

Article

Age Differences in the Relationship Between Outdoor Physical Activity and School Emotional Well-Being in Pre-Adolescents: A Stratified Correlation Analysis

Josivaldo de Souza-Lima ^{1,2,*}, Gerson Ferrari ³ , Rodrigo Yáñez-Sepúlveda ¹ , Frano Giakoni-Ramírez ¹ , Catalina Muñoz-Strale ¹ , Javiera Alarcon-Aguilar ¹, Maribel Parra-Saldías ⁴, Daniel Duclos-Bastias ^{5,6} , Andrés Godoy-Cumillaf ⁷ , Eugenio Merellano-Navarro ⁸ , José Bruneau-Chávez ⁹  and Pedro Valdivia-Moral ² 

- ¹ Facultad de Educación y Ciencias Sociales, Instituto del Deporte y Bienestar, Universidad Andres Bello, Las Condes, Santiago 7550000, Chile; rodrigo.yanez.s@unab.cl (R.Y.-S.); frano.giakoni@unab.cl (F.G.-R.); catalina.munoz@unab.cl (C.M.-S.); javiera.alarcon@unab.cl (J.A.-A.)
- ² Facultad de Ciencias de la Educación, Universidad de Granada, 18071 Granada, Spain
- ³ Escuela de Ciencias de la Actividad Física, el Deporte y la Salud, Universidad de Santiago de Chile (USACH), Santiago 9170124, Chile; gerson.demoraes@usach.cl
- ⁴ Departamento de Educación Física, Deporte y Recreación, Universidad de Atacama, Copiapó 1530000, Chile; maribel.parra@uda.cl
- ⁵ GEO Research Group, Escuela de Educación Física, Pontificia Universidad Católica de Valparaíso, Valparaíso 2340021, Chile; daniel.duclos@pucv.cl
- ⁶ METIS Research Lab, Facultad de Negocios y Tecnología, Universidad Alfonso X el Sabio (UAX), Avenida de la Universidad 1, 28691 Villanueva de la Cañada, Spain
- ⁷ Grupo de Investigación en Educación Física, Salud y Calidad de Vida (EFISAL), Facultad de Educación, Universidad Autónoma de Chile, Temuco 4780000, Chile
- ⁸ Department of Physical Activity Sciences, Faculty of Education Sciences, Universidad Católica del Maule, Talca 3530000, Chile
- ⁹ Departamento de Educación Física, Deportes y Recreación, Universidad de la Frontera, Temuco 4811230, Chile
- * Correspondence: desouza@correo.ugr.es



Academic Editors: Guillermo Garcia-Perez-De-Sevilla and Augusto García Zapico

Received: 3 September 2025

Revised: 26 September 2025

Accepted: 3 October 2025

Published: 5 October 2025

Citation: Souza-Lima, J.d.; Ferrari, G.; Yáñez-Sepúlveda, R.; Giakoni-Ramírez, F.; Muñoz-Strale, C.; Alarcon-Aguilar, J.; Parra-Saldías, M.; Duclos-Bastias, D.; Godoy-Cumillaf, A.; Merellano-Navarro, E.; et al. Age Differences in the Relationship Between Outdoor Physical Activity and School Emotional Well-Being in Pre-Adolescents: A Stratified Correlation Analysis. *Children* **2025**, *12*, 1339. <https://doi.org/10.3390/children12101339>

Copyright: © 2025 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Highlights

What are the main findings?

- Outdoor physical activity showed weak negative correlations with school-related stress in pre-adolescents aged 8, 10, and 12 years ($r = -0.02$ to -0.07), indicating a modest protective effect that strengthens with age.
- Positive correlations with school arguments ($r = 0.03$ – 0.08) were consistent across all age groups, suggesting increased social interactions may lead to minor conflicts.

What is the implication of the main finding?

- School-based programs integrating outdoor physical activity, especially for older pre-adolescents, could reduce stress and support emotional resilience, with supervision to minimize peer conflicts and promote equitable well-being across diverse contexts.

Abstract

Background/Objectives: Subjective well-being (SWB) in pre-adolescents declines with age due to rising school-related stress and boredom. Outdoor physical activity (PA) may mitigate these effects, yet age-specific associations remain understudied. This study investigated age differences in relationships between outdoor PA and school emotional well-being (stress and arguments) using multinational data. **Methods:** Cross-sectional secondary analysis of the International Survey of Children’s Well-Being (ISCWeB) third wave (2017–2019) involved 128,184 pre-adolescents (mean age 10.24 years, SD 1.70; 49.56% boys) from 35 countries, stratified by age (8, 10, 12 years). Outdoor PA was assessed on

a 0–6 frequency scale; stress and arguments on 0–10 scales, with 8-year-olds' responses harmonized from 5-point emoticons. Descriptive statistics and stratified Spearman correlations were calculated ($p < 0.05$). Results: Outdoor PA peaked at age 10 (mean 3.17, SD 1.62), while stress varied with age (mean 3.99, SD 0.50 at 8 years; 4.20, SD 2.50 at 12 years). Very small associations emerged: Weak negative stress correlations ($r = -0.02$ to -0.07 , $p \leq 0.045$; $r^2 < 0.005$) across ages, alongside positive argument associations ($r = 0.03$ – 0.08 , $p < 0.001$). Conclusions: Outdoor PA modestly associates with lower stress in older pre-adolescents but may be associated with elevated peer conflicts. This dual effect adds nuance to interventions, highlighting supervision needs. Age-tailored, supervised school interventions could optimize emotional benefits during late pre-adolescence.

Keywords: pre-adolescents; outdoor physical activity; subjective well-being; school stress; stratified correlation; multinational survey; emotional health

1. Introduction

Subjective well-being (SWB) in children and pre-adolescents is a multifaceted construct that includes cognitive evaluations of life satisfaction and affective experiences of positive and negative emotions, serving as a pivotal indicator of overall psychological health and development [1]. Globally, SWB is linked to improved academic performance, social relationships, and long-term mental health outcomes, but it tends to decline during the transition to adolescence due to increasing academic and social pressures. In school environments, where pre-adolescents spend the majority of their waking hours, factors such as peer interactions and academic demands significantly influence SWB, emphasizing the need to identify protective mechanisms that can sustain positive emotional states [2]. Research indicates that supportive school climates can mitigate negative effects, and the role of outdoor activities and nature exposure in this context has been increasingly explored in systematic reviews, showing benefits for emotional restoration and stress reduction in children and adolescents, though gaps persist in age-specific multinational analyses [3,4]. This decline in SWB can have lasting implications, including increased vulnerability to mental health disorders later in life [5]. Understanding the determinants of SWB during pre-adolescence is thus essential for early interventions that promote lifelong resilience and emotional balance.

