BMC Pediatrics

RESEARCH Open Access

"Active behaviour of parents is more associated with out-of-school physical activity in their children"

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Abstract

Background Active parents may have more active children, as parents act as role models for their children's physical activity (PA). Parents can facilitate access to PA, provide information, validate physical-sport behaviours, and offer emotional support. Also, the influence of parents' PA on children's PA in and out of the school context has not been well-established.

Objective This study aimed to examine the associations between parental PA and the PA levels of their children in both school and out-of-school settings, considering parental sex.

Methods A cross-sectional study was conducted in 2021 involving 1,030 parent-child dyads. Sociodemographic data and self-reported active behaviour measures were administered to both groups simultaneously. Multiple logistic regressions were performed to determine the associations.

Results A positive trend between parental and children's PA was observed only out of school (Trend OR = 1.55, 95% CI = 1.25–1.95; $p < 0.001$). Maternal moderate-to-vigorous physical activity (MVPA) of 151–300 min per week was associated with MVPA in children on school days with physical education classes (OR = 3.48; 95% CI, 1.04–12.1). A trend was found in the maternal group for MVPA in children out of school (Trend OR = 1.57 [95% CI = 1.24; 2.01]).

Conclusion Positive associations between MVPA in children and more than 150 min of MVPA per week from parents were found. Also, a trend between maternal PA and their children's out-of-school MVPA was identified, supporting future initiatives focused on family-based PA interventions.

Keywords Family, Physical education, Father, Mother, Exercise

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Introduction

It is well established that physical activity (PA) offers numerous benefits for the health of children and adolescents [1]. However, despite the extensive body of scientific evidence highlighting the health benefits of PA [2], a significant proportion of children and adolescents globally do not meet the minimum recommended levels of PA [3]. The recommended guideline specifies that children should engage in at least 60 min of moderate to vigorous intensity PA daily [4, 5]. In Chile, only three out of ten children meet these PA recommendations [6]. Furthermore, over the past two years, PA levels have declined considerably due to the impact of COVID-19 [7, 8]. Thus, PA promotion initiatives are paramount for children and youth.

The World Health Organization (WHO) has made substantial efforts in recent years to promote PA through health education and school-based programmes; however, these initiatives have not been sufficient [9]. For example, a study conducted in Spain revealed that children tend to engage in more PA outside of school, with boys consistently showing higher levels of activity than girls [10]. Moreover, research has demonstrated sex-based differences in PA among children and adolescents, with girls reporting less PA than boys [11, 12]. Chilean studies corroborate these findings, indicating that boys are generally more active than girls, a trend that extends into adolescence [13–15]. The lower levels of PA among girls have been attributed to a preference for sedentary activities during their leisure time [16], as well as to earlier biological maturation compared to boys [17]. Understanding the factors leading to child physical activity and sex differences may assist ongoing and future interventions.

Various intrapersonal factors and environmental barriers have been shown to affect the ability of children and adolescents to attain adequate levels of PA [18]. Many researchers have employed the socio-ecological model as a conceptual framework to identify the key factors influencing PA participation among children and adolescents [19] and to explore the interactions between these factors [20]. At the interpersonal level of the socio-ecological model, the role of family and close social networks is identified as crucial in shaping the active behaviours of children and adolescents [21, 22]. Parental involvement in PA is recognised as fundamental for both children and adolescents [23], with studies showing that parental PA levels are positively correlated with those of their children. Active parents tend to have more active children [24]. Additionally, parents serve an important role for their children's PA by facilitating access to PA, providing information, endorsing active behaviours, and offering emotional support [25–28].

