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Correlates of physical activity parenting: The Skilled Kids study.

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Running head: Correlates of physical activity parenting

Abstract

We examined the relationship between physical activity parenting (PAP) and child, family, and environmental factors in families. The participants were 840 families with young children (n = 993; 5.40 ± 1.14 years) and parents (n = 993; 35.8 ± 5.29 years). Parents' self-

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reported PAP (co-participation, (in)direct support and encouragement), child-specific (sex, age, temperament, outdoor time, organised physical activity or sports, sedentary time, media time, PA enjoyment, motor skills compared to peers, PA and sport facility use), family-specific (respondent's sex, age, education, exercise frequency, family income, family status, number of children in the family, child's birth order and partner's PAP and exercise frequency) and environment-specific (residential density, access to sport and outdoor facilities, type of house and access to electronic devices) factors were collected. Children's motor skills and anthropometrics were measured. After adjusting for the family cluster effect, child, family and environmental factors were entered into a linear mixed-effects model, with PAP as the response variable. The final model consisted of statistically significant factors, and parental education, which was forced into the model. Nine child- and family-related factors explained 15% of parenting variance between the children and 52% between the families. Partner's PAP ($B = .68$, $p < .001$) had the strongest association, whereas the child's temperament ($B = .08$, $p < .001$) and birth order ($B = -.10$, $p < .001$) had smaller but novel associations with the respondent's PAP. Partner's PAP and a range of child- and family-related factors should be considered when promoting parental support for child PA.

Key words: Children, physical activity, parental support, movement skills

A lack of physical activity parenting (PAP) practices is consistently associated with inactivity in children.[1,2] PAP practices can be defined as concrete behavioral strategies employed by parents to influence their children's physical activity (PA) behavior. This is a global issue because the prevalence of child inactivity[3] and motor deficiency, i.e., poor fundamental motor skills[4], is high and likely to increase. Importantly, these trends are associated with an increased prevalence of overweight and obesity and related health risk factors in children.[5,6] The promotion of child PA can therefore be seen as a public health priority, one in which parents are viewed as critical agents. However, the absence of information on PAP limits our ability to conduct interventions to increase PA in children.

Typically, PAP practices are operationalised as co-participation in PA with the child, the provision of direct or indirect support for the child's PA in terms of transportation, PA equipment and clothes and, lastly, encouraging PA.[7] Overall, a moderate effect size ($r = .38$, 95% CI .30-.46) has been found for the relationship between PAP and child PA[2]. However, the parent-child relationship is known to be bidirectional; i.e., a child's behavior influences parenting.[8,9] A recent study found that PAP moderates the efficacy of family-based PA intervention such that families with the lowest levels of PAP benefited from PA counseling the most.[10] Other studies have also highlighted the need to understand PAP more fully in order to enhance the poor overall success of PA interventions for children[11,12] and to provide more sustainable effects via motor skills interventions in children[13].

On one hand, thus far, research has mostly focused on the associations between PAP and child outcomes (e.g., PA and sedentary behavior), but relatively little is known about the factors explaining PAP itself. In addition to children's PA and sedentary behaviors[2], limited research literature suggests that PAP is positively associated with parental nurturance[14], parents' own PA[15], parents' perceived behavioral control over PAP, family income[16] and parental education and professional status[17]. On the other hand, PAP seems to have an inverse association with child age, parents' perceived importance of children's school performance, a lack of PA and sport facilities and concerns about safety.[16,18] Although a relatively wide range of factors seems to be associated with PAP, a more comprehensive perspective on the correlates of PAP remains absent.

Following ecological systems theory[19], factors in micro, meso, exo and macro systems have reciprocal interactions with one another and with an individual's behavior. Accordingly, when examining the correlates of PAP, a range of child-related, family-related and environmental factors should be examined simultaneously in order to account for potential interdependence between the various system levels. Consequently, we examined the correlates of PAP by performing a cross-sectional study with random-cluster sampling and adopting an ecological systems theory approach. Therefore, the assumption of this study was that child-related, family-related and environmental factors may be interdependent correlates of PAP in 2–7-year-old children.