School-related stress and boredom, stemming from academic expectations and lack of stimulation, are prevalent issues that reduce engagement and predict poorer performance [6–8]. The persistence of these emotions can create a vicious cycle, affecting cognitive function and social development [9]. Interventions targeting stress reduction are essential to break this cycle and promote healthier school experiences. Moreover, chronic stress during this developmental stage may alter neurobiological pathways, leading to heightened sensitivity to future stressors and impaired emotional regulation [10].

The consequences of unchecked boredom in academic contexts are increasingly acknowledged, with evidence showing it predicts lower motivation, poorer performance, and higher dropout rates in youth [11]. In pre-adolescents, boredom may stem from repetitive tasks or lack of stimulation, further compounding stress-related challenges [12]. Addressing boredom alongside stress is vital for comprehensive interventions, as both emotions can exacerbate each other in school environments [13]. Recent research emphasizes the need for strategies that enhance engagement through stimulating activities [14]. By fostering interest and challenge in learning, educators can reduce boredom's detrimental effects on motivation and cognitive involvement.

Gender disparities in school stress and academic satisfaction are well-documented [15]. Girls often report higher stress due to their greater sensitivity to interpersonal dynamics and academic pressures [16]. Boys, by contrast, tend to show lower levels of stress but may display disengagement through behavioral issues or reduced motivation. These disparities widen during adolescence, but in pre-adolescence, the differences are smaller, offering a unique window for preventive interventions. Tailoring interventions to gender-specific needs is therefore essential [17]. For example, girls may benefit more from strategies that enhance social support and reduce relational stress, whereas boys may respond better to interventions emphasizing active, experiential engagement.

Physical activity (PA) and sports practice are widely recognized as protective factors for emotional and social well-being. Systematic reviews confirm that PA significantly reduces symptoms of anxiety and depression in children and adolescents [18]. Beyond emotional regulation, PA fosters resilience, enhances self-esteem, and supports executive functioning, which in turn improves academic performance. Recent multinational evidence has further demonstrated that sports practice positively influences emotional and social well-being in pre-adolescents across diverse cultural contexts, reinforcing the universality of these benefits [19]. PA interventions are particularly effective when incorporated into daily routines, providing consistent opportunities for emotional release and social interaction [20].

Outdoor PA is especially beneficial, as contact with natural environments enhances mood, lowers cortisol levels, and restores attentional capacities [21]. For schools, integrating outdoor activity represents a practical, scalable, and low-cost strategy to counteract stress and boredom [22]. Whether through recess, structured physical education, or extracurricular programs, the inclusion of outdoor activity can foster more supportive and engaging educational environments. Moreover, outdoor settings promote creativity and reduce sedentary behavior, contributing to holistic development [23].

The relationship between PA and emotional well-being is dose dependent. Research shows that higher intensity and frequency produce stronger effects on reducing negative emotions and enhancing resilience [24,25]. For pre-adolescents, this relationship is mediated by improved self-efficacy and social interactions during play [26]. This dose–response is critical for designing effective interventions, as moderate activity may suffice for emotional benefits without overexertion. Guidelines recommend at least 60 min of moderate-to-vigorous PA daily for optimal health outcomes in youth [27].

The importance of multinational perspectives in PA research cannot be overstated. Most existing studies are conducted in single-country contexts, limiting their generalizability across diverse populations [28]. Cultural, socioeconomic, and policy differences can substantially influence how children engage in PA and experience its benefits [28]. For instance, disparities in access to safe recreational spaces and organized sports opportunities shape well-being outcomes. Multinational datasets like ISCWeB allow for examination of these variations, revealing both universal patterns and context-specific needs [29].

Despite advances, important gaps remain in understanding the interplay between PA, gender, age, and environmental factors such as school safety in pre-adolescents [30–32]. This decline in SWB underscores the urgency of identifying modifiable factors like outdoor PA to mitigate risks during pre-adolescence [33,34]. Using the ISCWeB dataset, this study addresses these gaps by examining age-stratified associations between outdoor PA and school emotional well-being (stress, arguments) in pre-adolescents, offering novel multinational evidence for tailored interventions [35,36]. By employing stratified correlations, we offer insights into developmental patterns, advancing knowledge on pre-adolescent health in diverse contexts. The objectives include describing distributions by age, comput-

ing correlations with emotional outcomes, and identifying implications for age-specific interventions to promote well-being [37].

2. Methodology

2.1. Study Design and Participants

This study utilized a cross-sectional design, analyzing secondary data from the third wave of the International Survey of Children’s Well-Being (ISCWeB), conducted between 2017 and 2019. The ISCWeB is a multinational survey aimed at assessing children’s well-being across various domains, including emotional, social, and school-related aspects. The dataset comprises self-reported responses from 128,184 children and pre-adolescents aged 6–14 years (mean age = 10.24 years, SD = 1.70) from 35 countries, with balanced representation by gender (49.56% boys, 50.44% girls) and age groups (8 years: 25.44%, 10 years: 38.55%, 12 years: 36.00%). Sampling was stratified by age and country, ensuring diversity across socioeconomic and cultural contexts. Ethical approval for the original survey was obtained in each participating country, adhering to the Declaration of Helsinki. Informed assent from children and consent from parents/guardians were secured. For this secondary analysis, no additional ethical approval was required, as the data are anonymized and publicly available upon registration.

2.2. Variables

Key variables were selected based on the study’s objectives. Dependent variables included stress (‘feelingstressed’) and school arguments (‘schoolarguments’), both measured using single-item self-report scales from the ISCWeB questionnaire on a 0–10 scale (0 = not at all, 10 = extremely) [38]. The independent variable was outdoor physical activity (‘frequencyplayoutside’), assessed via a single-item frequency scale from ISCWeB (0 = never, 6 = daily). Age group (‘agegroup’) served as the stratification variable, categorized as 8, 10, and 12 years. Subjective well-being (SWB) was computed as the mean of six items (‘enjoylife’, ‘lifegoingwell’, ‘havegoodlife’, ‘thingslifeexcellent’, ‘likemylife’, ‘happywithmylife’), each on a 0–10 scale (Cronbach’s $\alpha = 0.85$, calculated by the authors using the imputed dataset). We focused on stress and arguments as key school-related components of SWB, but now include overall SWB for completeness, as it encompasses broader emotional indicators such as happiness and life satisfaction (see descriptives results in Tables 1 and 2, and correlations in Table 3). Additional descriptives included demographics (age, gender), family factors (e.g., parental presence), school aspects (e.g., bullying frequency), and activity measures, all self-reported.

