Ciência & Saúde Coletiva

cienciaesaudecoletiva.com.br
ISSN 1413-8123. v.30, n.3

DOI: 10.1590/1413-81232025303.11582023

Association between family violence and physical activity in Brazilian adolescents: a quantile regression analysis

Associação entre violência familiar e atividade física em adolescentes brasileiros: Uma análise regressão quantílica

Asociación entre violencia familiar y actividad física en adolescentes brasileños: un análisis de regresión cuantil

Raycauan Silva Benthroldo (https://orcid.org/0000-0001-5631-8518) [1]
Eliseu Verly Júnior (https://orcid.org/0000-0002-1101-8746) [1]
Leandro Fórnias Machado de Rezende (https://orcid.org/0000-0002-7469-1399) [2]
Catarina Machado Azeredo (https://orcid.org/0000-0002-6189-4429) [3]
Emanuele Souza Marques (https://orcid.org/0000-0002-8633-7290) [1]

Resumo *O objetivo do estudo foi avaliar a associação entre a violência física familiar e diferentes domínios da atividade física em escolares. Estudo transversal com dados da Pesquisa Nacional de Saúde do Escolar 2015. A atividade física foi medida com questionário validado e compreendendo os sete dias prévios à entrevista. Foram avaliados os domínios de deslocamento, lazer, aulas de educação física e atividade física total. A violência física familiar foi avaliada com uma pergunta sobre exposição a agressões físicas no último mês. Análise de regressão quantílica foi realizada para avaliar a associação entre exposição e desfechos, estratificada por sexo. Meninas e meninos expostos à violência fizeram mais atividade física de deslocamento do que os não expostos. Meninos expostos à violência fizeram menos atividade física de lazer do que os não expostos, enquanto as meninas expostas à violência fizeram mais tempo nesta atividade do que as não expostas. Para a aula de educação física, meninos expostos à violência no percentil 80 tiveram mais tempo em aula. Para a atividade física total, meninas expostas à violência tiveram mais tempo de atividade física do que as não expostas. As associações foram distintas para cada domínio de atividade física por sexo.*
Palavras-chave *Atividade física, Violência familiar, Violência infantil, Adolescentes, Inquérito populacional*

Abstract *The study aims to assess the association between family physical violence and different domains of physical activity in students. Cross-sectional study with data from the National School Health Survey 2015. Physical activity was measured with a validated questionnaire and comprised the previous seven days. Physical activity domains investigated were commuting, leisure, physical education class, and total physical activity. Family physical violence was obtained with a question about exposure to physical aggression in the last month. Quantile regression analysis was performed to assess the association between exposure and outcomes, stratified by sex. Girls and boys exposed to family physical violence spent more time in commuting physical activity compared to those not exposed. Boys exposed to family physical violence spent less time in leisure physical activity compared to those not exposed, whereas girls exposed to violence spent more time in this activity than not exposed. For physical education class, exposed boys at the 80th percentile had more time for physical activity. For total physical activity, exposed girls had more time in this activity than unexposed girls. Associations were distinct for each physical activity domain by sex.*
Key words *Physical activity, Family violence, Child violence, Adolescents, Population Survey*

Resumen *El estudio tuvo como objetivo evaluar la asociación entre la violencia física familiar y diferentes dominios de la actividad física en escolares. Estudio transversal con datos de la Encuesta Nacional de Salud Escolar 2015. Se midió la actividad física con un cuestionario validado que abarcó los siete días previos a la entrevista. Se evaluaron los dominios de desplazamientos, ocio, clases de educación física y actividad física total. La violencia física familiar se evaluó con una pregunta sobre la exposición a agresiones físicas en el último mes. Se realizó un análisis de regresión cuantil para evaluar la asociación entre la exposición y los resultados, estratificados por sexo. Las niñas y los niños expuestos a la violencia realizaron más actividad física que los no expuestos. Los niños expuestos a la violencia realizaban menos actividad física en su tiempo libre que los no expuestos, mientras que las niñas expuestas a la violencia dedicaban más tiempo a esta actividad que las no expuestas. Para la clase de educación física, los niños expuestos a la violencia en el percentil 80 tuvieron más tiempo en clase. Para la actividad física total, las niñas expuestas a la violencia realizaron más tiempo de actividad física que las no expuestas. Las asociaciones fueron diferentes para cada dominio de actividad física por sexo.*
Palabras clave *Actividad física, Violencia familiar, Violencia infantil, Adolescentes, Encuesta de población*

[1] Departamento de Epidemiologia, Instituto de Medicina Social, Universidade do Estado do Rio de Janeiro. R. São Francisco Xavier 524, Maracanã. 20550-900 Rio de Janeiro RJ Brasil. raycauanbenthroldo@gmail.com
[2] Departamento de Medicina Preventiva, Escola Paulista de Medicina, Universidade Federal de São Paulo. São Paulo SP Brasil.
[3] Faculdade de Medicina, Universidade Federal de Uberlândia. Uberlândia MG Brasil.

Introduction

Family violence refers to interpersonal violence committed against family members or intimate partners, usually, but not exclusively, taking place at home[1]. It is an abusive behavior whereby one person gains power over another, resulting in potential harm, harm, or threat to harm[2]. Family violence can be manifested by psychological, physical, and sexual abuse or involve neglect or deprivation[1]. It is a global public health problem due to its high prevalence and serious health consequences for all victims regardless of their age group[3].

Physical family violence is the most prevalent violence's nature[4]. Global estimates of prevalence ranged from 60.2% in Africa to 21.9% in Asia for boys, 59% in South America, and 12% in Europe for girls[4]. Evidence has shown that children and adolescents exposed to family violence are exposed to a higher risk of post-traumatic stress disorder, adverse psychosocial outcomes, impaired development, and academic problems[5-7]. Additionally, they are more likely to adopt risky health behaviors throughout their life[2,8].

Physical activity's benefits for health are well known. To obtain its benefits, the World Health Organization (WHO) recommends children and adolescents do 60 minutes per day of moderate to vigorous-intensity physical activity across the week, primarily aerobic exercises[9]. Considering mental health outcomes, physical activity positively controls anxiety and depression and promotes self-esteem in this age group[9]. However, roughly 80% of global children and adolescents do not meet the WHO recommendations[9]. Physical inactivity is recognized as the fourth leading risk factor for death causes worldwide[10]. Besides, according to WHO 2018-2030 global action plan to reduce at 15% the prevalence of physical inactivity in the adult population[11], promoting an active lifestyle for adolescents is necessary. Thus, identifying its predictors is required for the development of effective public health programs to meet the WHO's global plan target. Noteworthy, a systematic review found that exposure to a high level of stress negatively influences the time spent on physical activity, and this time varied according to sex, age, and clinical condition[12].