Materials and methods

The ethics committee of the University of Jyväskylä approved the Skilled Kids study protocol on October 31, 2015. All parents signed written informed consent forms for their personal participation and their child(ren)'s participation in the study. Children were informed about their right to refuse to participate in the study at any time.

Random sampling and recruitment

The aim of this study was to collect a geographically representative sample of young children attending childcare in Finland. The study is based on a random-cluster sampling of 2,600 Finnish childcare centers, which were identified from a Finnish national registry of early educators. The desired sample size was 1,000 3–7-year-old children and their parents. We aimed to achieve this by recruiting participants from 30 childcare centers, assuming that there were around 50 children in a unit and the attrition rate was 33%. Childcare centers were chosen randomly, on the basis of postal codes, within metropolitan area and in Southern Finland, Central Finland and Northern Finland. The number of units included from each region was weighted based on the population of the region. In total, ten childcare centers refused to participate, with the main reasons being relating to a lack of space, interest or time or a low number of children. The staff members of each childcare center were instructed to deliver the study approval forms and questionnaires (n = 1579) to the parents via the children

attending their unit. Secondly, parents were asked to return the written form and completed questionnaires to the researchers via prepaid envelopes. Ultimately, a total of 37 childcare centers participated in the study: six from metropolitan areas, eleven from Southern Finland, thirteen from Central Finland, and seven from Northern Finland from 2015 to 2016. The total number of childcare centres included was higher than that initially planned because the mean number of 3–7-year old children reached per unit was lower than expected. Therefore, regional participant representativeness was ensured by including the few additional units. The parents of 1,239 children agreed to participate in the study, so the study's attrition rate was 21.5%. Measurements in the childcare centers were conducted by two of the researchers (DN and AS) and two research assistants between November 2015 and September 2016.

Physical activity parenting

A previously translated and utilised version[10] of the Family Physical Activity Environment (FPAE) questionnaire was used in determining parental support for children's PA[20]. The test-retest reliability of the questionnaire has been shown to be good in mothers of 5–6 and 10–12-year-old Australian children (ICC = .81 – .90). The FPAE consists of questions regarding three types of PAP practices, which are provided in three separate sections. The first section, regarding co-participation in PA, consists of the following item: "Evaluate how often you engage in PA, such as cycling, walking, playing outdoors or indoors, hiking and playing games, together as a family so that at least one parent is actively involved." The second section, regarding direct support on child's PA, contains the following item: "Evaluate how often you provide support for your child's participation in PA, such as taking him or her to a PA hobby or training, providing money for participation and buying sports clothing/equipment." The third section, regarding encouragement for PA, contains the following item: "Evaluate how often you praise your child for participating in PA, such as saying positive things to him or her for being physically active or physically skillful." Additionally, the parent was asked to evaluate two items considering his or her partner's PAP practices as follows: "Evaluate how often your partner participates in PA with your child, such as moving and playing games together" and "Evaluate how often your partner praises your child for participating in PA, such as saying positive things to him or her for being physically active or physically skillful." The frequency of PAP was queried using a six-point scale for each item (never, less than once per week, 1–2 times per week, 3–4 times per week, 5 – 6 times per week or daily). To simplify the interpretation of the numerical analyses, the answers were quantified as follows: "never" = 0, "less than once per week" = 0.5, "1–2 times per week" = 1.5, "3–4 times per week" = 3.5, "5–6 times per week" = 5.5, "daily" = 7.

Child-related, family-related and environmental factors

Along with the informed consent form, parents received a questionnaire concerning child temperament and another questionnaire considering other child-related, family-related and

environmental factors. Researchers measured children's motor skills and anthropometrics at childcare centers.

