Research Square

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Indirect Associations Between Sedentary Behavior Types and Internalizing Problems Among Adolescents: A Cross-Sectional Study

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Abstract

Background

Internalizing problems are common in adolescence. This study examined whether four sedentary behavior types (recreational screen, educational, cultural, social) are indirectly associated with internalizing problems through social support, and whether school belonging moderates these associations.

Methods

A 2023 cross-sectional survey in Guangxi, China, included 2,360 adolescents (56.0% boys; mean age = 14.2 years). Four sedentary behavior types, internalizing problems, social support, and school belonging were self-reported. A moderated indirect association model was tested using ordinary least squares regression with bias-corrected bootstrap (2,000 resamples), controlling for sex, age, and body mass index. The Associational Variable Analysis framework was used to avoid causal inference.

Results

Indices of moderated indirect association were − 0.047 (95% confidence interval [*CI*] [− 0.089, − 0.009]) for recreational screen, 0.042 (95% *CI* [0.010, 0.084]) for educational, 0.022 (95% *CI* [0.000, 0.051]) for cultural, and 0.041 (95% *CI* [0.011, 0.079]) for social sedentary behavior. Recreational screen behavior showed a positive indirect association with internalizing problems through reduced social support; educational, cultural, and social behaviors showed negative indirect associations. School belonging moderated these associations.

Conclusions

Sedentary behavior types differ in their indirect associations with internalizing problems. Recreational screen time may be a risk factor, while educational sedentary behavior may be protective through social support. Interventions should target specific sedentary behavior types rather than reduce all sedentary time.

Background

Internalizing problems in adolescents manifest primarily as depression, anxiety, emotional distress, and social withdrawal, and are among the most common mental health disorders in this population [1]. Globally, approximately 10%–20% of adolescents are affected by internalizing problems [2]. Between 2015 and 2024, the pooled prevalence of depressive symptoms among Chinese children and adolescents was 23.3% [3]. Internalizing problems adversely affect academic performance and

interpersonal skills and may persist into adulthood, increasing risks of suicidal behavior and substance abuse [4]. A meta-analysis showed that female sex (OR = 1.48), high academic stress (OR = 1.83), non-traditional family structure (OR = 1.48), and daily electronic screen time ≥ 2 hours (OR = 1.50) were positively associated with the risk of depressive symptoms [5].

Adolescence is a critical developmental period characterized by heightened sensitivity to social contexts and increased vulnerability to internalizing problems. Sedentary behavior is an important factor influencing adolescent mental health and is defined as sitting or reclining posture with energy expenditure not exceeding 1.5 metabolic equivalents while awake [6]. A 2026 dose–response meta-analysis indicated that prolonged sedentary time increases the risk of depression, with this association particularly pronounced among adolescents [7]. Subgroup analysis showed that the risk of depression accelerated after more than 3.7 hours of daily sedentary time among adolescents [7], suggesting a possible nonlinear threshold effect between sedentary behavior and internalizing problems. However, sedentary behavior is not a unidimensional construct, and different types of sedentary behavior may have fundamentally different effects on mental health [8]. A prospective study of 3,675 British adolescents found that more than 180 minutes of daily recreational screen time was associated with psychological distress, whereas 60–119 minutes of daily educational sedentary behavior was associated with lower distress [8]. A longitudinal study of 20,738 Chinese adolescents confirmed an association between more than 8 hours of daily sedentary time and depressive symptoms [9]. These findings suggest that the direction and magnitude of the association between sedentary behavior and mental health may vary by behavior type. However, existing studies have largely treated sedentary behavior as a homogeneous construct or focused on total sedentary time. Whether different sedentary behavior types show divergent associations with internalizing problems through the same psychosocial pathway remains an open question. Addressing this question is critical because it challenges the prevailing assumption that all sedentary behavior carries similar mental health risks and may reveal type-specific intervention targets.