Parent-child PA relations may also differ according to the sex of the parent. A study involving Chilean and Spanish children and adolescents identified a negative association between mothers' moderate to vigorous PA (MVPA) and their children's MVPA outside of school [29]. Evidence also suggests that fathers exert a stronger influence on boys' participation in sports and PA compared to mothers [30]. Research from Portugal indicates that children engage in more sports activities if the father is active; similarly, active mothers are positively associated with organised PA in girls [31]. Conversely, some studies report that only mothers' MVPA is associated with that of their children [32]. Another German study revealed a positive association between maternal education and children's MVPA. However, the inclusion of physical activity-related Family Health Climate as a mediating factor altered the relationship between parental education and children's MVPA and sedentary behaviour [33]. A meta-analysis concluded that the strength and nature of father–son and mother–daughter relationships vary widely across different countries and contexts [34]. However, these associations may become clearer and more consistent when assessed using objective measurement methods. Contradictory evidence exists, with some studies finding no correlation between parental PA and the PA levels of their children [35], nor in the overall parent-child PA relationship [36]. Despite the recognised importance of parental influence on PA in children and adolescents, few studies have examined PA participation within and outside the school context concerning mother-daughter, mother-son, father-daughter, and father-son relationships [37]. Unfortunately, the studies included in these associations on the effect of sex (mothers vs. fathers; boys vs. girls) and including children and adolescents are lacking.

Nevertheless, in the current study, the sex variable is included to answer the question of the greater influence of the father or the mother. To date, it is known that maternal influence on active behaviours such as active commuting is greater than that of the father [38] and that the sex of the parents plays a significant role in children's physical activity [28, 31]. Furthermore, this relationship diminishes as children transition from childhood to adolescence [39]. However, it remains unclear whether the parental influence is more prominent out of school or if it also extends to school-based physical activity practices.

Given this background, the main objective of this study was to examine the associations between parental PA and the PA levels of their children in both school and out-of-school settings, considering parental sex.

Methods

Study design and participants

This cross-sectional study was conducted in Valparaíso, Chile, during the autumn of 2021, and involved 515 parent–child dyads, totalling 1,030 participants. The sample consisted of 515 school-aged children and adolescents (142 children and 373 adolescents), each paired with one of their respective parents who chose to respond to the questionnaire ($n = 515$). The participants were from three schools in the Valparaíso region (V Region), representing different types of management (private and public).

Procedures

First, the study protocol adhered to the principles of the Declaration of Helsinki and was approved by the Bioethics Committee of the Pontificia Universidad Católica de Valparaíso, Chile (Code: BIOEPUCV-H 638–2023). After this, principals of the selected schools were invited to participate in the study. Following their agreement, a meeting was convened with administrative authorities (pedagogic area coordinators or physical education) and teaching staff to present and clarify the project's objectives and phases. Selected schools were required to offer a minimum of two physical education classes per week in the targeted grades (4th grade of primary to 2nd grade of secondary in Chilean educational system), considering children between 9 and 11 years old and adolescents between 12 and 16 years old. Each participating class had to include at least 15 students, and a minimum of 15 informed consent forms had to be obtained from both students and their parents or legal guardians. Before administering the questionnaires, informed consent was obtained from all participating parents, who were provided with detailed information on the study's objectives and procedures and granted permission for their child's participation. Finally, once authorisations were obtained from both schools and parents, the research team visited the schools to administer the questionnaires. Questionnaires for schoolchildren were applied during physical education or other regular classes, with the support of the respective physical education teacher. Parental questionnaires were administered during scheduled parent meetings at the schools (answered by either the mother or the father).

Measures

Sociodemographic factors

The parents completed a questionnaire regarding their sociodemographic characteristics, including age, date of birth, sex, type of school their child attends (private, subsidised, or public), and postal address. The children and adolescents filled out a questionnaire that included the name of their school, age, date of birth, school grade and class, biological sex, country of birth, mother's name, and full mailing address.

Physical activity

To evaluate the levels of MVPA among parents, the Global Physical Activity Questionnaire (GPAQ) [40] was employed, comprising 16 mixed-format questions (both closed and open-ended). Physical activities of moderate intensity were defined as expending 4 METs, while vigorous-intensity activities were defined as expending 8 METs. The equation used to calculate METs/min/week was: [(P2 * P3 * 8) + (P5 * P6 * 4) + (P8 * P9 * 4) + (P11 * P12 * 8) + (P14 * P15 * 4)], where P denotes the time variable and the appended number indicates the corresponding question related to work, transportation, or recreational activity. Question 16 (P16) pertains to the time allocated to sedentary behaviour. Parents achieving at least 150 min in MVPA per week were classified as active, whereas those who did not meet this threshold were classified as inactive [4].