Epidemiological studies about the association between violence and physical activity in children and adolescents focus on bullying, violent behavior, peer violence/injury, and adverse childhood experiences[7,13-19]. Retrospective cohort of regular students from the USA's public schools exposed to Adverse Childhood Experiences (ACEs) reported lower physical activity amount than their peers not exposed[16]. A cross-sectional survey aimed to evaluate the association between health behaviors and exposure to ACEs in adolescents found that those exposed had a lower chance of meeting physical activity's guidelines[17]. A populational sample of children and adolescents between 10 and 17 years old from the USA reported an inverse association between exposure to ACEs and physical activity[19]. A cohort study with adolescents aged between 9 and 10 years old from the USA reported that exposure to ACEs affects aerobic, but not total and anaerobic physical activity[18].

However, fewer know regarding the association between some violence aspects and physical activity features. Previous studies do not assess if exposure to violence could differently be associated with total and domain-specific physical activity in children and adolescents. Moreover, it is not known that violence can be associated with adolescents who practice physical activity at variable levels. Studies evaluating violence as ACEs present their results grouping different adverse experiences, making it difficult to disentangle the association of each violence's nature with physical activity. Furthermore, there is a scarcity of research that investigated this association in low-and-middle economic countries. Finally, it is important to point out that there are no studies that evaluate the association between family violence and total and domain-specific physical activity among adolescents.

Therefore, the present study aimed to assess the association between family physical violence and total and domain-specific physical activity in Brazilian adolescents. We hypothesized that the associations between family physical violence and physical activity differ by domains of physical activity, by sex, and are variable according to adolescents' physical activity levels.

Material and Methods

Study design and sample

We used data from the Brazilian National Survey of Student's Health (*Pesquisa Nacional de Saúde do Escolar* - PeNSE), a national representative, school-based survey carried out in 2015. The main objective of PeNSE was to assess the prevalence of risk and protective factors for health in adolescents from public and private

schools in Brazil[20]. Participants were selected by multiple-stage cluster sampling. Primary sampling units were schools and classrooms were second. All students from selected classes were invited to participate in the study. Schools with less than 15 students enrolled in 9th grade and those which had 9th grade only during the night period were excluded. Participants were not included in the study if they did not attend school during data collection, refused to participate or did not report their age and sex. Overall, the PeNSE 2015 sample account included 102,072 students enrolled in 9th grade from the 26 state capitals and Federal District – the sample's response rate was 97.3%. Our study comprised all 102,072 respondents in the PeNSE 2015.

Data was collected from April to September 2015. Participants responded to a self-administrated, multi-thematic questionnaire through a smartphone. The questionnaire included health risk factors, health behaviors, demographic and socioeconomic characteristics, familiar context, and type of school. Further details of PeNSE can be found elsewhere[20].

Instruments

Physical activity time was measured using a validated questionnaire[21], including information on the frequency and duration of commuting to and from home-school, leisure-time physical activity, and physical education classes in the last seven days.

Each domain comprises a specific type of physical activity practiced by adolescents daily. Commuting physical activity measures the time spent by adolescents shuttling to and from school. It includes the frequency and roughly the time the adolescents went to school cycling or walking. Leisure physical activity is compounded from activities practiced in the adolescent's free waketime. It includes participation in a sport team, weightlifting practice, dance, gymnastics, or another physical activity practiced. Physical education refers to the time adolescents spend actively during the physical education class. Each physical activity domain in the week was estimated by multiplying the frequency by the time spent in it.

Total physical activity time (in minutes) per week was calculated based on the sum of each physical activity domain. Adolescents who declared spending lower than 300 minutes were classified as insufficient active, and those who spent 300 or more minutes of physical activity were classified as physically active[9]. This classification was used to estimate the prevalence of adolescents meeting WHO's guidelines and to describe the sample.

Family physical violence was measured through the following single question: "*in the last 30 days, how many times have you been physically assaulted by an adult of your family*". Answers options varied from not once to twelve times or more. Adolescents who responded positively at least once in the last 30 days were considered victims of violence.

Demographic and socioeconomic variables were sex, age (in years), ethno-racial identity (white, black, brown/mixed, yellow, or indigenous), and household economic status score. Ethno-racial identity classification is compatible with the Brazilian Institute of Statistics and Geography (IBGE)[22] guidelines. The household economic status score was based on the ownership of the following goods and/or services: ownership of a landline, cell phone, computer, car and/or motorcycle, the number of bathrooms with shower, internet access in-home and hiring of housekeepers three or more times a week. For each positive answer by these questions were attributed one point. The household economic status was formulated adding each positive answer obtained was a scale from 0 to 10. Participants were classified with three or lower properties and four or more properties[23]. The family context included the family structure (living with both parents, single parents, and without father or mother)[24]. Variable related to school context was the type of school (public, private).

Statistical analysis

Descriptive analysis was performed to characterize the study sample. Means, standard deviations (SD), proportion and 95% confidence interval (95%CI) were calculated using Stata 15.0 *svy*[25] suite to address the complex sampling structure.

We performed a multivariable quantile regression model to examine the associations of family physical violence with total and domain-specific physical activity. Physical activity was not normally distributed, and the homoscedasticity assumption was not reached. Furthermore, the presence of outliers and an overly skewed distribution of the data would affect the residuals. Thus, quantile regression can accommodate these conditions[26]. In addition, physical activity variables were zero-inflated (i.e., the lowest positive values were at 60th percentile or higher), therefore coefficients were estimated

from the 60th to 85th percentiles by every five centiles by sex. It is common in the physical activity research field that the distribution of physical activity tends to be right-skewed and zero-inflated, representing the high prevalence of individuals which do not practice physical activity[27]. Selection of the adjustment variables was guided by the theoretical model developed from the synthesis of the literature on violence and physical activity (Figure 1). Multivariable models were adjusted by the following potential confounders: age, ethno-racial identity, household economic status, family structure, and school type, due to evidence of their associations with exposure and outcome variables[28-31]. Quantile regression coefficients express how much a specific quantile of the physical activity distribution is affected, in minutes, across the categories of family physical violence. For instance, the 60th percentile of commuting physical activity in boys exposed to family physical violence was, in minutes, 57.5 minutes higher compared with the 60th percentile in non-exposure boys. Confidence intervals (95%CI) were estimated using 200 bootstrap resampling. The coefficient for each percentile was graphically plotted jointly with their 95%CI. When the 95%CI of a coefficient does not cross the abscissa axis (i.e., the line representing the value 0), it indicates that the populational parameter is not equal to zero considering the level of 5%, suggesting an association between the predictor and outcome variable. The procedure PROC QUANTREG in the SAS On-demand for academics was used for the quantile regression analysis.