Ecological systems theory posits that adolescent development is shaped by the interplay between individual behavior and multiple environmental factors [10]. During adolescence, school and peer contexts become increasingly salient, and psychosocial resources such as school belonging and social support protect mental health. School belonging refers to perceived identification with and acceptance in school interpersonal relationships [11], and it is negatively correlated with internalizing symptoms in adolescents, serving as an important protective factor associated with lower levels of internalizing problems [12]. Social support refers to perceived emotional and instrumental support from family, friends, and other significant others [13]. Previous studies have found that social support is associated with sedentary behavior and negative emotions [14]. Network analysis revealed that friend support had a negative bridging effect and was negatively associated with the cross-symptom transmission of sedentary behavior and psychological distress [15]. A propensity score matching analysis further confirmed that the sedentary lifestyle group had significantly higher anxiety and depression scores and significantly lower social support levels [16]. Meanwhile, school belonging not only directly buffers the risk of internalizing problems but may also moderate the strength of the aforementioned bridging

pathway; longitudinal evidence supports the protective association of school belonging with internalizing problems [17, 18]. From a theoretical perspective, social support may serve as a bridging variable that links sedentary behavior to internalizing problems, but its role may depend on the functional context of the behavior. School belonging may further condition the strength of this indirect association.

Accordingly, this study treated four sedentary behavior types (recreational screen, educational, cultural, and social) as independent variables and constructed a model of moderated indirect associations to examine the direction and magnitude of indirect associations between sedentary behavior types and internalizing problems through social support, and whether school belonging moderates these associations. By focusing on a multi-ethnic region in China, this study provides evidence on contextual variation that may be relevant to both regional and international audiences. The Associational Variable Analysis (AVA) framework was used to avoid causal overinterpretation of cross-sectional data [19]. We hypothesized that: (1) recreational screen sedentary behavior would be positively indirectly associated with internalizing problems through reduced social support; (2) educational, cultural, and social sedentary behaviors would be negatively indirectly associated with internalizing problems through enhanced social support; and (3) school belonging would moderate the indirect associations, such that differences across sedentary behavior types would be larger at higher levels of school belonging. These findings may inform clinical practice by identifying type-specific targets for intervention in adolescent mental health.

Methods

This study was conducted and reported in accordance with the STROBE reporting guidelines for cross-sectional studies.

Study design and participants

This cross-sectional study was conducted among primary and secondary school students in grades 5–12 in the urban area of Baise (Youjiang District), Guangxi, China, between July and December 2023, using a multi-stage stratified cluster sampling method with classes as the primary sampling unit. The sampling frame comprised all public schools in the urban area: 14 primary, 8 junior high, and 4 senior high schools. Schools were stratified by educational level; in the first stage, four schools were randomly selected using a computer-generated random number sequence: one primary school, two junior high schools, and one senior high school. In the second stage, classes were randomly selected from each grade within each school; all students in selected classes were invited to participate. The survey was conducted anonymously and organized by class, with trained coordinators supervising the process. Of the 2,500 questionnaires distributed, all were returned (response rate: 100%). Fifteen students were excluded before eligibility assessment because they did not provide signed informed consent or did not meet the inclusion criteria for age or grade, leaving 2,485 participants who were initially eligible. Inclusion criteria were: (1) students in grades 5–12 currently enrolled in school; (2) age 10–18 years; and (3) ability to understand and independently complete the questionnaire. Exclusion criteria were: (1)

history of severe physical or psychiatric illness; (2) missing rate of key questionnaire information > 20%; and (3) refusal to participate or withdrawal during the study. After excluding 89 participants with > 20% missing data on key variables and 36 with severe illness, the final analytic sample comprised 2,360 participants (valid response rate: 94.4%), including 1,321 boys (56.0%) and 1,039 girls (44.0%), with a mean age of 14.2 ± 2.2 years (774 Han, 32.8%; 1,468 Zhuang, 62.2%; 118 other minorities, 5.0%).

The target sample size was determined by the number of available students in the selected schools; no formal a priori sample size calculation was performed. The final sample of 2,360 provided adequate precision for detecting small associations.

Informed consent

was obtained from the adolescents and their parents. The study was approved by the Medical Ethics Committee of Youjiang Medical University for Nationalities (Approval No. 2018030501). All procedures were in accordance with the 1964 Helsinki Declaration and its later amendments. The participant flow is described in the text; no separate flow diagram is provided because the sampling and exclusion process was straightforward.

Measures

Internalizing problems were assessed using the Chinese version of the Youth Self-Report (YSR) [20, 21]. The YSR consists of eight dimensions: anxious/depressed, withdrawn/depressed, somatic complaints, social problems, thought problems, attention problems, rule-breaking behavior, and aggressive behavior. The internalizing problems scale comprises three dimensions—anxious/depressed, withdrawn/depressed, and somatic complaints—totaling 30 items. Each item is scored on a 3-point scale: 0 = not true, 1 = somewhat or sometimes true, and 2 = very true or often true. Higher scores indicate more severe internalizing problems. Cronbach's α was .96.