The PA of children and adolescents was assessed using the Youth Activity Profile (YAP) questionnaire, validated for accuracy to MVPA [41, 42]. The YAP questionnaire is structured into three sections: "PA at school" (including physical education, recess, and lunchtime), "PA outside school" (before and after school, as well as weekend PA), and a "sedentary time" item. The response scale ranges from 1 (low PA) to 5 (high PA), with the mean score representing the YAP score [1–5]. Fairclough's equations [43] were applied to convert the scores into minutes/day of MVPA. The min/day of "MVPA at school", "extracurricular MVPA", and "weekend MVPA" were determined for children and adolescents. To identify active children and adolescents, the cut-off point was set at > 60 min/day of MVPA [44], with those failing to meet this criterion being classified as inactive. For more details, review the study protocol of the ACTIBESE project [45].

Statistical analysis

The percentage of missing data was deemed insufficiently high to justify limiting the analysis to complete cases; therefore, variables with missing values were imputed [46]. Missing data were addressed using the random forest method, which imputes datasets by utilising observed data to predict missing values [47]. The extent of missing data ranged from 0.19% (children's sex) to 27.9% for out-of-school. Descriptive statistics were calculated for the study variables, with means (M) and standard deviations (SD) for continuous variables, and frequencies (%) for categorical variables. Comparisons of continuous variables were conducted using independent samples t-tests, whereas categorical variables were assessed using the Chi-squared test. To determine the MVPA, Parental PA was dichotomised by current international

recommendations (reach or not reach 150 min MVPA). At the same time, children's PA was categorised based on the distribution of the sample's PA time across different contexts, chosen by the authors based on observational knowledge of the Chilean context [48] of PA for schoolchildren (cut-point in school with PE: 60 min/day; in school without PE: 20 min/day; out of school: 35 min/day).

Multiple logistic regression analyses and linear regression were performed to examine the associations between various levels of parental PA (independent variable) and the PA of their children, both during school hours and out of school. For the statistical analysis, we modelled parental PA as the independent variable and child PA as the dependent variable.

Table 1 Sociodemographic characteristics of parents and their children

Variables	Overall ($n=506$)[1]	Parents		*p*-value[2]
		Men ($n=111$)[1]	Women ($n=395$)[1]	
Age (years), Mean (SD)	42.01 (7.33)	44.49 (7.00)	41.31 (7.28)	**<0,001**
MVPA (min/week), Mean (SD)	465.9 (623.50)	500.1 (497.1)	456.3 (654.9)	**0,011**
PA Guidelines, n (%)				**0,003**
<150 min/wk	189 (37.35%)	28 (25.23%)	161 (40.76%)	
≥150 min/wk	317 (62.65%)	83 (74.77%)	234 (59.24%)	
		Children		
		Boys ($n=171$)	**Girls ($n=335$)**	
Age (years), Mean (SD)	11.67 (2.46)	11.79 (2.74)	11.61 (2.31)	0,286
School type, n (%)				**<0,001**
Public	239 (47.2%)	105 (61.4%)	134 (40.0%)	
Private	267 (52.8%)	66 (38.6%)	201 (60.0%)	
MVPA (min/day), Mean (SD)	66.02 (45.31)	74.36 (53.68)	61.75 (39.80)	**<0,001**
MVPA in-school with PE, n (%)				**<0,001**
<60 min/day	272 (53.8%)	74 (43.3%)	198 (59.1%)	
≥60 min/day	234 (46.3%)	97 (56.7%)	137 (40.9%)	
MVPA in-school without PE, n (%)				**<0,001**
<20 min/day	144 (28.5%)	7 (4.1%)	137 (40.9%)	
≥20 min/day	362 (71.5%)	164 (95.9%)	198 (59.1%)	
MVPA Out-of-school, n (%)				**0,005**
<35 min/day	318 (62.9%)	93 (54.4%)	225 (67.2%)	
≥35 min/day	188 (37.2%)	78 (45.6%)	110 (32.8%)	

[1] *MVPA* moderate-to-vigorous physical activity, *PE* physical education, *SD* Standard deviation

[2] $p<0.05$; $p<0.01$; $p<0.001$

Three thresholds were established for MVPA: in-school with physical education (≥60 min/day), in-school without physical education (≥20 min/day), and out-of-school (≥35 min/day) to apply logistic regression. Odds ratios and beta coefficients with 95% confidence intervals were calculated to evaluate the magnitude and significance of the associations between independent and dependent variables. Due to the sample size, the children's results were adjusted by age and sex. The significance level was set at $p<0.05$.