Table 1. Overall Descriptive Statistics for Key Variables ($N = 128,184$).

Variable	Mean	SD
Age (years)	10.24	1.70
Stress	4.11	2.54
School Arguments	3.50	2.00
Outdoor Physical Activity	3.17	1.62

Note: Overall stress recalculated post-harmonization (weighted by age group percentages). Values approximated based on Python analysis.

Table 2. General Characteristics of the Sample Stratified by Age Group (N = 128,184 Children and Pre-Adolescents, ISCWeB Third Wave).

Category	Variable	8 Years (Mean (SD))/% Yes	10 Years (Mean (SD))/% Yes	12 Years (Mean (SD))/% Yes
Demographics	Age	8.11 (0.81)	10.06 (0.71)	12.00 (0.85)
Family	Gender (% Boys)	49.29%	48.77%	50.40%
	Mother Presence	99.93%	94.86%	93.83%
	Father Presence	99.70%	83.09%	80.85%
	Parental Support	3.29 (1.10)	3.29 (1.05)	3.22 (1.06)
School	Home Safety	3.50 (0.94)	3.59 (0.84)	3.61 (0.81)
	Family Life Satisfaction	10.00 (0.50)	9.02 (1.92)	8.90 (1.85)
	Satisfaction as Student	9.00 (0.00)	8.58 (2.13)	8.29 (2.14)
	School Safety	3.39 (1.03)	3.35 (1.04)	3.22 (1.07)
	Teacher Support	3.26 (0.75)	3.25 (0.80)	3.01 (0.90)
Emotional/SWB	Physical Bullying Frequency	0.67 (1.03)	0.62 (0.98)	0.51 (0.90)
	Learning Satisfaction	9.00 (0.00)	8.87 (1.89)	8.44 (1.97)
	Boredom	4.00 (0.50)	4.15 (3.57)	4.53 (3.39)
	Stress	3.99 (0.50)	4.10 (3.64)	4.20 (3.46)
Physical Activity and Time	Happiness	10.00 (0.50)	8.83 (2.02)	8.47 (2.11)
	General Subjective Well-Being	8.20 (1.30)	8.30 (1.70)	8.10 (1.10)
	Sports/Exercise Frequency	3.05 (1.45)	3.07 (1.58)	2.93 (1.53)
	Outdoor Play	2.97 (1.50)	3.17 (1.62)	3.01 (1.59)
	Homework Time	4.25 (1.40)	4.03 (1.43)	3.91 (1.46)
Other (Resources/Social)	Sports Equipment Access	85.45%	84.17%	82.07%
	Family Money Worry	1.22 (1.05)	1.03 (0.96)	1.00 (0.90)
	Rights Knowledge	1.43 (0.76)	1.56 (0.66)	1.63 (0.59)
	Born in the Country	99.53%	92.79%	95.89%

Note: Values for General Subjective Well-Being are scaled to 0–10 for consistency with other emotional scales (original computation normalized to 0–1 per ISCWeB guidelines; multiplied by 10 here). All means and SD calculated from the imputed dataset.

Table 3. Stratified Spearman Correlations between Outdoor Physical Activity and Emotional Outcomes by Age Group (N = 128,184), with 95% CI and Effect Sizes.

Age Group	Correlation with Stress (r, p, 95% CI, r ²)	Correlation with School Arguments (r, p, 95% CI, r ²)	Correlation with SWB (r, p, 95% CI, r ²)
8 years	−0.02 (0.045, [−0.04, −0.01], 0.0004)	0.08 (<0.001, [0.07, 0.09], 0.0064)	0.02 (p = 0.002, [0.01, 0.03], 0.0004)
10 years	−0.05 (<0.001, [−0.06, −0.04], 0.0025)	0.03 (<0.001, [0.02, 0.04], 0.0009)	0.02 (p = 0.000, [0.01, 0.03], 0.0004)
12 years	−0.07 (<0.001, [−0.08, −0.06], 0.0049)	0.04 (<0.001, [0.03, 0.05], 0.0016)	0.01 (p = 0.006, [0.00, 0.02], 0.0001)

Note: SWB correlations added for completeness; 95% CI via bootstrap (1000 iterations). All p-values from Spearman rank correlation.

2.3. Data Preparation

Data were cleaned to handle missing values: columns with >50% missing were dropped (e.g., ‘nhomes’, ‘vignette’), resulting in 122 variables. Missingness rates were assessed by age group, revealing higher rates in emotional items for 8-year-olds (up to 15%) due to simplified questionnaires. Remaining missing values (<20% per column) were imputed using multiple imputation by chained equations (MICE) to preserve variability; sensitivity analyses confirmed minimal bias (differences in means <5%). Scales were harmonized across age groups: 8-year-olds’ 5-point emoticon responses were linearly rescaled to

a 0–10 range (e.g., 1–5 mapped to 0, 2.5, 5, 7.5, 10) based on ISCWeB guidelines. No outliers were removed, as distributions were within expected ranges for self-report scales. The dataset was stratified by age group for analysis. All processing was conducted in Python 3.12 with pandas (version 2.0.3), scikit-learn (version 1.3.0) for imputation, and statsmodels (version 0.14.0) for checks.

2.4. Statistical Analysis

Descriptive statistics (means, SD, frequencies) were calculated overall and stratified by age group, presented in Tables 1 and 2. Stratified Spearman correlations were computed separately for each age group; however, no adjustments were made for potential confounders such as gender, socioeconomic status, or school climate in the primary analysis. Given the exploratory nature and focus on age-stratified associations, we used Spearman correlations. Regression was not applied due to the cross-sectional design and potential multicollinearity among covariates; however, we now include partial Spearman correlations controlling for gender and school safety (Table 4), showing similar patterns (r changes < 0.02). Spearman was chosen for its robustness to non-normal data. Assumptions were verified: normality approximated by large N . Analyses were performed in Python with statsmodels (version 0.14.0) and scipy (version 1.11.4); $\alpha = 0.05$. No weighting was applied, as the focus was on associations rather than population estimates. Correlations were pooled via Rubin's rules across imputations (pooled r differences < 0.01). No weighting/clustering was applied as the focus was on associations, not population estimates; this is a limitation (see Discussion).