Results

Table 1 shows socioeconomic, demographic profile, and prevalence of family physical violence, physical activity practice, and means and standard deviation for each physical activity domains among Brazilian school adolescents.

Table 2 shows the means, standard deviation, and 95%CI of the amount for each physical activity domain practiced by adolescents according to the sex and family violence exposure condition.

The multivariable quantile regression model showed different associations of family physical violence with commuting, leisure-time physical activity, physical education class, and total physical activity for boys and girls (Table 3 and Figure 2 a_1 to d_2). Overall quantile regressions' percentiles predictive difference in minutes estimated and 95%CI, for total and domain-specific physical activity by sex is shown in Table 2.

Regarding commuting physical activity, both sexes at the exposure group reported spending more time than those not exposed in all percentiles (Figure 2 a_1 and a_2).

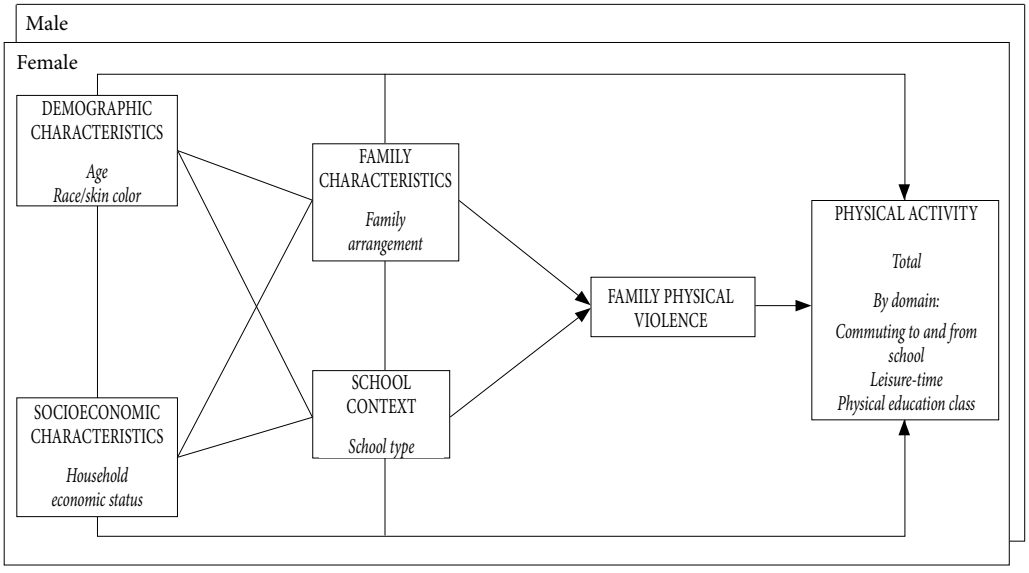

Figure 1. Investigative theoretical and operational model.

Source: Authors.

For leisure-time physical activity, the association between family physical violence differs for boys (Figure 2 b_1) and girls (Figure 2 b_2). Family physical violence was inversely associated with leisure-time physical activity in boys across the entire percentiles, except at 60th percentile (Figure 2 b_1). Girls who were exposed to family physical violence were positively associated with leisure-time physical activity only from 80th percentile (Figure 2 b_2).

At the physical education class, exposure to family physical violence was associated with higher physical activity only in 80th percentile in boys (Figure 2 c_1), but not in girls (Figure 2 c_2).

Finally, exposure to family physical violence was not associated with total physical activity in boys (Figure 2 d_1), but exposed girls reported higher total physical activity throughout all percentiles (Figure 2 d_2).

Discussion

Results show that physical family violence affects different specific domains and total physical activity between the sexes. Boys exposed to physical family violence tended to increase commuting and decrease leisure-time physical activity in overall percentiles. Also in all percentiles, exposed girls spend more commuting and total physical activity than non-exposed peers. Exposure positively associations with physical education activity in 80th percentile for boys. Finally, exposure was positively associated with leisure physical activity for girls above the 80th percentile.

Quantile regression analysis allowed an estimate of the association between family physical violence and total and domain-specific physical activity in adolescents in different groups allocated throughout different percentiles. The results support the idea that individuals included in different percentiles could respond differently to the same exposure condition[32]. The linear regression approach to examining this association assumes that the estimated differences would move along the distribution in the same direction. If we used the linear regression method some associations identified could not be found. However, our research result shows a diversity of coefficients from quantile regressions, suggesting that the association changes over each percentile group. This analytical method should be more adopted in future studies which can better explain how different groups within each percentile particularly respond to exposure conditions.

Table 1. Profile of the study sample.

Variable	Sample		
	N[a]	%	(95%CI)
Sex			
Boys	49,290	48.7	48.1-49.3
Girls	52,728	51.3	50.6-52.0
Age (years)			
≤13	17,290	18.2	17.2-19.3
14	51,611	51.0	50.1-51.9
15	20,864	19.8	19.1-20.5
≥16	12,337	11.0	10.4-11.5
Ethno-Racial Identity			
White	33,775	36.1	35.1-37.2
Black	12,849	13.4	12.8-13.9
Asian descent	4,580	4.1	3.9-4.3
Brown/mixed	46,935	43.1	42.1 - 43.9
Indigenous	3,825	3.3	3.1-3.5
Family Structure			
Both parents	58,773	59.3	58.5-60.0
Single Parent	36,616	35.0	34.3-35.6
Reconstituted Families	6,647	5.7	5.4-5.9
Household economic status score			
>4 goods and/or services	63,460	61.3	60.1-62.5
≤3 goods and/or services	38,138	38.7	37.5-39.9
School Type			
Public	81,154	85.5	83.4-87.5
Private	20,918	14.5	12.5-16.6
Family physical violence			
No	86,795	85.5	85.0-86.0
Yes	15,277	14.5	14.0-15.0
Physical activity			
Active (≥300 min/week)	37,645	37.3	36.5-38.0
Inactive (<300 min/week)	64,427	62.7	61.9-63.4

Variable	N[a]	Mean (SD)	(95%CI)
Commuting Physical activity	101,449	95.9 (1.6)	92.6-99.2
Physical Education Classes	101,568	54.9 (0.6)	53.3-56.0
Leisure Physical Activity	101,585	97.9 (0.9)	96.1-99.7
Total Physical Activity	101,072	198.3 (1.4)	195.6-201.1

Notes: [a]Number total subjects investigated; SD: Standard deviation; CI: Confidence Interval.