Sedentary behavior was measured using a modified version of the Adolescent Sedentary Activity Questionnaire (ASAQ) [22], adapted to the daily contexts of Chinese adolescents. The questionnaire contains eight items covering watching television/videos, playing electronic games, watching short videos/browsing the internet for entertainment, drawing/handicrafts/playing musical instruments/board games, reading e-books/searching online for study materials, chatting/listening to music, reading printed books, and doing homework. Time spent on each activity was reported using categorical options corresponding to average daily durations: 0 min/day, < 30 min/day (coded as 15 min/day), 30–60 min/day (coded as 45 min/day), 1–2 hr/day (coded as 90 min/day), 2–3 hr/day (coded as 150 min/day), and > 3 hr/day (coded as 210 min/day). Based on activity content and purpose, sedentary behaviors were classified into four types [23]: (1) recreational screen (TV/videos, electronic games, short videos/internet entertainment); (2) educational (e-books/online learning, homework); (3) cultural (drawing/handicrafts/music/board games, reading printed books); and (4) social (chatting/listening to

music). Daily average time for each of the four sedentary behavior types was calculated using a weighted average method [24]: (weekdays × 5 + weekends × 2) / 7, and reported in minutes per day.

Social support was assessed using the Chinese version of the Perceived Social Support Scale (PSSS) [13]. It contains 12 items across family, friend, and significant other support, scored on a 7-point Likert scale (0–6). Cronbach's α was .91.

School belonging was assessed using the Chinese version of the Delaware School Climate Scale–Student (DSCS-S) [11, 25]. It contains 36 items across eight dimensions; items are scored 1–4, with the school bullying dimension reverse-scored. Item 36 is a lie scale and is excluded from scoring. Cronbach's α was .87.

Covariates

Covariates included sex (boy = 0, girl = 1), age (years), and body mass index (BMI). Sex and age were self-reported; height and weight were measured by trained staff using standardized equipment. BMI was calculated as weight (kg) / height² (m²).

Procedure

Before the survey, all research staff received uniform training. The survey was administered anonymously in class units; students completed questionnaires independently, with coordinators supervising. After collection, questionnaires were checked on-site for completeness, and missing items were immediately filled in. Double data entry and logical checking were performed to ensure accuracy. A total of 2,500 questionnaires were distributed; 2,360 valid questionnaires were returned (valid response rate: 94.40%).

Statistical Analysis

EpiData 3.0 was used for data entry; SPSS 27.0 and R 4.6.0 were used for analysis. The significance level was α = .05. A model of moderated indirect associations [26] was constructed with four sedentary behavior types as independent variables (X), internalizing problems as the dependent variable (Y), social support as the intermediate variable (M), and school belonging as the moderator (W). This corresponds to the conceptual specification of a moderated indirect association model (PROCESS Model 14). Sex, age, and BMI were included as covariates (controlling for M and Y but not X).

The model is a saturated path model with observed variables (df = 0), so conventional SEM fit indices (CFI, TLI, RMSEA, SRMR) are not applicable. We therefore estimated the model using ordinary least squares (OLS) regression. Missing data were handled using listwise deletion; no missing data remained in the final analytic sample. Social support and school belonging were centered before computing the interaction term. Common method variance was assessed using Harman's single-factor test; the first

factor accounted for 30.48% of the variance, below the 40% threshold, indicating that common method variance was not a serious concern.

Given the cross-sectional nature of the data, results were reported following the Associational Variable Analysis (AVA) framework proposed by Weems (2025). Bias-corrected nonparametric percentile bootstrap with 2,000 resamples was used to test 95% confidence intervals for indirect associations [27]; an indirect association was considered significant if the interval did not include zero. The index of moderated indirect association [28] was used to test moderated associations; a moderated association was considered significant if the bootstrap 95% confidence interval for the index did not include zero. For significant interactions, simple slope analysis was conducted at the mean and ± 1 SD of school belonging. The model was fitted separately for each of the four sedentary behavior types. All models used the same covariate specification, estimation method, and bootstrap parameters. Sampling weights were not applied because the sampling design aimed to obtain a representative sample rather than to estimate population parameters. No subgroup analyses or sensitivity analyses were performed.