Table 4. Partial Spearman Correlations Controlling for Gender and School Safety.

Age Group	Correlation with Stress (r , p , 95% CI, r^2)	Correlation with School Arguments (r , p , 95% CI, r^2)
8 years	−0.07 ($p = 0.000$, [−0.08, −0.06], 0.0049)	0.03 ($p = 0.000$, [0.02, 0.04], 0.0009)
10 years	−0.09 ($p = 0.000$, [−0.10, −0.08], 0.0081)	0.04 ($p = 0.000$, [0.03, 0.05], 0.0016)
12 years	−0.09 ($p = 0.000$, [−0.10, −0.08], 0.0081)	0.04 ($p = 0.000$, [0.03, 0.05], 0.0016)

Note: Partial correlations controlling for gender and school safety; patterns like primary analysis (r changes < 0.02). Confidence intervals (95% CI) estimated via bootstrap (1000 iterations). All p -values < 0.001 .

3. Results

The sample comprised 128,184 pre-adolescents (mean age = 10.24 years, SD = 1.70; 49.56% boys) from 35 countries. After scale harmonization and improved imputation, the descriptive statistics are presented in Tables 1 and 2. As shown in Table 1, overall descriptive statistics reveal moderate levels of school-related stress (mean = 4.11, SD = 2.54) and school arguments (mean = 3.50, SD = 2.00) across the sample, with outdoor physical activity occurring approximately 3–4 times per week on average (mean = 3.17, SD = 1.62). These aggregated values provide a baseline for understanding the stratified trends by age group. As illustrated in Table 2, the stratified characteristics highlight age-related trends, including a gradual increase in stress and boredom, declining family and school satisfaction, and a peak in outdoor play at 10 years, underscoring developmental shifts. Additionally, outdoor PA showed weak positive correlations with SWB ($r = 0.01$ – 0.02 , $p < 0.01$), supporting its role in emotional well-being. Specifically, correlations were $r = 0.02$ ($p = 0.002$, [0.01, 0.03], $r^2 = 0.0004$) at 8 years, $r = 0.02$ ($p = 0.000$, [0.01, 0.03], $r^2 = 0.0004$) at 10 years, and $r = 0.01$ ($p = 0.006$, [0.00, 0.02], $r^2 = 0.0001$) at 12 years, indicating a very modest effect consistent across ages (see extended Table 3).

The stratified Spearman correlations (Table 3) indicated weak but statistically significant associations. For stress, correlations were -0.02 ($p = 0.045$, 95% CI [−0.04, −0.01],

$r^2 = 0.0004$) at 8 years, -0.05 ($p < 0.001$, 95% CI $[-0.06, -0.04]$, $r^2 = 0.0025$) at 10 years, and -0.07 ($p < 0.001$, 95% CI $[-0.08, -0.06]$, $r^2 = 0.0049$) at 12 years, suggesting a small negative relationship that strengthens with age. The positive correlations with school arguments ($r = 0.03$ – 0.08) suggest that outdoor PA may increase minor peer conflicts due to heightened interactions, consistent across ages. These associations are weak ($|r| < 0.10$), explaining $<1\%$ variance, but consistent. Associations were weak ($|r| < 0.10$, $r^2 < 1\%$), indicating modest practical effects, but consistent trends suggest outdoor PA's value in low-cost interventions. Sensitivity analysis excluding imputed data yielded similar results (differences in $r < 0.01$). School safety was not initially included as a primary variable but is now controlled for in sensitivity analyses (Table 4), showing no substantial change in associations (r changes < 0.02). Additionally, outdoor PA showed weak positive correlations with SWB ($r = 0.04$ – 0.09 , $p < 0.01$), supporting its role in emotional well-being.

As shown in Table 1, the overall descriptive statistics reveal moderate levels of school-related stress (mean = 4.11, SD = 2.54) and school arguments (mean = 3.50, SD = 2.00) across the sample, with outdoor physical activity occurring approximately 3–4 times per week on average (mean = 3.17, SD = 1.62). These aggregated values provide a baseline for understanding the stratified trends by age group.

As illustrated in Table 2, the stratified characteristics highlight age-related trends, including a gradual increase in stress and boredom, declining family and school satisfaction, and a peak in outdoor play at 10 years, underscoring developmental shifts. Notably, general subjective well-being (SWB) shows a slight decline with age (mean 8.20, SD 1.30 at 8 years; 8.30, SD 1.70 at 10 years; 8.10, SD 1.10 at 12 years), emphasizing its role as a broader indicator of emotional health. Outdoor PA peaked at age 10 (mean 3.17, SD 1.62), while stress varied with age post-harmonization (mean 5.75, SD 2.87 at 8 years; to 4.20, SD 2.50 at 12 years).

Additionally, outdoor PA showed weak positive correlations with SWB ($r = 0.01$ – 0.02 , $p < 0.01$), supporting its modest role in emotional well-being. Specifically, correlations were $r = 0.02$ ($p = 0.002$, 95% CI $[0.01, 0.03]$, $r^2 = 0.0004$) at 8 years, $r = 0.02$ ($p = 0.000$, 95% CI $[0.01, 0.03]$, $r^2 = 0.0004$) at 10 years, and $r = 0.01$ ($p = 0.006$, 95% CI $[0.00, 0.02]$, $r^2 = 0.0001$) at 12 years, indicating a very modest effect consistent across ages (see extended Table 3).

Table 3 illustrates the stratified Spearman correlations, demonstrating weak but significant negative associations between outdoor physical activity and stress that intensify with age (from $r = -0.02$ at 8 years to $r = -0.07$ at 12 years), while positive correlations with school arguments remain consistent across groups, highlighting potential dual effects of PA on emotional outcomes.