Source: Authors.

Our findings showed that all percentiles of family physical violence had a positive relation with commuting physical activity in both sexes. Additionally, Table 2 information shows that in both groups girls and boys practice the same mean time in commuting physical activity. A study that investigated the association of exposure to cumulative ACEs and health behavior during the COVID-19 pandemic using

a nationally representative sample of adolescents (range 10-14 years) from the USA reported that adolescents exposed to 4 or plus ACEs had few hours by the week of physical activity and least days meeting WHO's physical activity guidelines[33]. However, no previous research investigated the relationship between exposure to family violence and commuting physical activity exactly. One potential explanation is that adolescent victims of family physical violence

Table 2. Physical activity time for each domain, by sex and family violence exposure conditions.

Physical activity domains	Boys			
	Exposed		Not exposed	
	Mean (SD)	95%CI	Mean (SD)	95%CI
Commuting Physical Activity	54.0 (2.0)	50.0-58.0	44.2 (1.0)	42.2-46.2
Physical Education Classes	68.9 (1.8)	65.3-72.5	62.8 (0.8)	61.1-64.6
Leisure Physical Activity	119.7 (3.0)	113.8-125.6	131.5 (1.4)	128.8-134.3
Total Physical Activity	242.6 (4.4)	234.0-251.3	238.9 (2.0)	234.9-243.0
Physical activity domains	**Girls**			
	Exposed		Not exposed	
	Mean (SD)	95%CI	Mean (SD)	95%CI
Commuting Physical Activity	54.2 (1.6)	50.9-57.5	43.8 (0.9)	42.0-45.7
Physical Education Classes	48.2 (1.3)	45.6-50.8	45.6 (0.7)	44.1-47.2
Leisure Physical Activity	70.9 (2.1)	66.8-75.0	67.3 (1.0)	65.2-69.4
Total Physical Activity	173.5 (3.1)	167.2-179.7	157.0 (1.6)	153.8-160.2

Notes: SD: Standard deviation; CI: Confidence Interval.

Source: Authors.

Table 3. Quantile regression's percentiles predictive difference estimated coefficients and 95% confidence intervals for total and specific domains of physical activity by sex.

Percentiles	Total Physical Activity		Leisure Physical Activity		Commuting Physical Activity		Physical Education Classes	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Percentile 60th								
Δ[a]	-10.0	33.8	-20.0	4.0	57.5	45.0	0.0	0.0
(95%CI)	(-25.4 – 5.4)	(19.5 – 48.1)	(-29.9 – 10.0)	(-0.67 – 8.7)	(49.7 – 65.2)	(30.1 – 59.9)	(-0.1 – 0.1)	(-0.7 – 0.7)
Percentile 65th								
Δ[a]	-9.6	33.0	-24.3	1.4	50.0	26.5	0.3	0.0
(95%CI)	(-23.7 – 4.3)	(15.6 – 50.4)	(-34.9 – -13.8)	(-3.5 – 6.4)	(39.0 – 60.7)	(22.4 – 30.6)	(-0.9 – 1.6)	(-1.7 – 1.7)
Percentile 70th								
Δ[a]	-0.4	41.0	-26.6	5.0	25.0	26.5	0.0	0.0
(95%CI)	(-12.1 – 11.3)	(29.4 – 52.6)	(-45.6 – -7.6)	(-2.7 – 12.7)	(13.8 – 36.1)	(17.5 – 35.5)	(0.0 – 0.0)	(-0.2 – 0.2)
Percentile 75th								
Δ[a]	-2.5	27.6	-35.7	0.7	25.0	35.0	0.6	0.0
(95%CI)	(-18.9 – 13.9)	(16.7 – 38.6)	(-50.8 – -20.6)	(-12.7 – 14.0)	(7.9 – 42.0)	(26.7 – 43.2)	(-0.5 – 1.7)	(-0.6 – 0.7)
Percentile 80th								
Δ[a]	0.0	32.5	-30.0	5.0	29.9	35.0	14.3	0.0
(95%CI)	(-17.2 – 17.2)	(19.7 – 45.2)	(-40.2 – -19.7)	(-6.7 – 16.7)	(11.7 – 48.0)	(14.0 – 55.9)	(6.5 – 22.1)	(-0.5 – 0.5)
Percentile 85th								
Δ[a]	13.0	30.9	-36.6	29.0	25.0	22.7	6.2	0.7
(95%CI)	(-9.0 – 35.1)	(13.2 – 48.5)	(-57.1 – -16.1)	(16.2 – 41.8)	(4.8 – 45.1)	(12.0 – 33.4)	(-0.4 – 12.9)	(-2.5 – 4.1)

Notes: CI: Confidence Interval. [a]Coefficient represents the estimated difference, in minutes, between the time of physical activity domain in each group of exposure conditions. The reference group in the analysis was the exposure group. The model was adjusted by age, ethno-racial identity, household economic status, family structure, and school type.

Source: Authors.