Height (Charder HM 200P) and weight (Seca 877) were measured by the researchers in the childcare centers. Body mass index (BMI) values were calculated as weight/height^2 (kg/m^2) and converted to BMI standard deviation scores (BMI SDS) using national BMI references. A child's outdoor time was assessed via the following question: "How much time, on average, does your child spend outdoors after a preschool day/on the weekends?" The scale for weekdays ranged from 0 to 3 (0 = not at all; 1 = 1 = under 30 mins/d; 2 = approx. 30-60 mins/d; 3 = over 60 mins/d), and the scale for weekends ranged from 0 to 4 (0 = not at all; 1 = under 30 mins/d; 2 = approx. 30-60 mins/d; 3 = 1-2 hrs/d; 4 = over 2 hrs/d). The total score from both scales was used to represent outdoor time. A child's participation in organised PA or sports was assessed via the following question: "Does your child participate in organised PA or sports in a group or sports club?" In the answer was "yes", further questions regarding such activities were asked: "How many times a week?" and "For how many minutes at a time?" The total minutes spent on organised PA or sports per week was calculated and used in the analyses.

Concerning PA and sports facilities use, parents were asked to "Evaluate how often your child has used sport or outdoor facilities situating in your own locality or a municipality nearby." There was a list of ten different PA and sport facilities (e.g., playing field, playground, swimming hall and indoor sports hall) and an open space for facilities that had been used but were not listed. In addition, parents were asked "Is there a large area for children's free-play in your home's yard (front or back yard, garden, etc.)?" and "How often is your child allowed to play in the yard?" In each case, facility use was scored on a scale from 0 to 4 (0 = does not exist; 1 = nearly never; 2 = randomly; 3 = weekly; 4 = approximately daily). Total facility use was calculated and used to represent PA and sports facility usage.

Parents were asked to evaluate their children's sedentary time via the following question: "Think about your child's typical day and situations when he or she is sitting, lying down, or in some other way sedentary (e.g., in a car, sand box or trolley; in front of TV or playing with a puzzle). For how long, at the most, does such a sedentary activity last without breaks?" Furthermore, parents were asked, "How often does your child spend in long and continuous sedentary activities during a day?" The total number of sedentary minutes during a day was calculated (mins/time * times/day) and used to represent sedentary time. Moreover, parents were also asked the following question: "How much time does the child spend consuming media entertainment (TV, computer, console, tablet, smart phone, etc.) on weekdays and on weekend days?" The scale used ranged from 0 to 5 (0 = not at all; 1= under 30 mins/d; 2 = approx. 30–60 mins/d; 3 = 1–2 hrs/d; 4 = 2–3 hrs/d; 5 = over 3 hrs/d).

Fundamental motor skills were measured by a trained researcher (DN) and research assistants by using the Test of Gross Motor Development, the third version (TGMD-3)[21]. Both researcher and her assistant were trained to analyse with TGMD-3. They had practised with Ulrich's official TGMD-3 videos and they passed TGMD-3 reliability test. Also, researchers

and assistants had earlier experience of using and analysing the TGMD-3 via live- or video-observing. The test protocol was equal in terms of time (1 hour / group), group size (3-4 children / group), clothing (light clothes with the possibility to move easily, without socks) and the test equipment. During the measurements, there was no rush. The test space was familiar childcare centre space to ensure the feel of security for children. If there were children with difficulty of understanding (no common language) or other challenges (health issues or behavioural challenges), familiar person from the childcare centre was present during the measurements. The TGMD-3 was done always in the same order (run, gallop etc.) and with the same instructions and demonstrations. Overall, TGMD-3 consists of six locomotor (run, gallop, hop, skip, jump and slide) and seven object-control (two-handed strike, forehand strike, one-hand dribble, two-hand catch, kick, and overhand- and underhand throw) test items, and each test item is evaluated qualitatively according to detailed performance criteria. The sum of all 13 test items was used to represent fundamental motor skill proficiencies. In addition, the parent's perceptions of the child's movement skills as compared to his or her peers were investigated with the following question: "When you compare the movement skills of your own child to other children of the same age, is he or she less skillful than others, as skillful as others or more skillful than others?" The scale used ranged from 1 to 3 (1 = less skillful; 2 = as skillful; 3 = more skillful). Moreover, the parent was asked to evaluate their perceptions of their child's PA enjoyment on a scale from 0 to 4 (0 = never; 1 = rarely; 2 = can't say; 3 = usually; 4 = almost always) via the following question: "How frequently do you perceive that your child is enjoying PA?"