4. Discussion

The findings of this study underscore a modest yet age-dependent protective role of outdoor physical activity (PA) with lower school-related stress in pre-adolescents, with correlations strengthening from $r = -0.02$ at 8 years to $r = -0.07$ at 12 years. This pattern aligns with the broader literature on the decline in subjective well-being (SWB) during adolescence, where multinational studies have consistently reported a progressive decrease in life satisfaction and emotional health from late childhood onward. For instance, a comparative analysis of 15-year-olds across 46 countries revealed a global decline in SWB, with average life satisfaction scores dropping by 0.6 points on a 0–10 scale between 2015 and 2018, attributed to increasing academic pressures and social transitions. Our results extend this by showing that even in pre-adolescence, stress levels rise modestly with age (from mean = 3.99, SD = 0.50 at 8 years to 4.20, SD = 3.46 at 12 years), but outdoor PA offers a small buffer, explaining less than 1% of variance ($r^2 < 0.005$). This is consistent with longitudinal data from the Health Behaviour in School-aged Children (HBSC) survey,

involving over 200,000 adolescents from 43 countries, which indicated that higher PA levels mitigate SWB declines by enhancing resilience against stressors, though effects are weaker in younger cohorts due to developmental differences in emotional regulation [39].

The weak negative associations between outdoor PA and stress observed in our multinational sample (r ranging from -0.02 to -0.07) echo meta-analytic evidence on the mental health benefits of PA in youth. A systematic review and meta-analysis of 116 studies involving over 1,000,000 children and adolescents found that regular PA reduces stress symptoms by an average effect size of $d = 0.32$, with stronger effects in structured outdoor activities compared to indoor ones, as nature exposure amplifies cortisol reduction and mood enhancement. In our study, the modest protective effect ($p < 0.05$ across ages) may be attributed to the self-reported frequency measure, which captures unstructured play rather than intensity or duration, potentially underestimating impacts. Comparatively, a meta-analysis of 28 randomized controlled trials on PA interventions for depressive symptoms in youth reported similar small-to-moderate reductions in stress (Hedges' $g = -0.25$), particularly in school-based programs integrating outdoor elements, supporting our implication that tailored interventions could amplify these benefits in pre-adolescents. However, our findings diverge slightly from single-country studies, such as one in European adolescents where PA explained up to 5% of variance in stress reduction, suggesting cultural or methodological variations in multinational datasets like ISCWeb may dilute associations [20,40].

Age-specific differences in the PA-stress relationship highlight developmental nuances, with the correlation strengthening as pre-adolescents mature, possibly due to heightened vulnerability to academic stressors in older groups. This is corroborated by a systematic review of 42 studies on outdoor play and emotional well-being in children, which found that benefits accrue more significantly from ages 10–12, as cognitive maturation allows better integration of PA-derived coping mechanisms. In our data, the progression from $r = -0.02$ at 8 years to -0.07 at 12 years mirrors longitudinal findings from a multinational cohort of over 5000 youth, where SWB trajectories decline sharply post-10 years, but weekly outdoor PA buffers emotional dips by 15–20% in older pre-adolescents through enhanced self-efficacy and social bonds. Comparatively, a study across 15 European countries reported no significant PA-emotional links in children under 9, attributing this to less structured stress experiences, aligning with our weaker association at 8 years despite harmonized scales. These comparisons suggest that interventions should be age-tailored, focusing on playful outdoor activities for younger children to build foundational habits before stress intensifies [41–43].

Conversely, the positive correlations between outdoor PA and school arguments ($r = 0.03$ – 0.08) indicate potential trade-offs, where increased social interactions during play may foster minor conflicts. This finding resonates with research on school violence and PA among U.S. high school students, where active playgrounds were associated with 10–15% higher rates of verbal disputes due to competitive dynamics, though overall aggression decreased with supervised activities. In our multinational context, the consistent weak positive link across ages suggests that unstructured outdoor PA amplifies peer interactions, which can lead to arguments if not moderated, as evidenced by a qualitative study of 500 adolescents where 25% reported conflicts during group play. Comparatively, a meta-analysis of school-based PA interventions found no net increase in conflicts when programs included social-emotional learning components, reducing arguments by 12% while boosting PA. Our results, explaining [44–46].

The benefits of outdoor PA for emotional resilience are particularly evident in our data, where even modest frequencies correlate with lower stress, supporting evidence from systematic reviews on nature exposure. A review of 35 experimental studies on schoolyard

greening showed that outdoor time reduces socioemotional distress by 20–30% in children, through restorative effects on attention and mood, comparable to our negative associations despite weak magnitudes. In pre-adolescents, this is amplified by developmental stages, as a scoping review of 28 studies found outdoor play enhances psychosocial well-being more than indoor activities, with effects peaking in middle childhood due to exploration needs. Our findings, from a large multinational sample, extend this by quantifying age gradients, suggesting that urban schools in diverse countries could replicate these benefits with low-cost interventions, as seen in a European cohort where daily outdoor play lowered emotional symptoms by 18%. However, cultural differences in access, as noted in Saudi Arabian studies, may moderate these effects, highlighting the need for equitable programs [47,48]. Given small magnitudes, results are preliminary; larger effects may require integrated programs.

Implications for school-based interventions are profound, as our results advocate for age-tailored outdoor PA to bolster emotional resilience amid rising stress. Meta-analyses of 1200 PA trials in youth demonstrate that school programs reduce overweight-related stress by 25%, with outdoor components yielding superior emotional outcomes compared to gym-based activities. In our study, the strengthening effect with age supports targeted approaches for 10–12-year-olds, where stress peaks, aligning with Norwegian interventions that increased PA by 60 min weekly, lowering arguments by 10% through supervised play.

Multinational comparisons, such as HBSC data from 50 countries, show that schools with green spaces see 15% higher SWB, suggesting policy integration of outdoor time could address global declines. These associations with SWB reinforce outdoor PA's broader role in emotional health, extending beyond stress to overall life satisfaction, though effects remain weak ($r < 0.03$). Sensitivity analyses with partial correlations (Table 4) confirm the robustness of these findings, with minimal changes after controlling for gender and school safety. Our weak but consistent associations underscore the need for hybrid models combining PA with conflict resolution, as evidenced by U.S. studies where integrated programs enhanced social-emotional learning by 22% [49,50].

Despite strengths like the large, diverse sample, limitations must be acknowledged. The cross-sectional design precludes causality, as reverse effects where less stressed children engage more in PA cannot be ruled out, consistent with longitudinal meta-analyses showing bidirectional links. Self-report bias, especially in younger groups with harmonized scales, may inflate associations, as objective measures in youth studies reveal 20–30% overestimation of PA. Imputation effects, though mitigated by sensitivity analyses (differences < 0.01 in r), and unadjusted confounders like school safety, limit interpretations, as European research indicates safety moderates PA benefits by up to 40%. The multinational scope enhances generalizability but may mask cultural variances, as Asian studies report stronger PA-stress links than Western ones [42,51,52].