For the linear regression models, the outcome variable was the time spent in MVPA by children in the three contexts, and the exposure variable was the weekly level of parental MVPA. Two main models were used: the crude model, child MVPA (in-school with PE, in-school without PE, and out-of-school) as the outcome variable and parental MVPA level as the exposure; the adjusted model: the crude model was additionally adjusted for age, sex, and school type. In models stratified by one of these variables, that variable was excluded as a covariate from the corresponding estimation.

Interaction terms by age and sex of children were tested for each outcome variable. Results were shown stratified by these variables only when the interaction term was statistically significant. The level of statistical significance was set at $p<0.05$.

All analyses were conducted using RStudio v4.0.2, with the tidyverse (v2.0.0), gtsummary (v1.7.1), and missForest (v1.5) packages [47, 49–51], as well as GraphPad Prism version 9.00 (GraphPad, San Diego, CA, USA).

Results

Table 1 presents the characteristics of parents and their children. The parents had an average age of 42.0 ± 7.3 years, and the children had an average age of 11.7 ± 2.5 years. Fathers demonstrated a significantly higher age and average minutes per day (min/day) in MVPA compared to mothers. Among children, there were no statistically significant differences in age between boys and girls. Regarding MVPA, a greater proportion of boys met the daily recommendations on school days with physical education (PE) classes compared to girls (56.7% vs. 40.9%; $p<0.001$).

On school days without PE classes, 95.9% of boys achieved more than 20 min of MVPA, whereas only 59.1% of girls did so ($p<0.01$). During out-of-school periods (weekends), 45.6% of boys reached 35 min per day in MVPA compared to 32.8% of girls ($p<0.01$).

Figure 1 illustrates the odds ratio (OR) values for the relationship between parents' meeting MVPA recommendations (both mothers and fathers) and their children's MVPA across three periods: MVPA during school days with PE, MVPA during school days without PE, and MVPA out-of-school. A positive trend was observed only

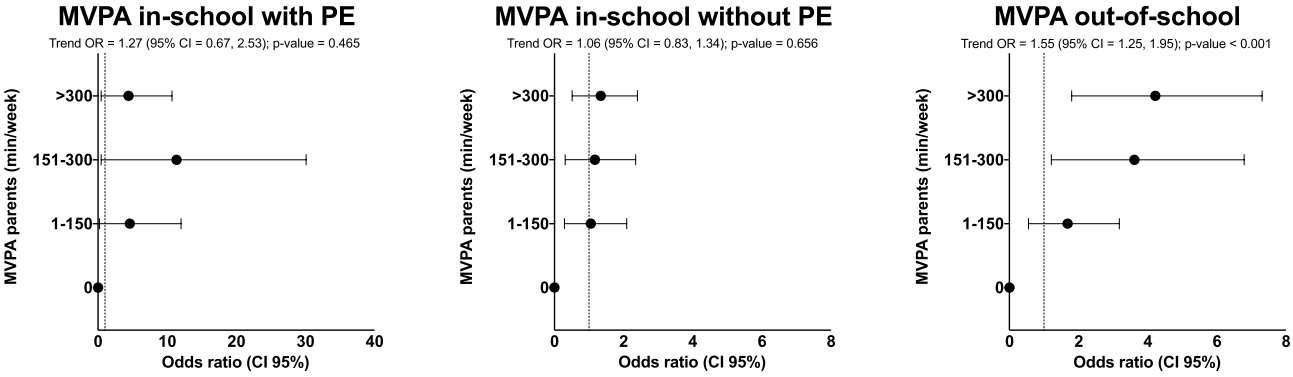

Fig. 1 Association between MVPA of parents and their children. **a** association between total MVPA parents and in-school MVPA considering PE of their children; (**b**) association between total MVPA parents and in-school MVPA without considering PE of their children; (**c**) association between total MVPA parents and out-of-school MVPA of their children; bold indicates statistical significance ($p < 0.05$)