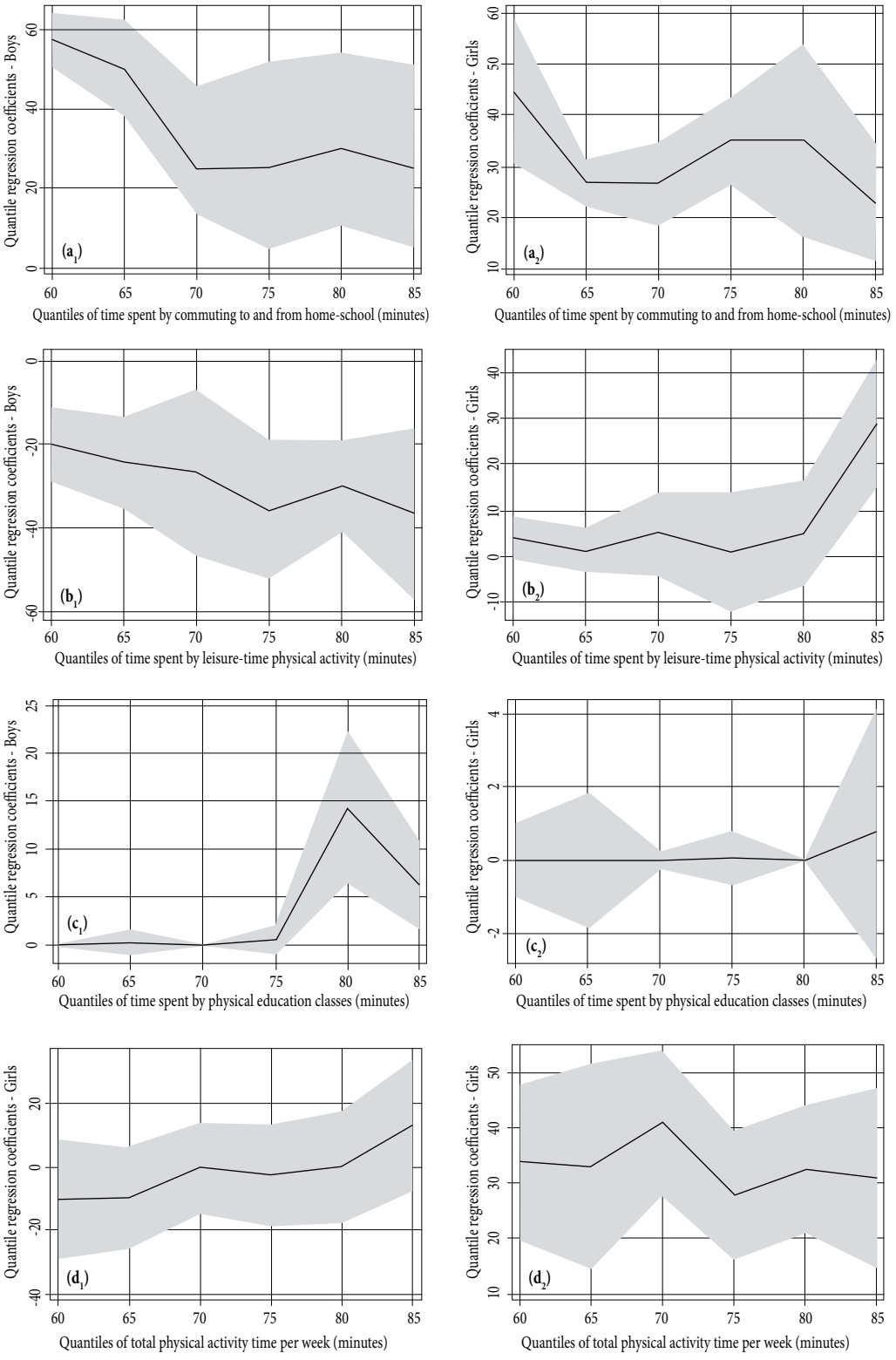

Figure 2. Quantile regression coefficients for quantiles of time spent in total and domain physical activity by sex.

Note: The solid line shows quantile regression coefficients of predictive median difference for the exposed group at each quantile. The shaded area represents the 95% confidence interval for the quantile regression coefficients. The dashed line represents the abscissa axis.

Source: Authors.

choose to make a longer journey home-school to increase the time spent away from home, where the violence occurs, thus avoiding longer time with the aggressor and the occurrence of new episodes. The COVID-19 pandemic allowed us to visualize the impact of longer time spent together between victim and aggressor and increased violence within the home[34]. For some children and adolescents, home is not the safest place to be, whereby the higher time the victim spends with the aggressor more vulnerable to conflicts and violence.

Our results showed that boys engaged more in leisure physical activity than girls. It reflects a worldwide reality in which girls report less time doing this physical activity domain than boys[35]. The strongest evidence for health benefits is from the time engaged in leisure physical activity[9]. Therefore, it is important to identify evidence-based interventions to promote leisure physical activity in girls, so that they can obtain health benefits. In boys, in the overall percentiles, exposure to family physical violence was negatively associated with leisure physical activity. Quantile regressions' coefficients allowed us to identify that which higher the percentile, bigger the difference in leisure physical activity between the boys exposed to physical family violence and those not exposed. Research investigating the involvement in fights in the last 12 months and different types of physical activity in a school-based sample of adolescents (15-19 years) from Santa Catarina, a southern state in Brazil, reported that those boys more involved in fight practice more individual and in group physical activity than not exposure[36]. However, this study used an exposure condition involving a fight with peers, not exposure to family physical violence, which would explain the difference between results.

On the other hand, family physical violence was positively associated with leisure physical activity in girls above the 80th percentile. Noteworthy, using only Table 2 information does not have a difference in leisure physical activity between exposure and not exposure girls. However, quantile regression allowed us to identify the difference only on the higher percentile. This shows that girls who engage more frequently in leisure physical activity when exposed to family physical violence tend to spend more time doing so. Engaging in regular physical activity has a role in managing stress[37], which could stand for emotion-focused coping eliminating displeasure feelings[38]. Seigel *et al.*[39] support a behavioral activation theory in which women's exposure to stress-induced conditions could boost physical activity to higher levels, but this response varies by emotional and behavioral traits individual. This mechanism can explain partially the results obtained. Those who regularly respond to practice physical activity to cope with stress report higher exercise behavior than they do not[37,39]. These results are not corroborated with previous findings. Research of a birth cohort of adolescents (aged 15 at follow-up) from 20 large cities of the USA investigated the association of exposure to community and family violence in childhood (5 to 9 years old) in health behaviors in adolescence, including physical activity, and not identify association[8]. Harada *et al.*[17] investigated the association of exposure to ACEs and weight-related health behavior in a national sample of children (aged 6 to 17 years) from the United States and found a negative association with physical activity daily between exposure for parent divorce, household mental illness, and household substance abuse, but not with domestic violence. However, both researchers used parents as a source of measure for exposure and outcome, which differs from our data, collected by adolescent interviews. Unfortunately, PeNSE questionnaire did not investigate the types and reasons for doing leisure physical activity, which would be helpful to better explain these results.

Regarding physical education classes, the boys show a mean time of participation in these classes higher than girls, corroborating with previous research[40,41]. For boys, we can identify a small higher mean of time in exposure (68.9, 95%CI: 65.3-72.5) than not exposure group (62.8, 95%CI: 61.1-64.6). However, the quantile's regression coefficients show an association only in the percentile 80th in boys. Study that investigated peers' physical violence victimization episodes and involvement in fights and participation in physical education observed a positive association between participation in physical education classes and physical violence victimization and involvement in fights[42]. A study using a national representative sample of children (10 to 17 years) from the United States collected information from children's parents about exposure to ACEs and sports participation in the least 12 months and identified a negative association for boys between those exposure to only once ACEs, but not than those exposure to two or more ACEs[19]. Generally, sport is a typical physical educations' classes component and has been associated with the physical fight in youth[14]. It is important to mention that the literature points

to family violence as a risk factor for involvement in fights. Adolescents who are victims of this type of violence learn that violence can be one way of resolving conflicts[43]. In this sense, our results may conceal a possible perpetration role of this group, once adolescents' exposure to physical abuse has more chance of being violence perpetrator[44]. Further research should evaluate the possible link between exposure to family physical violence, violence perpetration, and domain-specific physical activity in adolescents.