Lastly, the child's temperament was assessed by using the Colorado Childhood Temperament Inventory[22]. The inventory consists of 30 questions (scores range from 1 to 5 for each) that evaluate the parent's perception of six factors (five items for each factor) in the child's temperament, namely sociability, emotionality, activity, attention span persistence, reaction to food and soothability. Based on a partial correlational analysis adjusted for the child's age and sex, a factor created from the total scores for sociability, activity and attention span persistence (termed 'agreeable temperament') correlated positively with PAP ($r = .282$, $p < .001$), and a factor created from emotionality and reaction to food (termed 'demanding temperament') was negatively correlated with PAP ($r = -.195$, $p < .001$). Therefore, we formed a single temperament score using a total of these two factors. The minimum of the scale was corrected to the zero. Therefore, a lower score indicates a more demanding temperament, and a higher score indicates a more agreeable temperament.

Concerning the family-level factors, the questionnaire included questions about the respondent's sex (male or female, henceforth referred to as father or mother, respectively), age (in years), education (1 = comprehensive school; 2 = high school/vocational school; 3 = polytechnic; 4 = university), family income level (1 = 0–13999 ; 2 = 14000–19999 ; 3 = 20000–39999 ; 4 = 40000–69999 ; 5 = 70000–99999 ; 6 = 100000–119000 ; 7 = 120000–139000 ; 8 = over 140000), family status (1 = nuclear family; 2 = single family; 3 = blended family; 4 = some other), respondent exercise frequency (0 = not at all; 1 = randomly few times a month; 2 = approximately once a week; 3 = 2–3 times a week; 4 = over four times a week), partner exercise frequency (the same scale as used for the respondent), the

number of children in the family, and the child's birth order in the family. We transformed family status into a binominal factor such that all statuses other than the nuclear family were merged (1 = other family statuses than the nuclear family; 2 = nuclear family). The mean score for the partner's PAP (described above in 'Physical activity parenting') items was used in the analyses.

The environmental factors included in the questionnaire consisted of the residential density of the family's location, which was evaluated indirectly, using the postal code of the childcare centre the child was attending as a reference and the national population density registry for categorisation (metropolitan area = 876.4–2,964, city = 24.65–762.9, rural area = 4.93–64.35, and countryside = 1.49–8.56 inhabitants per km²). Access to PA and sport facilities was assessed using the information derived from the "use of PA and sport facilities" category and by interpreting a score > 0 as indicating an accessible facility. Each accessible facility was scored equally as 1, and the total number of accessible facilities was used in the analyses. The question "What kind of house you are living in?" was used to assess a participant's type of residence (1 = blocks of flats; 2 = terraced house; 3 = detached house). Finally, a child's access to electronic devices was evaluated by asking "Does your child have access to some of the following: 1) a TV, 2) a game console, 3) a computer, 4) a smartphone, tablet, Ipad or other smart device, 5) something else, and if so, what?" The total number of accessible devices was used in the analyses.

Statistical analyses

Statistical analyses were performed using the statistical software package IBM SPSS, Version 24.0. The internal consistency of the PAP items was tested via corrected item-total correlations (the correlation between the item and a composite score for all the other remaining items) and by Cronbach's alphas (α). We decided to keep all three items regarding PAP practices in the analyses, although a mother's "direct support for a child's PA" showed a corrected item-total correlation below the level 0.3, which is considered "good"[23] (Table 1). This item was included because there would have been a marginal improvement in Cronbach's α if that item had been deleted (if deleted, α 0.569) and due potential loss of content information because parenting practices are likely to have mutual interactions with other factors. Differences in PAP practices between mothers and fathers were tested via Mann-Whitney U-tests because abnormal distributions were found. Descriptive statistics were used for the background characteristics of the study sample. Differences in child-related, family-related and environmental factors and PAP between mothers and fathers were tested by using independent-samples T-tests for normally distributed continuous factors and Mann-Whitney U-tests for non-normally distributed continuous, ordinal, and categorical factors.