Table 2 Trend of probability of children complying according to the recommendations based on the sex of the parents

Characteristic	MVPA in-school with PE		MVPA in-school without PE		MVPA Out-of-school	
	OR (95% CI)	Trend OR (95% CI)	OR (95% CI)	Trend OR (95% CI)	OR (95% CI)	Trend OR (95% CI)
MVPA Father						
0 min	1		1		1	
1–150 min	5.2 (0.00; 24,23)		1.51 (0.16; 14.5)		7.54 (0.94; 76.40)	
151–300 min	2.79 (0.00; 5,16)	1.11 (0.11; 16.8)	2.66 (0.33; 25.2)	1.33 (0.77; 2.42)	5.26 (0.80; 44.90)	1.37 (0.84; 2.30)
>300 min	2.29 (0.01; 2,10)		2.45 (0.40; 17.5)		5.64 (0.96; 44.90)	
MVPA Mother						
0 min	1		1		1	
1–150 min	1.29 (0.40; 4.07)		0.73 (0.24; 2.20)		1.01 (0.39; 2.55)	
151–300 min	3.48* (1.04; 12.10)	1.28 (0.96; 1.72)	0.62 (0.19; 2.02)	1.01 (0.77; 1.31)	2.56* (1.00; 6.66)	1.57* (1.24; 2.01)
>300 min	2.02 (0.83; 5.06)		0.98 (0.41; 2.32)		3.46* (1.67; 7.42)	

MVPA Moderate-to-vigorous physical activity, *PE* Physical education

OR Odds Ratio

during the out-of-school period, indicating an association between parental and children's PA (Trend OR = 1.55, 95% CI = 1.25–1.95; $p < 0.01$).

Table 2 displays trends in parental MVPA by sex across three categories: 1–150 min/week, 151–300 min/week, and > 300 min/week. These trends were analysed based on whether children met the 60 min/day MVPA guideline. No significant associations were found between fathers' MVPA and children's MVPA. However, maternal MVPA in the 151–300 min/week category was associated with children's MVPA on school days with PE (OR = 3.48; 95% CI = 1.04–12.1). A trend was also identified in the maternal group regarding children's MVPA during out-of-school periods (Trend OR = 1.57; 95% CI = 1.24–2.01).

In the logistic regression models, a significant interaction was found between child sex and out-of-school MVPA ($p = 0.048$); therefore, the results are presented stratified by the sex of the children in Supplementary Table S2. In the case of age, a significant interaction was observed with in-school MVPA without physical education ($p = 0.023$); however, due to the absence of observations in the "<20 min/day" category among participants under 12 years of age, regression models were not stratified. Instead, descriptive data for each category are presented in Supplementary Table S3.

In the linear regression models, interaction terms for age and sex yielded consistently significant results for sex (in-school with PE: $p = 0.019$; in-school without PE: $p = 0.021$; out-of-school: $p = 0.047$). Therefore, stratified results by sex are presented in Supplementary Table S4.

Table 3 shows the linear regression between the minutes of MVPA for parents and their children. Significant associations were observed only in the model adjusted for age, sex, and type of school. This adjusted model successfully established statistically significant associations. Regarding physical activity at school, it is evident that the total relationship is based on over 300 min of MVPA for both parents, similar to what is observed for mothers.

The same pattern was observed with MVPA at school, excluding PE class, where an association was established starting from 151 min of MVPA among all parents and fathers. In the case of mothers, the association was only established from 300 min of MVPA.

The highest associations were found in physical activity out of school, both overall and by parent sex. In general, associations between MVPA are more pronounced

Table 3 Lineal regression between MVPA of children in three different moments and MVPA of parents, overall and by sex