We identify in research a great difference between total physical activity means between sexes, with boys engaging more than girls. Regarding the quantile regressions coefficients' data, we identify a positive association between total physical activity with exposure to family violence for girls only. Moreover, regressions' coefficients identify that the difference in the time of total physical activity between the groups is the same along all percentiles for the girls. Earlier study identified a negative association only for boys[19]. A longitudinal study using data from a national representative sample of adolescents (aged 10 to 11 years) from 21 United States cities investigated the relationship of exposure to accumulative ACEs with health-related behavior and found a negative association in those children exposure to two or more ACEs only in aerobic activities, but not in total or anaerobic activities[18]. Therefore, our study results support the evidence of the heterogeneity of the influence of the different types of violence exposure and physical activity, its relationship should be investigated in future research.

Epidemiological evidence has suggested an association between ACEs and health risk behavior in adolescence and adulthood[45]. Family physical violence also has been associated with the development of obesity and physical inactivity[16], cardiovascular disease, psychiatric disorder, and premature mortality[45]. Some evidence suggests that exposure to violence is associated with higher stress response hormone levels throughout life and a frame of dangerous chronic stress conditions[46], with impaired function hypothalamic-pituitary-adrenal axis and immune system[46]. Moreover, exposure to ACEs it is associated with poor mental health in adolescents[47-49]. Therefore, poor mental health originates from exposure to family violence can be the pathway between the exposure condition and the physical activity practice. Previous results reported that adolescents with poor mental health engaged less in physical activity[50,51]. However, evidence has shown it could be changed with the maintenance of an active lifestyle in adolescence[52]. Physical activity could work as a prophylactic component for toxic stress due to its effect on the brain, endocrine, and immune functioning[9]. Indeed, other unhealthy behaviors, such as smoking, drinking alcohol, excessive television viewing, and drug use, to be generally coping and stress management behavior, which could probably be the same mechanism affecting regular physical activity[12]. This relation is little explored, mainly in the adolescent population[12], and other studies with different sample and methodological designs are needed to evaluate its relationship and to support evidence-based public health programs aiming to promote adolescents' health conditions.

Exposure to family violence in early life is a public health problem, and schools are key institutions to appraise these issues. Adolescents spend most of the day inside the school, the strict and extended bond maintained between students' family members and the school community allows a relationship of security and intimacy. US Centers for Disease Control and Prevention (CDC), along with universities, federal agencies, non-governmental organizations from the state, and local voluntary organizations, summarized the major guidelines for the implementation to prevent unintentional injuries, violence, and suicide in youths. The guidelines recommend that schools and communities adopt their guidance with higher priority based on their owner necessity and resource availability[53]. Furthermore, Brazil has the School Health Program, which aims to contribute to health promotion and peace culture addressing the identification, notification, and prevention of violence through joint actions of public education and public health[54].

This study has some strengths that should be considered. The originality of the research question can be highlighted. There are no studies that investigated the association between family physical violence and total and domain-specific physical activity in adolescents. In addition, the large and representative sample size, and the high survey response rate (97.3%) of Brazilians' capitals student adolescents, permit generalizability of the results for this population. The use of quantile regression is also a strength of this study, as it provides additional insights into the association of family physical violence with physical activity.

However, the findings should be interpreted with caution, as there are some limitations.

Firstly, the cross-sectional design may be challenging to quantify causal effects. Other limitation concerns the measurement error of the exposure. Family physical violence was measured through a single question and until 30 days early exposure that was not permitted assess the intensity and frequency of exposure. Additionally, only adolescents who regularly attend the school responded to the questionnaire, which may underestimate the prevalence of violence once adolescents who suffer physical abuse tend to fault more times than those who do not. Future studies should be conducted using a validated, reliable, and comprehensive instrument to measure family physical violence and its frequency and intensity. Another limitation is the small time-window of the questionnaire on physical activity (7 days prior to the interview date) and the impossibility of identifying the intensity of the exercise performed. Despite bringing more robustness to the information, such aspects can be minimized when considering the recommendation of the WHO[9]. Besides it guides 300 minutes of moderate-to-vigorous physical activity, it emphasizes that some physical activity is better than nothing. However, although the questionnaire is validated to estimate physical activity, a direct instrument has the most reliable and accurate measurements. It is worth noting that the data used in this research was gathered in 2015 and investigation and analysis with current data would show more accurate information. Finally, future longitudinal studies are necessary to analyses the intensity of physical activities and their association with family physical violence and other violence forms and their possible directions.

To conclude, results suggest a distinct association between family physical violence and physical activity in adolescents. Adolescents exposed to family physical violence spend more time commuting physical activity in both sexes. Exposed boys spend less time in leisure-time physical activity, while for girls, there was a positive effect above the 80th percentile. The experience of family physical violence was associated with higher time spent in physical education classes in boys at the 80th percentile of activity. Finally, exposed girls spend more time in total physical activity per week than those not exposed.

The results of this study support the hypothesis that the association between family physical violence and physical activity differs by domain and sex. Nevertheless, it is worth highlighting the scarcity of studies focusing on this relationship. It reinforces the need for further studies to explore better the relationship between exposure to family physical violence in adolescents and physical activity (total and by domain). Recommend evaluating the association of other types of family violence, such as psychological, emotional, neglect, and sexual and physical activity in children and adolescents.

Collaborations

RS Benthroldo: data curation, formal analysis & writing original draft. E Verly Júnior: data curation, formal analysis, validation, writing review & editing. LFM Rezende: writing review & editing. CM Azeredo: writing review & editing. ES Marques: data curation, formal analysis, supervision, validation, visualization, writing review & editing.