When examining the associations between PAP and child-related, family-related, and environmental factors, hierarchical linear mixed models, instead of hierarchical linear regression models, were used because we found notable intra-class correlations within family clusters (n = 993; ICC = 0.790). There were, on average, 1.09 ± 0.33 children involved in the study from each of the families (n = 991) and 2.15 ± 0.50 (maximum of four) children per family (n = 153) among those families in which more than one child was involved in the study. In all models, the goodness of fit was significantly better when mixed models with a family cluster were used (for all models, $p < .001$). Also, the cluster effect of childcare center was tested, but the models having a childcare center cluster were not significantly better than those with only a family cluster. Therefore, the mixed models were based on a two-level hierarchy in which a child was nested within a family cluster.

Firstly, all the child-related, family-related and environmental factors predicting PAP were entered into the mixed model simultaneously as fixed factors (Model 1). Statistically least significant fixed factors were removed from the model one at a time. The mixed model was re-run with all the remaining factors until there were no statistically insignificant factors left. In the order of removal, the statistically insignificant factors removed were: sedentary behavior, fundamental motor skills, BMI SDS, family income level, type of the living house, access to PA and sport facilities, residential density, access to electronic devices, respondent's age, respondent's sex, movement skills compared to peers, organised PA or sports, family status, media time, and the child's sex. Consequently, only statistically significant factors explaining PAP were left in the final mixed model, Model 2. This so called backwards-method made it possible to take the interdependency (mutual covariance) of predictors into account at each step of modeling. Parental educational level was retained in Model 2, regardless of its statistical insignificance, because education [17] has been shown to be associated with parenting and may have underlying interactions with the other factors. We decided to retain birth order as a predictor in the models instead of the overall number of children in the family due to multicollinearity and birth order' stronger statistical magnitude. No evidence of multicollinearity was found for any other factors in the mixed model.

The results report standardised beta-coefficients, along with 95% confidence intervals and statistical significance, for both models. Regarding Model 2, the coefficients of determination (R^2) were calculated for determining the proportion of variability that statistically significant predictor factors (and parental education) explain of the respondents' PAP between children and families. For the child level, the R^2 was calculated as the proportion of change in residual variance when the statistically significant explainable factors were added in the model. The total child-level variance was calculated as follows: (var ε(m0) - var ε(m1)) / var ε(m0). The R^2 for the family level was calculated as the proportion of change in intercept variance and total family-level variance when the explainable factors were added to the model: (var u0(m0) - var u0(m1)) / var u0(m0)[24]. Level of significance was set in all analyses to $p < 0.05$ (two-tailed).

Results

Fathers reported a significantly higher PAP frequency (median of 3.33 times per week) as compared to mothers (median of 2.83 times a week) ($U = 49100.5$, $p < .05$) (Table 1). Fathers reported higher frequencies of engaging in all PAP practices (direct support for PA, co-participation in PA with the child and encouragement of PA), and direct support for a child's PA was significantly higher in fathers as compared to mothers (median 1.50 vs 1.50 times per week; $U = 45925.5$, $p < .01$). There were no differences in PAP between girls and boys.