Variables	Overall		Fathers		Mothers	
	Beta-c (95% CI)	Beta-a (95% CI)	Beta-c (95% CI)	Beta-a (95% CI)	Beta-c (95% CI)	Beta-a (95% CI)
MVPA In-school with PE						
0 min	—	—	—	—	—	—
1–150 min	0.04 (−0.24; 0.33)	0.12 (−0.06; 0.30)	0.05 (−0.69; 0.78)	0.52* (0.04; 1.0)	0.06 (−0.26; 0.37)	0.06 (−0.14; 0.25)
151–300 min	0.20 (−0.08; 0.49)	0.18 (0.00; 0.35)	0.38 (−0.27; 1.0)	0.45* (0.03; 0.87)	0.18 (−0.15; 0.50)	0.10 (−0.10; 0.30)
>300 min	0.14 (−0.08; 0.37)	0.23* (0.09; 0.37)	0.30 (−0.28; 0.87)	0.46* (0.08; 0.83)	0.13 (−0.12; 0.37)	0.19* (0.04; 0.34)
MVPA In-school without PE						
0 min	—	—	—	—	—	—
1–150 min	0.07 (−0.22; 0.36)	0.14 (−0.04; 0.32)	0.08 (−0.66; 0.82)	0.55* (0.07; 1.0)	0.08 (−0.23; 0.39)	0.08 (−0.12; 0.27)
151–300 min	0.23 (−0.05; 0.52)	0.20* (0.03; 0.38)	0.41 (−0.24; 1.1)	0.48* (0.06; 0.90)	0.21 (−0.11; 0.53)	0.13 (−0.07; 0.33)
>300 min	0.17 (−0.05; 0.39)	0.26* (0.11; 0.40)	0.33 (−0.24; 0.90)	0.49* (0.11; 0.87)	0.15 (−0.09; 0.40)	0.21* (0.06; 0.37)
MVPA Out-of-school						
0 min	—	—	—	—	—	—
1–150 min	0.01 (−0.27; 0.30)	0.07 (−0.16; 0.31)	0.18 (−0.55; 0.90)	0.54 (−0.04; 1.1)	0.00 (−0.31; 0.31)	−0.01 (−0.27; 0.25)
151–300 min	0.34* (0.06; 0.62)	0.34* (0.11; 0.57)	0.62 (−0.03; 1.3)	0.71* (0.21; 1.2)	0.30 (−0.02; 0.62)	0.22 (−0.05; 0.48)
>300 min	0.28* (0.06; 0.50)	0.40* (0.21; 0.59)	0.37 (−0.19; 0.94)	0.56* (0.11; 1.0)	0.30* (0.05; 0.54)	0.37* (0.17; 0.58)

Models were adjusted using age, sex and school type as covariates. Beta-c: crude coefficients; Beta-a: adjusted coefficients; *CI* Confidence interval, *MVPA* Moderate-to-vigorous physical activity. *$p < 0.05$

between fathers and children than between mothers and children. Furthermore, fathers exhibit stronger associations with their children's MVPA compared to mothers.

Discussion

This study aimed to examine the associations between parental PA and the PA levels of their children in both school and out-of-school settings, considering parental sex. The findings provide critical insights into the relationship between parental MVPA and children's MVPA across different settings. The results also indicate significant sex disparities in MVPA among both parents and children. The OR demonstrated a positive trend between meeting MVPA guidelines in children out of school and the minutes of MVPA performed by parents. Additionally, the linear regression results indicated a clearer association between all parents' MVPA, fathers' and children's MVPA both in and out of school, compared to the associations observed with mothers. This aligns with previous research that highlights sex differences in adult PA levels [52, 53]. According to the Chilean survey on PA habits, the role of the mother is more important than that of the father in children aged 5–10 years, while the father has greater relevance in adolescents aged 11–17 years [54]. Among children, boys consistently met daily MVPA recommendations more frequently than girls, particularly on school days with PE classes and during out-of-school periods.

The lower levels of MVPA observed in girls are a cause for concern, as they may reflect potential barriers such as limited access to supportive environments, restrictive norms, or less emphasis on competitive sports for women [54]. Programs designed to address these barriers by promoting inclusive and diverse physical activity opportunities could be essential to reduce sex disparities in physical activity participation [55].

The observed association between maternal MVPA, specifically in the 151–300 min/week range, and children's compliance with daily MVPA recommendations in school settings underscores the importance of parental PA as a determinant of children's PA behaviours. This finding aligns with existing research indicating that active parents are more likely to have active children, with mothers, who often serve as primary caregivers, exerting significant influence on children's daily routines [29, 31]. However, the absence of a statistically significant association between fathers' MVPA and children's PA on school days suggests that maternal influence may be more substantial, or that fathers' involvement may differ in nature or timing [38].