References

1. Krug EG, Dahlberg LL, Mercy JA, Zwi AB, Lozano R. Child abuse and neglect by parents and other caregivers. In: World Health Organization (WHO). *World report on violence and health*. Geneva: WHO; 2002. p. 57-86.
2. Huecker M, King K, Jordan G, Smock W. *Domestic Violence*. Treasure Island: StatPearls; 2021.
3. Hillis S, Mercy J, Amobi A, Kress H. Global Prevalence of Past-year Violence Against Children: A Systematic Review and Minimum Estimates. *Pediatrics* 2016; 137(3):e20154079.
4. Moody G, Cannings-John R, Hood K, Kemp A, Robling M. Establishing the international prevalence of self-reported child maltreatment: a systematic review by maltreatment type and gender. *BMC Public Health* 2018; 18(1):1164.
5. Haahr-Pedersen I, Ershadi AE, Hyland P, Hansen M, Perera C, Sheaf G, Bramsen RH, Spitz P, Vallières F. Polyvictimization and psychopathology among children and adolescents: A systematic review of studies using the Juvenile Victimization Questionnaire. *Child Abuse Negl* 2020; 107:104589.
6. Norman RE, Byambaa M, De R, Butchart A, Scott J, Vos T. The long-term health consequences of child physical abuse, emotional abuse, and neglect: a systematic review and meta-analysis. *PLoS Med* 2012; 9(11):e1001349.
7. Hughes K, Bellis MA, Hardcastle KA, Sethi D, Butchart A, Mikton C, Jones L, Dunne MP. The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis. *Lancet Public Health* 2017; 2(8):e356-e366.
8. James S, Donnelly L, Brooks-Gunn J, McLanahan S. Links Between Childhood Exposure to Violent Contexts and Risky Adolescent Health Behaviors. *J Adolesc Health* 2018; 63(1):94-101.
9. World Health Organization (WHO). *WHO guidelines on physical activity and sedentary behaviour*. Geneva: WHO; 2020.
10. World Health Organization (WHO). *Global health risks: mortality and burden of disease attributable to selected major risks*. Geneva: WHO; 2009.
11. World Health Organization (WHO). *Global action plan on physical activity 2018-2030: more active people for a healthier world*. Geneva: WHO; 2018.
12. Stults-Kolehmainen MA, Sinha R. The effects of stress on physical activity and exercise. *Sports Med* 2014; 44(1):81-121.
13. Turagabeci AR, Nakamura K, Takano T. Healthy lifestyle behaviour decreasing risks of being bullied, violence and injury. *PLoS One* 2008; 3(2):e1585.
14. Garry JP, Morrissey SL. Team sports participation and risk-taking behaviors among a biracial middle school population. *Clin J Sport Med* 2000; 10(3):185-190.
15. Demissie Z, Lowry R, Eaton DK, Hertz MF, Lee SM. Associations of school violence with physical activity among U.S. high school students. *J Phys Act Health* 2014; 11(4):705-711.
16. Duke NN, Borowsky IW. Health Status of Adolescents Reporting Experiences of Adversity. *Glob Pediatr Health* 2018; 5:2333794X18769555.
17. Harada M, Guerrero A, Iyer S, Slusser W, Szilagyi M, Koolwijk I. The Relationship Between Adverse Childhood Experiences and Weight-Related Health Behaviors in a National Sample of Children. *Acad Pediatr* 2021; 21(8):1372-1379.
18. Lewis-de Los Angeles WW. Association Between Adverse Childhood Experiences and Diet, Exercise, and Sleep in Pre-adolescents. *Acad Pediatr* 2022; 22(8):1281-1286.
19. Noel-London K, Ortiz K, BeLue R. Adverse childhood experiences (ACEs) & youth sports participation: Does a gradient exist? *Child Abuse Negl* 2021; 113:104924.
20. Instituto Brasileiro de Geografia e Estatística (IBGE). *Pesquisa Nacional de saúde do Escolar 2015*. Rio de Janeiro: IBGE; 2016.
21. Tavares LF, Castro IR, Cardoso LO, Levy RB, Claro RM, Oliveira AF. Validity of indicators on physical activity and sedentary behavior from the Brazilian National School-Based Health Survey among adolescents in Rio de Janeiro, Brazil. *Cad Saude Publica* 2014; 30(9):1861-1874.
22. Instituto Brasileiro de Geografia e Estatística (IBGE). *Características* Étnico-raciais da População: Classificações e identidades. Rio de Janeiro: IBGE; 2013.
23. Silva RMA, Andrade ACS, Caiaffa WT, Medeiros DS, Bezerra VM. National Adolescent School-based Health Survey - PeNSE 2015: Sedentary behavior and its correlates. *PLoS One* 2020; 15(1):e0228373.
24. Langøy A, Smith ORF, Wold B, Samdal O, Haug EM. Associations between family structure and young people's physical activity and screen time behaviors. *BMC Public Health* 2019; 19(1):433.
25. StataCorp. *Stata 18 Survey Data Referencial Manual*. Stata Press; 2023.
26. Hao L, Naiman DQ. *Quantile regression*. Thousand Oaks: SAGE Publications; 2007.
27. Nobre AA, Carvalho MS, Griep RH, Fonseca MJMD, Melo ECP, Santos IS, Chor D. Multinomial model and zero-inflated gamma model to study time spent on leisure time physical activity: an example of ELSA-Brasil. *Rev Saude Publica* 2017; 51:76.
28. Aleksovska K, Puggina A, Giraldi L, Buck C, Burns C, Cardon G, Carlin A, Chantal S, Ciarapica D, Colotto M, Condello G, Coppinger T, Cortis C, D'Haese S, De Craemer M, Di Blasio A, Hansen S, Iacoviello L, Issartel J, Izzicupo P, Jaeschke L, Kanning M, Kennedy A, Ling F, Luzak A, Napolitano G, Nazare JA, Perchoux C, Pischon T, Polito A, Sannella A, Schulz H, Sohun R, Steinbrecher A, Schlicht W, Ricciardi W, MacDonncha C, Capranica L, Boccia S. Biological determinants of physical activity across the life course: a "Determinants of Diet and Physical Activity" (DEDIPAC) umbrella systematic literature review. *Sports Med Open* 2019; 5(1):2.
29. Mulder TM, Kuiper KC, van der Put CE, Stams GJM, Assink M. Risk factors for child neglect: A meta-analytic review. *Child Abuse Negl* 2018; 77:198-210.
30. O'Donoghue G, Kennedy A, Puggina A, Aleksovska K, Buck C, Burns C, Cardon G, Carlin A, Ciarapica D, Colotto M, Condello G, Coppinger T, Cortis C, D'Haese S, De Craemer M, Di Blasio A, Hansen S, Iacoviello L, Issartel J, Izzicupo P, Jaeschke L, Kanning M, Ling F, Luzak A, Napolitano G, Nazare JA, Perchoux C, Pesce C, Pischon T, Polito A, Sannella A, Schulz H, Simon C, Sohun R, Steinbrecher A, Schlicht W, MacDonncha C, Capranica L, Boccia S. Socio-economic determinants of physical activity across the life course: A "DEterminants of DIet and Physical ACtivity" (DEDIPAC) umbrella literature review. *PLoS One* 2018; 13(1):e0190737.