Results

Of the 2,500 questionnaires distributed, all were returned and screened. Fifteen students were excluded because they did not provide signed informed consent or did not meet the inclusion criteria for age or grade, leaving 2,485 initially eligible. After excluding 89 participants with > 20% missing data and 36 with severe illness, 2,360 participants were included in the final analysis (1,321 boys [56.0%]; 1,039 girls [44.0%]; mean age = 14.2 ± 2.2 years; 774 Han [32.8%], 1,468 Zhuang [62.2%], 118 other minorities [5.0%]). There were no missing data on the variables included in the moderated indirect association model.

All four sedentary behavior types were positively correlated with internalizing problems (r = .072–.160, all p < .01). School belonging (r = − .135, p < .01) and social support (r = − .296, p < .01) were negatively correlated with internalizing problems. The four sedentary behavior types were positively correlated with one another (r = .207–.543, all p < .01), and school belonging was positively correlated with social support (r = .440, p < .01). **See Table 1**.

Using social support as the intermediate variable and school belonging as the moderator, a moderated indirect association model was fitted separately for each of the four sedentary behavior types. Because the model is a saturated path model with observed variables (df = 0), conventional fit indices are not applicable and are not reported. Table 2 presents the path coefficients and conditional indirect associations.

Recreational screen sedentary behavior was negatively associated with social support (a_1 = −0.123, SE = 0.022, p < .001), whereas educational (a_1 = 0.103, SE = 0.022, p < .001), cultural (a_1 = 0.051, SE = 0.023, p = .028), and social (a_1 = 0.094, SE = 0.022, p < .001) sedentary behaviors were positively associated with social support. Across the four models, social support was negatively associated with internalizing

problems (b_1 = −3.470 to − 3.812, all p < .001), and the interaction between school belonging and social support was significant (b_3 = 0.379–0.440, all p < .05).

The indices of moderated indirect association were − 0.047 (95% *CI* [− 0.089, − 0.009]) for recreational screen, 0.042 (95% *CI* [0.010, 0.084]) for educational, 0.022 (95% *CI* [0.000, 0.051]) for cultural, and 0.041 (95% *CI* [0.011, 0.079]) for social sedentary behavior. The 95% *CI* for the cultural sedentary behavior index had a lower bound of exactly 0.000, indicating a marginally significant moderating effect; this result should be interpreted with caution.

For conditional indirect associations, recreational screen behavior showed positive indirect associations at low, mean, and high levels of school belonging (0.473, 0.426, and 0.380, respectively), whereas educational, cultural, and social behaviors showed negative indirect associations (e.g., educational: −0.435, − 0.393, and − 0.351, respectively). All conditional indirect associations had 95% *CIs* excluding zero. The index of moderated indirect association for cultural behavior had a lower bound of exactly 0.000, indicating a marginally significant moderating effect. **See** Table 2 **and** Figs. 1–2.

When sex, age, and BMI were included as covariates, sex was associated with internalizing problems (recreational screen model: β = −4.115, SE = 0.512, p < .001), with girls scoring higher than boys. BMI showed a marginally significant association in some models (recreational screen model: β = 0.123, *SE* = 0.062, p = .047). Age was not associated with internalizing problems (all p > .05). Full covariate results for all four models are available in the online supplementary material (Online Resource 1).

Discussion

This study provides evidence that social support serves a bridging role between sedentary behavior and internalizing problems during adolescence, but the direction of this indirect association differs across sedentary behavior types. Recreational screen sedentary behavior showed a positive indirect association with internalizing problems, whereas educational, cultural, and social sedentary behaviors showed negative indirect associations. These findings align with developmental theories emphasizing that the psychosocial consequences of behavior depend on its functional context during adolescence. A study of U.S. adolescents with chronic pain found that physical activity was negatively associated with internalizing problems [29]. An ecological momentary assessment study also found that momentary fluctuations in social support were associated with short-term changes in internalizing symptoms [30]. However, different sedentary behavior types displace social support to varying degrees. Recreational screen sedentary behavior often replaces face-to-face social time, directly weakening social support networks, whereas educational sedentary behavior occurs in school or learning contexts and may co-occur with academic engagement and teacher–student interaction [31, 32]. These findings challenge the assumption that sedentary behavior is a homogeneous risk factor and suggest that its psychosocial consequences depend on functional context. These results have direct implications for clinical practice: mental health practitioners should assess sedentary behavior by type, rather than treating all sitting time as uniformly harmful.