Descriptive statistics for the investigated child-related, family-related and environmental factors are presented in Table 2. Girls ($n = 488$; 49.1%) and boys ($n = 505$; 50.9%) were nearly equally represented in the study sample, whereas more mothers ($n = 865$; 87.1 %) responded than fathers ($n = 128$; 12.9 %). More than half (60.2 %) of the respondents had higher-level educational backgrounds, i.e., polytechnic or university. Most of the families (60.5%) had overall incomes between 40,000 and 99,999 euros. Fathers were significantly older than mothers (mean 38.39 vs 35.42, $p < .001$), and the partners of fathers provided significantly more PA support to their children than the partners of mothers (mean 3.36 vs 2.82, $p < .01$) (Table 2). The boys spent more time outdoors (mean 5.22 vs 4.97, $p <.01$), enjoyed PA more (mean 3.66 vs 3.59, $p < .05$) and scored better in fundamental motor skills (mean 53.34 vs 51.07, $p < .05$) as compared to girls. In addition, boys spent more time with media devices (mean 5.15 vs 4.94, $p < .05$) and had access to more electronic devices (mean 0.62 vs 0.48, $p < .05$) than the girls. There were no other statistically significant differences in the child-related, family-related or environmental factors or PAP practices between sexes.

When all the child-level, family-level and environmental factors were entered into the two-level hierarchical mixed model simultaneously (Model 1), partner's PAP, respondent's exercise frequency and child's age, outdoor time, temperament and birth order significantly predicted the respondent's PAP (Table 3). These statistically significant child- and family-related factors and parental education (n.s.) explained approximately 15% of the variability in the respondents' PAP between children and approximately 52% of the variability between all the 840 families (Model 2). Notably, partner's PAP alone (standardised $B = 0.68$, $p < .001$) explained the same proportion of the variation in the respondent's PAP as all the other predictors together.

Discussion

To the authors' knowledge, this is the first study to use an ecological systems framework to explore the factors associated with physical activity parenting (PAP). A model with nine child- and family-specific factors explained 15% of the variability in PAP between children ($n = 993$) and 52% of the variability in PAP between families ($n = 840$). A parent's perception his or her partner's PAP was approximately as weighty a predictor of PAP as the other eight factors of the final model together. In light of a recent study highlighting the bidirectional interaction between PAP and a child's PA[9], the present study suggests multiple

child- and family-related factors are associated with PAP, in addition to the child's actual PA behavior.

It seems that PAP comprises a highly shared dimension of parenting so that if a parent provides either high or low PA support to the child, the partner is most likely perceived to behave similarly. From the light of the present study, it is thus surprising that the role of partner's or spouse's parenting has been typically ignored in the research literature considering PAP[2,25] and even in the theoretical models aiming at representing a holistic approach to PAP[7]. It should be highlighted that the high congruence in the perceptions of behavior by the participant and his/her partner is a common phenomenon, and has been thought to be because members of couples tend to be actually similar[26] and because we are projecting our own feelings and thoughts in our reflections of other's behavior[27].

However, although PAP should be perceived as a single dimension of a shared parenthood, it likely is a challenge for family-based PA interventions. Given the fact that either mother or father is usually involved in a family PA intervention, there is no knowledge how the perceptions of PAP by the uninvolved partner influence the effectiveness of intervention. It may be that in order to promote PAP, both parents should be involved in the behavior change process. Additionally, more research on the role of the partner's parenting practices is needed because perceptions of PAP likely differ more substantially between the parent and the partner if both evaluate such practices from their own perspectives. Interestingly, the magnitude of the association between a respondent's PAP and his or her partner's PAP was similar among both fathers and mothers (data not shown).

