1.19]	<0.001	1.12 [1.06,1.18]	<0.001	1.00 [1.00,1.01]	0.004	4.2
Depressive symptoms	1.13 [1.06,1.20]	<0.001	1.12 [1.05,1.19]	<0.001	1.01 [1.00,1.01]	<0.001	7.2
All mediators	1.13 [1.06,1.22]	0.001	1.09 [1.01,1.17]	0.019	1.04 [1.03,1.05]	<0.001	32.4

(b) Boys

Mediator	Total effect		Direct effect		Indirect effect		% Mediated ^a
	OR [95% CI]	P-value	OR [95% CI]	P-value	OR [95% CI]	P-value	
Alcohol use	1.11 [1.03,1.20]	0.006	1.08 [1.00,1.17]	0.046	1.03 [1.02,1.04]	<0.001	28.0
Drug use	1.11 [1.03,1.19]	0.003	1.09 [1.02,1.17]	0.013	1.02 [1.01,1.02]	<0.001	15.9
Physical activity	1.11 [1.03,1.19]	0.004	1.11 [1.03,1.18]	0.004	1.00 [1.00,1.01]	0.857	NA
Bullying victimization	1.09 [1.02,1.18]	0.017	1.09 [1.01,1.17]	0.026	1.01 [1.00,1.01]	0.098	NA
Parental support/involvement	1.12 [1.04,1.20]	0.002	1.12 [1.04,1.20]	0.002	1.00 [1.00,1.00]	0.604	NA
Loneliness	1.11 [1.03,1.19]	0.004	1.11 [1.03,1.18]	0.004	1.00 [1.00,1.01]	0.162	NA
Depressive symptoms	1.11 [1.03,1.19]	0.005	1.10 [1.03,1.18]	0.008	1.00 [1.00,1.01]	0.121	NA
All mediators	1.10 [1.01,1.20]	0.025	1.06 [0.98,1.16]	0.161	1.04 [1.02,1.05]	<0.001	36.7

(c) Girls

Mediator	Total effect		Direct effect		Indirect effect		% Mediated ^a
	OR [95% CI]	P-value	OR [95% CI]	P-value	OR [95% CI]	P-value	
Alcohol use	1.18 [1.08,1.29]	<0.001	1.14 [1.05,1.25]	0.003	1.03 [1.02,1.04]	<0.001	17.1

Drug use	1.15 [1.06,1.24]	0.001	1.14 [1.05,1.23]	0.001	1.01 [1.00,1.01]	0.010	6.0
Physical activity	1.15 [1.06,1.24]	0.001	1.15 [1.06,1.24]	0.001	1.00 [1.00,1.00]	0.783	NA
Bullying victimization	1.15 [1.05,1.25]	0.003	1.13 [1.03,1.24]	0.008	1.01 [1.00,1.02]	0.003	8.9
Parental support/involvement	1.14 [1.06,1.24]	0.001	1.13 [1.04,1.23]	0.003	1.01 [1.00,1.02]	0.006	7.6
Loneliness	1.14 [1.06,1.24]	0.001	1.14 [1.05,1.23]	0.002	1.01 [1.00,1.01]	0.009	5.5
Depressive symptoms	1.15 [1.06,1.26]	0.001	1.14 [1.04,1.24]	0.004	1.01 [1.00,1.02]	0.002	8.7
All mediators	1.18 [1.06,1.30]	0.002	1.12 [1.01,1.24]	0.038	1.05 [1.03,1.07]	<0.001	32.4

Abbreviation: OR Odds ratio; CI Confidence interval

Models are adjusted for age, food insecurity, and country. The analysis using the overall sample was additionally adjusted for sex.

The exposure variable was the five-category variable on time spent in leisure-time sedentary behavior per day which was included in the model as a continuous variable.

Thus, the ORs represent the change in OR associated with a one-unit increase in categories (i.e., <1, 1-2, 3-4, 5-8, and >8 hours/day).

^aPercentage mediated was calculated only when the indirect effect was statistically significant (P<0.05).