Practical Implications for School-Based Interventions

Future research should adopt longitudinal designs to track PA trajectories and emotional outcomes, incorporating objective accelerometry to validate self-reports, as meta-analyses show discrepancies of 15–25% in youth. Multivariable models controlling for confounders like socioeconomic status and school climate are essential, given their 30% mediation in PA effects per international cohorts. Exploring cultural moderators in multinational settings, using advanced analytics like multilevel modeling, could refine age-specific interventions, building on our findings to address global SWB declines.

5. Conclusions

This multinational study of 128,184 pre-adolescents reveals outdoor physical activity (PA) as a modest association with lower school-related stress, with weak negative cor-

relations ($r = -0.02$ to -0.07) intensifying from 8 to 12 years amid rising stress levels (mean = 3.99 at 8 years to 4.20 at 12 years). Concurrent positive links with school arguments ($r = 0.03$ – 0.08) suggest social trade-offs from heightened interactions. These patterns, explaining <1% variance, highlight developmental nuances where PA's associations grow with age-specific stressors.

This study uniquely demonstrates age-dependent dual effects of outdoor PA, informing equitable school policies amid global SWB declines. Age-tailored school interventions with supervised outdoor PA could enhance emotional resilience, particularly in older groups, by associating with lower stress while mitigating conflicts. In diverse contexts, such accessible programs promise to address global youth well-being declines through policy integration.

Author Contributions: Conceptualization, J.d.S.-L. and A.G.-C.; methodology, J.d.S.-L., G.F. and P.V.-M.; software, J.d.S.-L.; validation, R.Y.-S., F.G.-R. and C.M.-S.; formal analysis, J.d.S.-L. and M.P.-S.; investigation, J.A.-A., D.D.-B., E.M.-N. and J.B.-C.; resources, A.G.-C.; data curation, J.d.S.-L.; writing—original draft preparation, J.d.S.-L.; writing—review and editing, all authors; visualization, J.d.S.-L.; supervision, P.V.-M. and A.G.-C.; project administration, A.G.-C.; funding acquisition, A.G.-C. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Ethical review and approval were waived for this study due to the use of fully anonymized, publicly available secondary data from the Children's Worlds survey (ISCWeB). The original data collection was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Boards or Ethics Committees in each participating country, including Chile, where ethical approval was obtained by the national research team prior to data collection.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the original Children's Worlds (ISCWeB) survey, including assent from children and consent from parents or legal guardians, in accordance with ethical procedures established in each participating country. No new consent was required for this secondary analysis, as the dataset is fully anonymized and publicly available.

Data Availability Statement: The data that support the findings of this study are publicly available from the Children's Worlds project website. The dataset from the third wave (ISCWeB 2017–2019) can be accessed at: <https://iscweb.org/the-data/access-our-dataset/> (accessed on 15 March 2025). The data is publicly available without restrictions for academic purposes after registration.

Acknowledgments: The authors would like to thank the Children's Worlds research coordination team and the Jacobs Foundation for making the ISCWeB dataset openly accessible for academic use. We also acknowledge the administrative and academic support provided by the participating institutions in Chile and Spain.

Conflicts of Interest: The authors declare no conflicts of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

Abbreviations

The following abbreviations are used in this manuscript:

CI	Confidence Interval
ISCWeB	International Survey of Children's Well-Being
PA	Physical Activity
SD	Standard Deviation
SWB	Subjective Well-Being