31. Uijtdewilligen L, Nauta J, Singh AS, Mechelen W, Twisk JW, Horst K, Chinapaw MJ. Determinants of physical activity and sedentary behaviour in young people: a review and quality synthesis of prospective studies. *Br J Sports Med* 2011; 45(11):896-905.
32. Mitchell JA, Dowda M, Pate RR, Kordas K, Froberg K, Sardinha LB, Kolle E, Page A. Physical Activity and Pediatric Obesity: A Quantile Regression Analysis. *Med Sci Sports Exerc* 2017; 49(3):466-473.
33. Raney JH, Testa A, Jackson DB, Ganson KT, Nagata JM. Associations Between Adverse Childhood Experiences, Adolescent Screen Time and Physical Activity During the COVID-19 Pandemic. *Acad Pediatr* 2022; 22(8):1294-1299.
34. Marques ES, Moraes CL, Hasselmann MH, Deslandes SF, Reichenheim ME. Violence against women, children, and adolescents during the COVID-19 pandemic: overview, contributing factors, and mitigating measures. *Cad Saude Publica* 2020; 36(4):e00074420.
35. Guthold R, Stevens GA, Riley LM, Bull FC. Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1·6 million participants. *Lancet Child Adolesc Health* 2020; 4(1):23-35.
36. Silva KS, Lopes MVV, Knebel MTG, Mello GT, Costa RM, Lapolli B, Barbosa-Rinaldi IP, Pizani J. Physical aggression among adolescents f rom Santa Catarina: association with sociodemographic factors and physical activity. *Rev Bras Cineantropom Hum* 2017; 19(6):686-695.
37. Johnson-Kozlow M, Sallis J, Calfas K. Does life stress moderate the effects of a physical activity intervention? *Psychology Health* 2004; 19(4):479-489.
38. Edenfield T, Blumenthal J. Exercise and Stress Reduction. In: Contrada RJ, Baum A, editors. *The Handbook of Stress Science: Biology, Psychology, and Health.* New York: Springer Publishing Company, LLC; 2011.
39. Seigel K, Broman JE, Hetta J. Behavioral activation or inhibition during emotional stress-implications for exercise habits and emotional problems among young females. *Nord J Psychiatry* 2002; 56(6):441-446.
40. Martins J, Marques A, Peralta M, Henriques-Neto D, Costa J, Onofre M, González Valeiro M. A Comparative Study of Participation in Physical Education Classes among 170,347 Adolescents from 54 Low-, Middle-, and High-Income Countries. *Int J Environ Res Public Health* 2020; 17(15):5579.
41. Ferrari G, Rezende LFM, Wagner GA, Florindo AA, Peres MFT. Physical activity patterns in a representative sample of adolescents from the largest city in Latin America: a cross-sectional study in Sao Paulo. *BMJ Open* 2020; 10(9):e037290.
42. Barros S, Barros M, Hardman C, Silva Júnior A, Nascimento J, Brito A, Nahas M. Aulas de Educação Física e indicadores de violência em adolescentes. *Rev Bras Ativ Fis Saude* 2013; 18(5):566-575.
43. Cecconello AM, Antoni CD, Koller SH. Práticas educativas, estilos parentais e abuso físico no contexto familiar. *Psicol Estudo* 2003; 8(n. esp.):45-54.
44. Duke NN, Pettingell SL, McMorris BJ, Borowsky IW. Adolescent violence perpetration: associations with multiple types of adverse childhood experiences. *Pediatrics* 2010; 125(4):e778-e786.
45. Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, Koss MP, Marks JS. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. *Am J Prev Med* 1998; 14(4):245-258.
46. Shonkoff JP, Garner AS. The lifelong effects of early childhood adversity and toxic stress. *Pediatrics* 2012; 129(1):e232-e246.
47. Jokinen T, Alexander EC, Manikam L, Huq T, Patil P, Benjumea D, Das I, Davidson LL. A Systematic Review of Household and Family Alcohol Use and Adolescent Behavioural Outcomes in Low- and Middle-Income Countries. *Child Psychiatry Hum Dev* 2021; 52(4):554-570.
48. Li SM, Zhang C, Bi K, Chen MS. Longitudinal impacts of adverse childhood experiences on multidimensional health outcomes: Predicting trajectories in mental, physical, and behavioral health. *Child Abuse Negl* 2023: 106543.
49. Thai TT, Cao PLT, Kim LX, Tran DP, Bui MB, Bui HHT. The effect of adverse childhood experiences on depression, psychological distress and suicidal thought in Vietnamese adolescents: Findings from multiple cross-sectional studies. *Asian J Psychiatr* 2020; 53:102134.
50. McMahon EM, Corcoran P, O'Regan G, Keeley H, Cannon M, Carli V, Wasserman C, Hadlaczky G, Sarchiapone M, Apter A, Balazs J, Balint M, Bobes J, Brunner R, Cozman D, Haring C, Iosue M, Kaess M, Kahn JP, Nemes B, Podlogar T, Poštuvan V, Sáiz P, Sisask M, Tubiana A, Värnik P, Hoven CW, Wasserman D. Physical activity in European adolescents and associations with anxiety, depression and well-being. *Eur Child Adolesc Psychiatry* 2016; 26(1):111-122.
51. Guddal MH, Stensland S, Småstuen MC, Johnsen MB, Zwart JA, Storheim K. Physical activity and sport participation among adolescents: associations with mental health in different age groups. Results from the Young-HUNT study: a cross-sectional survey. *BMJ Open* 2019; 9(9):e028555.
52. Easterlin MC, Chung PJ, Leng M, Dudovitz R. Association of Team Sports Participation With Long-term Mental Health Outcomes Among Individuals Exposed to Adverse Childhood Experiences. *JAMA Pediatr* 2019; 173(7):681-688.
53. Barrios L, Sleet D, Mercy J. CDC School Health Guidelines to Prevent Unintentional Injuries and Violence. *Am J Health Educ* 2003; 34(5):18-22.
54. Brasil. Ministério da Saúde (MS). *Saúde na Escola*. Brasília: MS; 2009.

Article submitted 30/07/2023
Approved 16/04/2024
Final version submitted 18/04/2024

Chief editors: Maria Cecília de Souza Minayo, Romeu Gomes, Antônio Augusto Moura da Silva