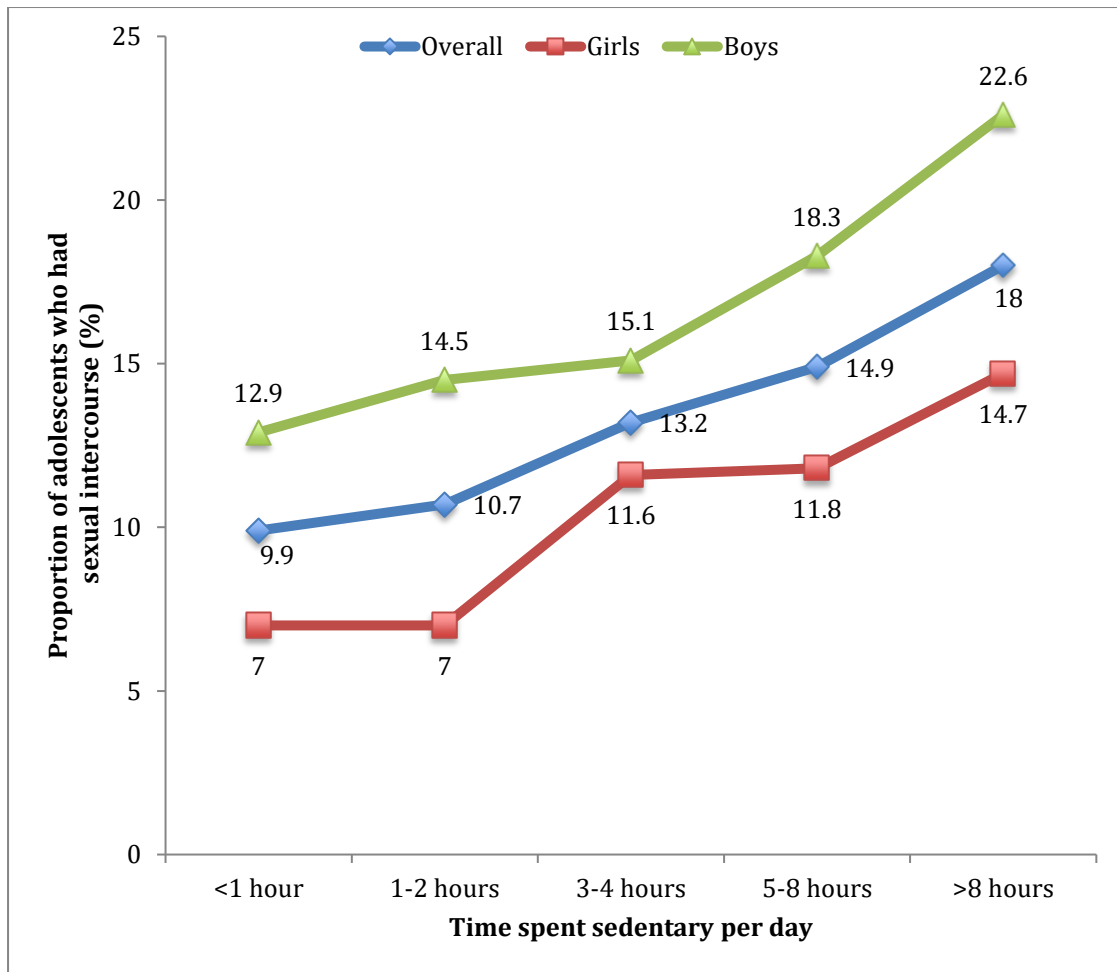


Figure 1 Proportion of adolescents who had sexual intercourse in the past 12 months by time spent in leisure-time sedentary behavior per day

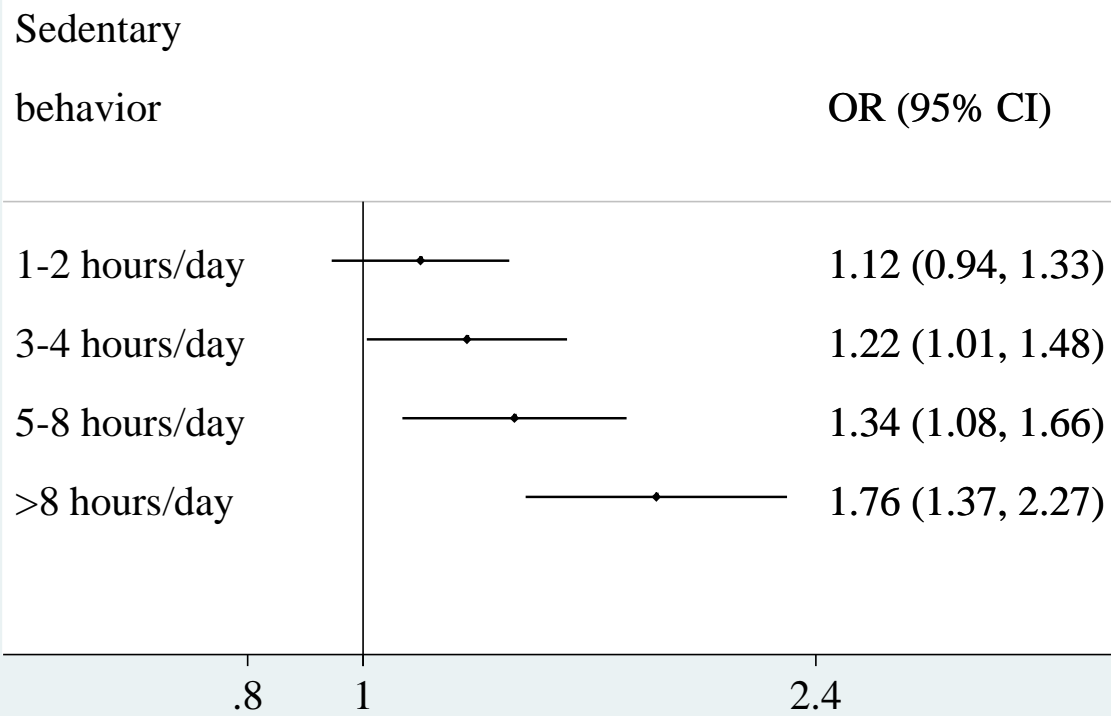


Figure 2 Association between time spent in leisure-time sedentary behavior per day and sexual intercourse estimated by multivariable logistic regression

Abbreviation: OR Odds ratio; CI Confidence interval

Reference category is <1 hour/day.

Model is adjusted for age, sex, food insecurity, and country.