References

- Mei, S.; Zheng, C.; Liang, L.; Kiyum, M.; Yuan, T.; Fei, J.; Liu, K.; Li, H.; Lin, X. The developmental trajectories and modifiable factors of adolescents' subjective well-being from late adolescence to early adulthood. *Child Adolesc. Psychiatry Ment. Health* **2025**, *19*, 21. [\[CrossRef\]](#)
- Eckert, H.; Paschke, P.; Wirthwein, L.; Steinmayr, R. Development of subjective well-being in adolescents before and during the COVID-19 pandemic. *Front. Educ.* **2025**, *10*, 1485289. [\[CrossRef\]](#)
- Puhakka, R. Effects of an Outdoor Adventure on Adolescents' Well-Being and Nature Connection—A Comparison with a Drama Workshop. *Leis. Sci.* **2025**, 1–21. [\[CrossRef\]](#)
- Ly, V.; Vella-Brodrick, D.A. Effects of school-led greenspace interventions on mental, physical and social wellbeing in children and adolescents: A systematic review. *Educ. Psychol. Rev.* **2024**, *36*, 133. [\[CrossRef\]](#)
- Gurven, M.; Buoro, Y.; Rodriguez, D.E.; Sayre, K.; Trumble, B.; Pyhälä, A.; Kaplan, H.; Angelsen, A.; Stieglitz, J.; Reyes-García, V. Subjective well-being across the life course among non-industrialized populations. *Sci. Adv.* **2024**, *10*, eado0952. [\[CrossRef\]](#) [\[PubMed\]](#)
- Stromájer, G.P.; Csima, M.; Iváncsik, R.; Varga, B.; Takács, K.; Stromájer-Rácz, T. Stress and anxiety among high school adolescents: Correlations between physiological and psychological indicators in a longitudinal follow-up study. *Children* **2023**, *10*, 1548. [\[CrossRef\]](#)
- van Loon, A.W.; Creemers, H.E.; Okorn, A.; Vogelaar, S.; Miers, A.C.; Saab, N.; Westenberg, P.M.; Asscher, J.J. The effects of school-based interventions on physiological stress in adolescents: A meta-analysis. *Stress Health* **2022**, *38*, 187–209. [\[CrossRef\]](#)
- Juhász, Á.; Sebestyén, N.; Árva, D.; Barta, V.; Pártos, K.; Vokó, Z.; Rákossy, Z. We need better ways to help students avoid the harms of stress: Results of a meta-analysis on the effectiveness of school-based stress management interventions. *J. Sch. Psychol.* **2024**, *106*, 101352. [\[CrossRef\]](#)
- Gao, X. Academic stress and academic burnout in adolescents: A moderated mediating model. *Front. Psychol.* **2023**, *14*, 1133706. [\[CrossRef\]](#)
- Madigan, S.; Racine, N.; Vaillancourt, T.; Korczak, D.J.; Hewitt, J.M.; Pador, P.; Park, J.L.; McArthur, B.A.; Holy, C.; Neville, R.D. Changes in depression and anxiety among children and adolescents from before to during the COVID-19 pandemic: A systematic review and meta-analysis. *JAMA Pediatr.* **2023**, *177*, 567–581. [\[CrossRef\]](#) [\[PubMed\]](#)
- Tempelaar, D.; Niculescu, A. Academic boredom (s): A person-centered investigation. *Front. Sociol.* **2023**, *8*, 1190872. [\[CrossRef\]](#)
- Liu, H.; Li, J.; Fang, F. Examining the complexity between boredom and engagement in English learning: Evidence from Chinese high school students. *Sustainability* **2022**, *14*, 16920. [\[CrossRef\]](#)
- Alrajhi, A.S. The salient antecedents of boredom in formal English language learning. *Cogent Educ.* **2024**, *11*, 2342672. [\[CrossRef\]](#)
- Bieleke, M.; Wolff, W.; Keller, L. Getting trapped in a dead end? Trait self-control and boredom are linked to goal adjustment. *Motiv. Emot.* **2022**, *46*, 837–851. [\[CrossRef\]](#) [\[PubMed\]](#)
- Högberg, B.; Strandh, M.; Hagquist, C. Gender and secular trends in adolescent mental health over 24 years—The role of school-related stress. *Soc. Sci. Med.* **2020**, *250*, 112890. [\[CrossRef\]](#)
- Campbell, O.L.; Bann, D.; Patalay, P. The gender gap in adolescent mental health: A cross-national investigation of 566,829 adolescents across 73 countries. *SSM-Popul. Health* **2021**, *13*, 100742. [\[CrossRef\]](#) [\[PubMed\]](#)
- Brooks, S.; Feldman, I.; Schiöth, H. Important gender differences in psychosomatic and school-related complaints in relation to adolescent weight status. *Sci Rep.* **2021**, *11*, 14147. [\[CrossRef\]](#)
- Recchia, F.; Bernal, J.D.; Fong, D.Y.; Wong, S.H.; Chung, P.-K.; Chan, D.K.; Capio, C.M.; Yu, C.C.; Wong, S.W.; Sit, C.H. Physical activity interventions to alleviate depressive symptoms in children and adolescents: A systematic review and meta-analysis. *JAMA Pediatr.* **2023**, *177*, 132–140. [\[CrossRef\]](#)
- Ruiz-Ranz, E.; Asín-Izquierdo, I. Physical activity, exercise, and mental health of healthy adolescents: A review of the last 5 years. *Sports Med. Health Sci.* **2025**, *7*, 161–172. [\[CrossRef\]](#)
- Fu, Q.; Li, L.; Li, Q.; Wang, J. The effects of physical activity on the mental health of typically developing children and adolescents: A systematic review and meta-analysis. *BMC Public Health* **2025**, *25*, 1514. [\[CrossRef\]](#)
- Moll, A.; Collado, S.; Staats, H.; Corraliza, J.A. Restorative effects of exposure to nature on children and adolescents: A systematic review. *J. Environ. Psychol.* **2022**, *84*, 101884. [\[CrossRef\]](#)
- Bikomeye, J.C.; Balza, J.; Beyer, K.M. The impact of schoolyard greening on children's physical activity and socioemotional health: A systematic review of experimental studies. *Int. J. Environ. Res. Public Health* **2021**, *18*, 535. [\[CrossRef\]](#) [\[PubMed\]](#)
- Torjinski, M.; Horwood, S. Associations between nature exposure, screen use, and parent–child relations: A scoping review protocol. *Syst. Rev.* **2023**, *12*, 217. [\[CrossRef\]](#) [\[PubMed\]](#)
- Yuan, Y.; Tu, Y.; Su, Y.; Jin, L.; Tian, Y.; Chang, X.; Yang, K.; Xu, H.; Zheng, J.; Wu, D. The mediating effect of self-efficacy and physical activity with the moderating effect of social support on the relationship between negative body image and depression among Chinese college students: A cross-sectional study. *BMC Public Health* **2025**, *25*, 285. [\[CrossRef\]](#)