The results of the present study support previous findings regarding the significant associations between PAP and child age, PA and PA enjoyment and the parent's own PA habits.[15] However, the novel finding of the present study suggests that child temperament, which is understood as a relatively stable and sometimes even innate characteristic[22], influences PAP. The results suggest that the frequency of PA support the child receives from his or her parents is influenced by the child's temperament. In other words, how the child reacts to daily issues such as social situations, emotions, activity, and food, as well as how the child can focus and self-soothe. The influence of temperament is considerable. For instance, parents of a child scoring low on the temperament scale participated rarely together in PA and gave less frequently support for their child's PA. It may be that the parents of children with more demanding temperament characteristics are under pressure to use more controlling parenting practices and are thus unable to provide support for PA because they must attend to other things. If so, a challenging temperament may be a risk factor regarding the child's PA. This conclusion is indirectly supported by a relatively limited but consistent literature indicating that parenting practices that are high in control and demandingness are negatively associated with the amount and enjoyment of PA in children.[28–30] Additionally, the combination of demanding temperament in childhood, low parental education level and demanding and controlling parenting pattern is shown to predict obesity trajectories in girls between 2 and 6 years of age.[31] Overall, although there is some evidence supporting the notion that a child's temperament influences PAP, further studies, preferably longitudinal

studies, are needed to confirm the causal relationship between a child's temperament and PAP.

The present study suggests that firstborns tend to receive the highest parental support in terms of PA while, later siblings are less supported. A recent study showed that parents may perceive "Having more than one child", "Helping older family members", and "Evening meetings for parents" as barriers to co-participation in PA with their 6–14-year-old children.[32] It is likely that parents with multiple children have approximately the same quantity of family time but must share it among all their children and other duties. This may result in, for example, lower co-participation in PA with an individual child. However, the significance of birth order may be marginal because the difference between the firstborn and the second-born corresponded to 0.2 incidences of PAP per week.

The main limitation of this study relates to the fact that it is based mainly on parents' self-reports. Essentially, PAP represents the perceptions of the parents and is not based on objective measures, such as observations. However, observations are not feasible in population-level studies. Importantly, parent-perceived PAP is shown to be a consistent correlate of children's PA,[2] and this supports the notion that such self-reports are practically relevant. However, test-retest reliability of the PAP measure was not examined in the current study and it limits the generalization of the findings. Additionally, Cronbach's alpha of the three PAP items was found to be relatively low (< 0.6). As a result, the study results are impeded by low reliability. However, it is well-known that Cronbach's alpha tend to be underestimated when very few items are used and, therefore, it can argued that the Cronbach's alpha of the PAP items is acceptable[33]. Perceptions of one's partner's PAP should be interpreted with caution because they may be largely biased and may greatly differ from the partner's own perceptions of his or her PAP. A considerably high percentage of the respondents had a higher education degree (60.2%), and the results may not therefore represent the reality in families with poor educational backgrounds. Lastly, it should be noted that cross-sectional study setting makes it impossible to identify causal relationships between PAP and all the investigated factors.

Because this, was to the authors' knowledge, the first study to examine the correlates of PAP from an ecological systems theory perspective, there likely exist factors that were not included but are associated with PAP. For instance, siblings have been shown to play an important role in children's PA[20], and this family-level factor could be an additional predictor of PAP. The influence of nonstandard work schedules among parents has been associated with worsened family functioning,[17] and in future studies, families' heterogeneous life situations should be taken into account in the context of PAP. In addition, the overall number of hours spent in childcare and children's behavioral problems may influence PAP, and these issues should be investigated in future studies. On the other hand, the strengths of the study include geographically representative random sampling, sufficient overall sample size, a relatively large sample size for fathers and appropriate statistical analysis that takes clustering effects into account. Fathers usually represent a marginal subgroup of respondents in studies on parenting,[34] and it is likely that the smaller sample size for fathers is, the more likely it is that the fathers included are a select group and not representative of fathers in general.

Perspectives

The current study suggests that physical activity parenting (PAP) on the part of both parents and a range of child and family factors associated with PAP should be taken into consideration when designing interventions to enhance parental support for children's PA. On the other hand, majority of the variability in PAP remained unidentified, a fact which should be addressed in the forthcoming studies. A careful consideration of the partner's parenting practices may be especially important when intervening in families with low PAP. This is because PAP seems to be perceived as a highly shared dimension of parenthood and any positive influences on PAP brought about by an intervention for a participating parent may be counteracted by an uninvolved and unmotivated partner. Based on the identified correlates of PAP, a child's temperament, age and birth order can be interpreted as determining the level of PAP, but not vice versa. Regarding the other identified correlates of PAP, longitudinal studies are needed to determine the direction of causality.