School belonging moderated the strength of the social support indirect association. At higher levels of school belonging, the difference in indirect associations between recreational screen behavior and other sedentary behavior types became larger. Previous studies have shown that school belonging is associated with internalizing and externalizing problems through social support [33], with peer support showing the strongest indirect association [34]. A longitudinal study of Australian adolescents found that school belonging was associated with reductions in depression, anxiety, and stress symptoms over subsequent years [35]. A cross-lagged study also found bidirectional associations between school belonging and problem behaviors, with improvements in school belonging being associated with subsequent reductions in problem behaviors [36]. These findings suggest that school belonging strengthens the indirect association of social support by enhancing individuals' perception and utilization of social support resources. Adolescents with high school belonging have stronger social connections in the school context, making the differences among sedentary behavior types in their associations with internalizing problems through social support more pronounced. This moderation pattern underscores that school belonging is not merely a protective factor but a contextual amplifier of the psychosocial indirect associations linking sedentary behavior to mental health, suggesting that school-based interventions aimed at strengthening belonging may be particularly beneficial for adolescents with high recreational screen time.

The four sedentary behavior types showed a consistent pattern of differential indirect associations with internalizing problems through social support: recreational screen behavior was positive, whereas educational, cultural, and social behaviors were negative. A study of 12,529 adolescents found that recreational screen time was indirectly associated with school adjustment through perceived physical health [37]. Another study found that screen-based recreational sedentary behavior < 2 hours/day and cultural sedentary behavior < 2 hours/day were associated with reduced risk of internalizing behaviors, and further found that the combined exposure group of “outdoor activity ≥ 1 hour/day + screen-based recreational sedentary behavior < 2 hours/day” had the lowest risk of internalizing behaviors [38]. A longitudinal study using accelerometer-based objective measurement further showed that higher moderate-to-vigorous physical activity, light physical activity, and lower sedentary time were associated with lower peer problems, depressive symptoms, and psychological distress during adolescence [39]. The differential pattern can be attributed to differences in the social displacement properties of sedentary behavior types. Recreational screen sedentary behavior displaces face-to-face social time and directly weakens social support networks [31, 32], whereas educational sedentary behavior occurs in school contexts without displacing social connection. Cultural sedentary behavior is typically active in nature, and social sedentary behavior is inherently interpersonal. These results suggest that interventions should move beyond blanket recommendations to reduce all sedentary time and instead adopt type-specific strategies: prioritizing the reduction of recreational screen time, while cautiously considering educational sedentary behavior, which may co-occur with social support and academic engagement. Clinicians and school health practitioners should incorporate this distinction into screening and intervention programs.

However, this study has limitations. The cross-sectional design precludes causal inference. However, any potential reverse causality would likely attenuate the observed associations toward the null, making our estimates conservative. Sedentary behavior data were self-reported and may be subject to recall bias. Although all measures were self-reported, Harman's single-factor test indicated that the first factor accounted for 30.48% of the variance (below the 40% threshold), suggesting common method variance was not a serious concern. Future studies using accelerometers or ecological momentary assessment could provide more precise measures. The sample came from a single urban area in Guangxi, limiting broad generalization; however, it provides a socio-culturally specific context (a multi-ethnic region) that is understudied in sedentary behavior research. The small effect sizes suggest that social support is only a partial intermediate variable, and other psychosocial factors (e.g., sleep quality, peer relationships) may also play a role. Methodologically, the moderated indirect association model was estimated using OLS regression rather than structural equation modeling because the model contains only observed variables and is saturated ($df = 0$). Conventional SEM fit indices do not apply to saturated path models; therefore, model fit is not reported. All indirect and conditional indirect associations were tested using bias-corrected bootstrap, which provides more accurate confidence intervals for nonlinear combinations of parameters than the delta method. The AVA framework further ensures that we report probabilistic associations rather than causal pathways. Future research could use longitudinal designs or cross-lagged models to examine the direction of associations, incorporate objective measures, validate findings in diverse populations, and explore other potential intermediate variables and the differential roles of social support from different sources.

Conclusions

This study provides preliminary evidence that different types of sedentary behavior are differentially associated with adolescent internalizing problems through social support, and that school belonging moderates these indirect associations. Recreational screen time may be a risk factor, whereas educational, cultural, and social sedentary behaviors may serve protective functions. These findings challenge the assumption that sedentary behavior is a homogeneous risk factor and highlight the importance of type-specific interventions in clinical and school settings. Mental health practitioners should prioritize reducing recreational screen time while not over-restricting educational sedentary behavior, and should consider strengthening school belonging as a protective factor. Future longitudinal research is needed to establish causality and to examine additional psychosocial mechanisms linking sedentary behavior to adolescent mental health.