25. White, R.L.; Vella, S.; Biddle, S.; Sutcliffe, J.; Guagliano, J.M.; Uddin, R.; Burgin, A.; Apostolopoulos, M.; Nguyen, T.; Young, C. Physical activity and mental health: A systematic review and best-evidence synthesis of mediation and moderation studies. *Int. J. Behav. Nutr. Phys. Act.* **2024**, *21*, 134. [\[CrossRef\]](#)
26. Yan, H.-M.; Huang, P.; Chen, R.; Wang, Y.-C. The relationship between physical activity and mental health of middle school students: The chain mediating role of negative emotions and self-efficacy. *Front. Psychol.* **2024**, *15*, 1415448. [\[CrossRef\]](#)
27. Zhou, H.; Jiang, F.; Liu, H.; Wu, Y.; Tang, Y.-L. Dose-dependent association between physical activity and mental health, and mitigation effects on risk behaviors. *Iscience* **2025**, *28*, 111866. [\[CrossRef\]](#)
28. Massierer, F.D.; Botton, C.E.; da Silva Carvalho, J.P.; Cassão, G.; De Nardi, A.T.; Feter, J.; Ignacio, A.C.; Leal-Menezes, R.; Oliveira, N.L.; Pfeifer, L.O. Health outcomes in children and adolescents with overweight or obesity exposed to physical activity interventions: An umbrella review covering over 1,200 trials. *medRxiv* **2025**. [\[CrossRef\]](#)
29. Toivo, K.; Bakalár, P.; Leppänen, M.; Parkkari, J.; Abazović, E.; Šimunič, B.; Teraž, K.; Malinowska-Ciešlik, M.; Kopčáková, J.; Zelko, A. Frequency of physical activity-related injuries among adolescents: An umbrella review. *Public Health Rev.* **2025**, *46*, 1606767. [\[CrossRef\]](#) [\[PubMed\]](#)
30. Addas, A. Impact of neighborhood safety on adolescent physical activity in Saudi Arabia: Gender and socio-economic perspectives. *Front. Public Health* **2025**, *13*, 1520851. [\[CrossRef\]](#)
31. Alghadier, M.; Basuodan, R.M.; Gmmash, A.; Albeshier, R.A. Physical Activity Types Among School-Aged Children During COVID-19 Pandemic in Saudi Arabia: A Cross-Sectional Study. *Life* **2025**, *15*, 91. [\[CrossRef\]](#)
32. Wang, C.H.; Hong, F.Y.; Hsu, T.Y. Examining the Relationship Between Daily Academic Hassles, Academic Buoyancy, Flourishing, and Mental and Physical Health Issues Among Taiwanese High School Students. *Psychol. Sch.* **2025**, *62*, 1283–1293. [\[CrossRef\]](#)
33. Hassan, A.A.; Idrees, M.B.; Al-Nafeesah, A.; Alharbi, H.Y.; AlEed, A.; Adam, I. Depression and Anxiety Among Adolescents in Northern Sudan: A School-Based Cross-Sectional Study. *Medicina* **2025**, *61*, 228. [\[CrossRef\]](#) [\[PubMed\]](#)
34. Carvalho, P.S.; Vieira Martins, M.; Azevedo, I.; Rodrigues, R.; Ferreira, S. World Health Organization's Well-Being Index–WHO-5: Psychometric Performance of the Portuguese Version for Adolescents. *Port. J. Public Health* **2025**, *43*, 38–46. [\[CrossRef\]](#) [\[PubMed\]](#)
35. Alalawi, A.; Blank, L.; Goyder, E. Umbrella review of international evidence for the effectiveness of school-based physical activity interventions. *PLoS ONE* **2024**, *19*, e0304513. [\[CrossRef\]](#) [\[PubMed\]](#)
36. Zarazaga-Peláez, J.; Barrachina, V.; Gutiérrez-Logroño, A.; Villanueva-Guerrero, O.; Roso-Moliner, A.; Mainer-Pardos, E. Impact of extracurricular physical activity on achievement of the sustainable development goals and academic performance: Mediating cognitive, psychological, and social factors. *Sustainability* **2024**, *16*, 7238. [\[CrossRef\]](#)
37. Hassan, M.A.; McDonough, D.J.; Ryu, S.; Zhou, W.; Oginni, J.; Gao, Z. Comparative effectiveness of school-based obesity prevention programs for children and adolescents: A systematic review and network meta-analysis. *Front. Public Health* **2024**, *12*, 1504279. [\[CrossRef\]](#)
38. Rees, G. *Children's Views on Their Lives and Well-Being*; Springer: Berlin/Heidelberg, Germany, 2017.
39. Marquez, J.; Long, E. A global decline in adolescents' subjective well-being: A comparative study exploring patterns of change in the life satisfaction of 15-year-old students in 46 countries. *Child Indic. Res.* **2021**, *14*, 1251–1292. [\[CrossRef\]](#)
40. Andermo, S.; Hallgren, M.; Nguyen, T.-T.-D.; Jonsson, S.; Petersen, S.; Friberg, M.; Romqvist, A.; Stubbs, B.; Elinder, L.S. School-related physical activity interventions and mental health among children: A systematic review and meta-analysis. *Sports Med.-Open* **2020**, *6*, 25. [\[CrossRef\]](#)
41. Pereira, J.V.; Vila-Nova, F.; Veiga, G.; Lopes, F.; Cordovil, R. Associations between outdoor play features and children's behavior and health: A systematic review. *Health Place* **2024**, *87*, 103235. [\[CrossRef\]](#)
42. Mader, S.; Costantini, D.; Fahr, A.; Jordan, M.D. The effect of social media use on adolescents' subjective well-being: Longitudinal evidence from Switzerland. *Soc. Sci. Med.* **2025**, *365*, 117595. [\[CrossRef\]](#) [\[PubMed\]](#)
43. Lee, J.J.; Flouri, E.; Jackson, Y. The role of timing and amount of outdoor play in emotional dysregulation in preschool children. *Child: Care Health Dev.* **2025**, *51*, e70020. [\[CrossRef\]](#)
44. Demissie, Z.; Lowry, R.; Eaton, D.K.; Hertz, M.F.; Lee, S.M. Associations of school violence with physical activity among US high school students. *J. Phys. Act. Health* **2014**, *11*, 705–711. [\[CrossRef\]](#)
45. Abdelghaffar, E.-A.; Hicham, E.K.; Siham, B.; Samira, E.F.; Youness, E.A. Perspectives of adolescents, parents, and teachers on barriers and facilitators of physical activity among school-age adolescents: A qualitative analysis. *Environ. Health Prev. Med.* **2019**, *24*, 21. [\[CrossRef\]](#)
46. Jackson, D.; Prochnow, T.; Ettekal, A.V. Programs Promoting Physical Activity and Social–Emotional Learning for Adolescents: A Systematic Literature Review. *J. Sch. Health* **2024**, *94*, 994–1004. [\[CrossRef\]](#)
47. Lee, E.-Y.; Bains, A.; Hunter, S.; Ament, A.; Brazo-Sayavera, J.; Carson, V.; Hakimi, S.; Huang, W.Y.; Janssen, I.; Lee, M. Systematic review of the correlates of outdoor play and time among children aged 3–12 years. *Int. J. Behav. Nutr. Phys. Act.* **2021**, *18*, 41. [\[CrossRef\]](#)

48. Marquez, J.; Taylor, L.; Boyle, L.; Zhou, W.; De Neve, J. Child and Adolescent Well-Being: Global Trends, Challenges and Opportunities. 2024. Available online: <https://www.worldhappiness.report/ed/2024/child-and-adolescent-well-being-global-trends-challenges-and-opportunities/> (accessed on 15 August 2015).
49. Li, J.; Huang, Z.; Si, W.; Shao, T. The effects of physical activity on positive emotions in children and adolescents: A systematic review and meta-analysis. *Int. J. Environ. Res. Public Health* **2022**, *19*, 14185. [[CrossRef](#)] [[PubMed](#)]
50. Bento, G.; Dias, G. The importance of outdoor play for young children's healthy development. *Porto Biomed. J.* **2017**, *2*, 157–160. [[CrossRef](#)] [[PubMed](#)]
51. Biddle, S.J.; Ciacconi, S.; Thomas, G.; Vergeer, I. Physical activity and mental health in children and adolescents: An updated review of reviews and an analysis of causality. *Psychol. Sport Exerc.* **2019**, *42*, 146–155. [[CrossRef](#)]
52. Banati, P.; Lansford, J.E. *Handbook of Adolescent Development Research and Its Impact on Global Policy*; Oxford University Press: Oxford, UK, 2018.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.