The positive trend between parental MVPA at recommended guidelines and children's out-of-school MVPA is also noteworthy (Trend OR = 1.55). This suggests that mothers may exert a stronger influence outside structured environments such as schools, where children's PA is less formally regulated. Research has shown that parents engaging in recreational PA, such as walking or outdoor activities, can encourage similar behaviours in their children through shared activities and indirect reinforcement [56]. This makes sense, as parents and children may have more interaction time after school hours, where physical activity modelling and parental support can determine physical activity within the family system [28].

Concerning current knowledge and the findings of this study, family-based interventions should be a fundamental focus to promote behavioural changes toward a more active lifestyle in children and adolescents. For instance, interventions that incorporate motivational variables [57] appear effective in increasing daily step counts [58], such as the use of pedometers combined with feedback and monitoring processes [59]. Undoubtedly, schools serve as the primary medium for establishing contact and communication with families. This is facilitated through the maintenance of "captive groups," which enables the dissemination of information via emails, newsletters, phone calls, parent meetings, informational forums, participation in school events, etc [60]. Furthermore, schools have the unique opportunity to organise joint activities between parents and children, such as competitions and recreational outings beyond the school setting.

Strengths and limitations

Among the study's strengths is the large number of participants, which allows for more robust statistical analyses and accurate interpretations. Additionally, the findings are among the few that have been conducted within the Latin American context, contributing to regional knowledge by highlighting a significant issue and proposing solutions to address physical inactivity in children and adolescents through greater family involvement. However, the study also has certain limitations. These include its cross-sectional design, the reliance on self-reported physical activity, a sex imbalance within the sample, and the lack of consideration for other forms of physical activity, such as those performed with peers or in significant activities like walking and playing with pets.

Future implications

While the findings presented are insightful, they reflect trends that may vary across school or out-of-school contexts. The role of socioeconomic status, parental support systems, and school resources should be considered in future research to comprehensively understand the observed trends. It is important for future studies to consider the different combinations of parent and child sex, as well as age groups, in order to examine potential interactions and gain a deeper understanding of the underlying phenomena. Moreover, interventions aimed at enhancing maternal PA could have the dual benefit of increasing PA in children, particularly in more informal, out-of-school settings.

Conclusion

The trend showing positive associations between maternal PA and children's out-of-school MVPA supports initiatives aimed at family-based PA interventions. These findings contribute to the body of evidence suggesting that promoting parental PA, particularly maternal, could be an effective strategy to increase children's PA levels. In addition, the study's results highlight the multifaceted nature of PA promotion, underscoring the roles of both structured school programs and parental behaviour. Interventions that integrate family-based PA programs and sex-gender sensitive approaches are critical for sustaining children's PA and addressing sex-gender inequalities.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12887-025-06014-8.

Supplementary Material 1.

Supplementary Material 2.

Supplementary Material 3.

Acknowledgements

The authors would like to thank IRyS Group members, the School of Physical Education, and the Research Department from Pontificia Universidad Católica de Valparaíso, Chile, for their constant support in research activities. The same schools participated in the project.

Authors' contributions

The study concept and design were conceived by FRR, and SHJ assisted in refining the study questionnaires and study design by SHJ. FRR and SHJ handle data collection. SHJ and FRR conducted analyses. All authors prepared the first draft of the manuscript. JCP, JCO, JBS and RER critically and deeply revised the manuscript. All authors revised and approved the submitted version of the manuscript.

Funding

This project has been financed by the Fondo Nacional de Investigación para el Desarrollo Científico y Tecnológico, FONDECYT of the Agencia Nacional de Investigación y Desarrollo (ANID) of the Chilean Government. FONDECYT Regular project 2023, Nº 1230801.

Data availability

Data is provided within the manuscript or supplementary information files.

Declarations

Ethics approval and consent to participate

The project adheres to the principles outlined in the Declaration of Helsinki (World Medical Association, 2013), with approval obtained from the Bioethics Committee of the Pontificia Universidad Católica de Valparaíso, Chile (Code: BIOEPUCV-H 638–2023).

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Received: 22 May 2025 / Accepted: 30 July 2025
Published online: 25 August 2025

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