Declarations

Ethics approval and consent to participate

The study was approved by the Medical Ethics Committee of Youjiang Medical University for Nationalities (Approval No. 2018030501). All procedures were in accordance with the 1964 Helsinki

Declaration and its later amendments. Informed consent was obtained from all adolescents and their parents.

Consent for publication

Not applicable. This study does not contain any individual person's data in any form (including individual details, images, or videos).

Competing interests

The authors declare that they have no competing interests.

Authors' information

Not applicable.

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Author Contribution

SW conceived and designed the study, conducted the statistical analyses (including moderated indirect association modeling and bias-corrected bootstrap procedures), and wrote the original draft. LH coordinated the field survey, managed data collection and project administration, and assisted with manuscript review and editing. JH participated in data collection and preliminary analyses and assisted with manuscript review. SD performed the literature search, contributed to data interpretation, and revised the manuscript. RG supervised the study, acquired the funding, provided critical feedback on the analysis and manuscript, and approved the final version. All authors read and approved the final manuscript. RG had full access to all data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request. The data are not publicly available due to privacy and ethical restrictions.

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Tables

Table 1 Correlations Among Sedentary Behavior Types, School Belonging, Social Support, and Internalizing Problems

Variable	*M ± SD*	1	2	3	4	5	6	7
1. Recreational screen	128.5 ± 118.2	1						
2. Educational	139.0 ± 83.3	0.207**	1					
3. Cultural	104.9 ± 87.6	0.261**	0.543**	1				
4. Social	62.6 ± 60.1	0.256**	0.388**	0.452**	1			
5. School belonging	107.4 ± 24.6	-0.029	0.063**	0.062**	0.060**	1		
6. Social support	44.6 ± 16.0	-0.115**	0.097**	0.053**	0.088**	0.440**	1	
7. Internalizing problems	16.5 ± 13.2	0.160**	0.072**	0.122**	0.091**	-0.135**	-0.296**	1

Note. *M* = mean; *SD* = standard deviation. ** $p < .01$.

Table 2. Path Coefficients and Conditional Indirect Associations of the Moderated Indirect Association Model for Sedentary Behavior Types

Path/Association	Recreational screen	Educational	Cultural	Social
Path coefficients				
Sedentary behavior → social support(a_1)	-0.123*** (0.022)	0.103*** (0.022)	0.051* (0.023)	0.094*** (0.022)
Social support → internalizing problems (b_1)	-3.470*** (0.321)	-3.803*** (0.319)	-3.747*** (0.319)	-3.812*** (0.320)
School belonging → internalizing problems (b_2)	-0.607 (0.408)	-0.662 (0.414)	-0.721 (0.417)	-0.723 (0.413)
Social support × school belonging (b_3)	0.379* (0.148)	0.407** (0.151)	0.425** (0.153)	0.440** (0.151)
Sedentary behavior → internalizing problems (direct association)	1.706*** (0.293)	1.273*** (0.279)	1.803*** (0.287)	1.588*** (0.280)
Index of moderated indirect association ($a_1 \times b_3$)	−0.047* (95% CI [−0.089, −0.009])	0.042** (95% CI [0.010, 0.084])	0.022† (95% CI [0.000, 0.051])	0.041** (95% CI [0.011, 0.079])
Conditional indirect associations				
Low school belonging (−1 *SD*)	0.473*** (95% CI [0.301, 0.672])	−0.435*** (95% CI [−0.653, −0.239])	−0.211* (95% CI [−0.408, −0.010])	−0.402*** (95% CI [−0.608, −0.210])
Mean school belonging	0.426*** (95% CI [0.270, 0.596])	−0.393*** (95% CI [−0.583, −0.214])	−0.190* (95% CI [−0.371, −0.009])	−0.360*** (95% CI [−0.551, −0.187])
High school belonging (+1 *SD*)	0.380*** (95% CI [0.237, 0.537])	−0.351*** (95% CI [−0.527, −0.190])	−0.168* (95% CI [−0.332, −0.008])	−0.319*** (95% CI [−0.493, −0.164])

Note. Path coefficients are reported as *β* (*SE*) based on OLS regression. Conditional indirect associations and the index of moderated indirect association are reported with 95% confidence intervals based on bias-corrected nonparametric percentile bootstrap with 2,000 resamples. Covariates included sex, age, and BMI. Because the model is a saturated path model with observed variables (*df* = 0), conventional fit indices (CFI, TLI, RMSEA, SRMR) are not applicable. The 95% *CI* for the cultural sedentary behavior index had a lower bound of exactly 0.000, indicating a marginally significant moderating effect; this result should be interpreted with caution. *$p < .05$. **$p < .01$. ***$p < .001$. †Marginally significant (95% *CI* lower bound = 0.000). Path symbols are shown in Fig. 1.

Figures

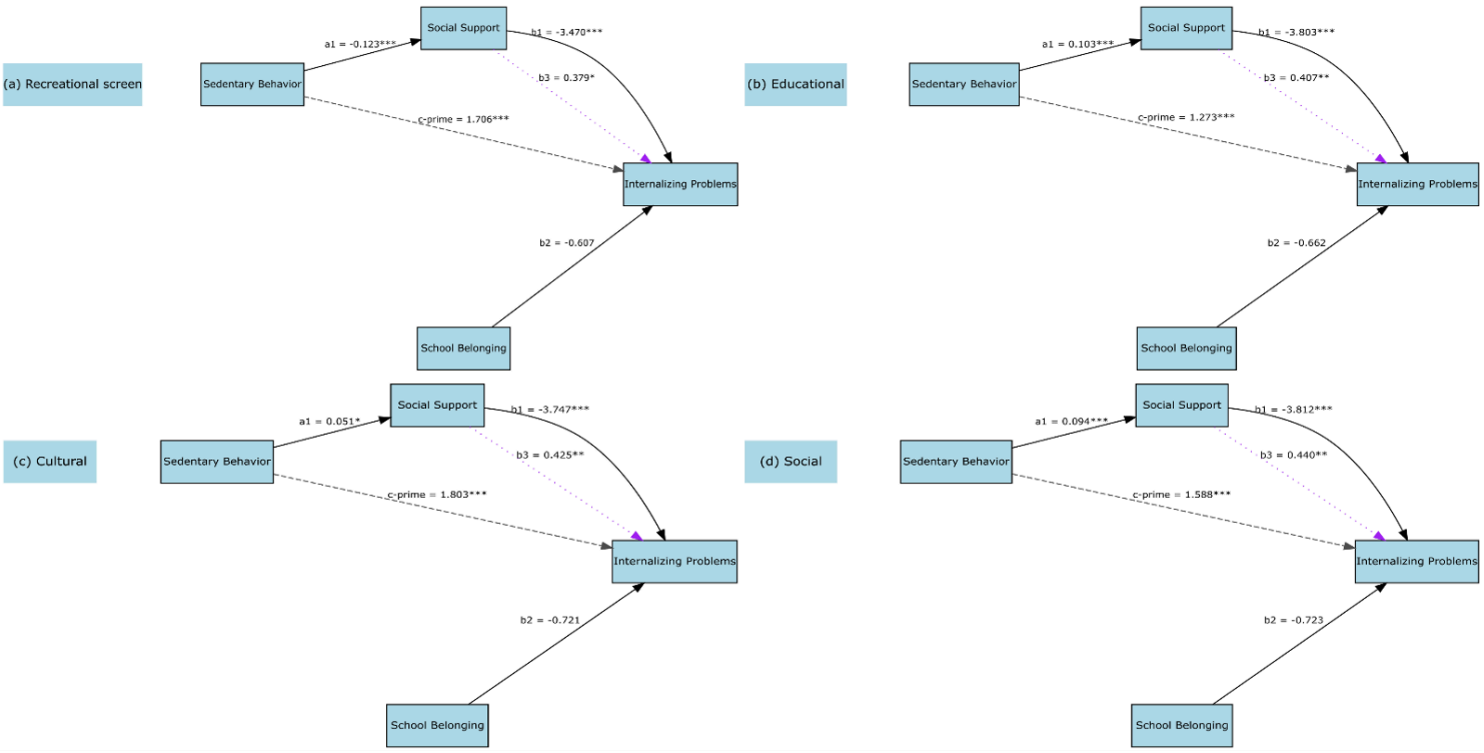


Figure 1

Path analysis models of social support, school belonging, and internalizing problems across sedentary behavior types

Note. Panels (a)–(d) represent recreational screen, educational, cultural, and social sedentary behavior types, respectively. Path coefficients are unstandardized regression coefficients. X = sedentary behavior, M = social support, W = school belonging, Y = internalizing problems; W × M = interaction between school belonging and social support. Dashed arrows indicate direct associations (c'), and dotted arrows indicate interaction associations (b_3). $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$

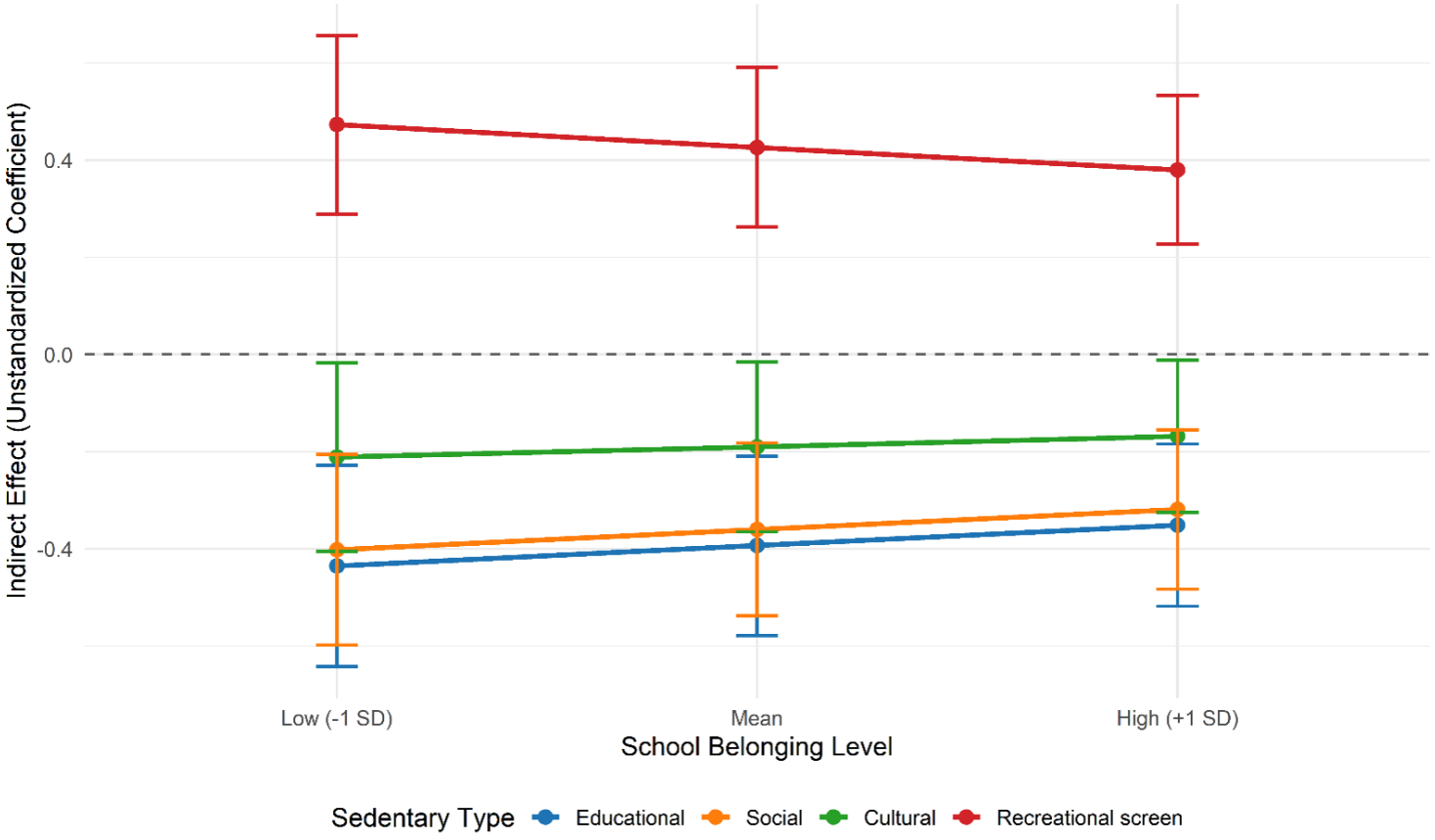


Figure 2

Conditional indirect associations between sedentary behavior types and internalizing problems through social support at different levels of school belonging

Note. School belonging was divided into low, mean, and high levels based on the mean and ±1 *SD*. Points represent point estimates; error bars represent 95% confidence intervals based on bias-corrected nonparametric percentile bootstrap with 2,000 resamples. The dashed line at zero serves as a reference.

Supplementary Files

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