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Table 1. Descriptive and scale information on the physical activity parenting measure

Respondent	*N*	Min	Max	Mean (95 % CI)	SD	Corrected item-total correlation	Cronbach's alpha
Mother							
Mean of physical activity-related parenting practices*	865	0.17	7	3.19 (3.09 - 3.29)	1.52		0.55
Co-participation in physical activity with the child	865	0	7	3.35 (3.20 - 3.49)	2.14	0.384	
Direct support for child's physical activity*	851	0	7	1.88 (1.77 - 1.99)	1.67	0.282	
Praise for the child due to physical activity	859	0	7	4.31 (4.15 - 4.46)	2.32	0.450	
Father							
Mean of physical activity-related parenting practices	128	0.5	7	3.54 (.3.24 - 3.84)	1.71		0.61
Co-participation in physical activity with the child	128	0.5	7	3.57 (3.16 - 3.97)	2.30	0.316	
Direct support for child's physical activity	125	0	7	2.46 (2.08 - 2.84)	2.16	0.417	
Praise for the child due to physical activity	127	0	7	4.57 (4.15 - 4.99)	2.37	0.549	
All							
Mean of physical	993	0.17	7	3.23	1.55		0.57

	activity-related parenting practices				(3.14 - 3.33)			
		Co-participation in physical activity with the child	993	0	7	3.37 (3.24 - 3.51)	2.16	0.372	
		Direct support for child's physical activity	976	0	7	1.95 (1.84 - 2.06)	1.75	0.306	
		Praise for the child due to physical activity	986	0	7	4.34 (4.20 - 4.49)	2.33	0.465	

Response scale ranging from 0 (never) to 7 (daily).

* Statistically significant difference between mothers and fathers at the level of $p < .05$

Table 2. Descriptive statistics for child-related, family-related and environmental factors

		Units of analysis		*N*	Min	Max	Mean	Median	SD
Child factors									
	Sex	N	Girls *n* = 488 (49.1 %;) Boys *n* = 505 (50.86 %)	993					
	Age	Years		993	2.50	7.75	5.40	5.50	1.14
	BMI SDS	Standard deviation score		985	-4.55	3.45	0.18	0.17	1.06
	Outdoor time≠	Possible range 0-7		993	1	7	5.10	5	1.18
	Organized physical activity or sports	Mins/wk		949	0	421	48.45	41	64.65
	Sedentary time	Mins/d		972	15	405	85.20	75	48.38
	Media time≠	Possible range 0-10		989	0	9	5.05	5	1.40
	Physical activity enjoyment≠	Possible range 0-4		992	1	4	3.63	4	0.56
	Fundamental motor skills≠	Possible range 0-100		940	4	88	52.21	54	15.27
	Movement skills compared to peers	Possible range 1-3		983	1	3	2,13	2	0.49
	Physical activity and sport facility use	Total of physical activity and sport facility use		991	2	37	21.74	22	4.16
	Temperament	Possible		968	0	71	39.17	39	10.08

		range 0-90							
Family factors									
	Respondent's sex	N	Mother *n* = 865 (87.1 %); Father *n* = 128 (12.9 %)	993					
	Respondent's age*	Years		989	21	54	35.8	35	5.29
	Respondent's education	Possible range 1-4	University or polytechnic 60.2 %	991	1	4	2.84	3	0.881
	Family income level (annual)	Possible range 1-8	< 40 000 € 24.5 %; 40 000 – 99 999 € 60.5 %; > 99 999 € 15 %	903	1	8	4.34	4	1.47
	Family status	Possible range 1-2	Nuclear family 78 %; Other 22 %	987					
	Respondent's exercise frequency	Possible range 0-4		937	0	4	2.71	3	1.03
	Partner's exercise frequency	Possible range 0-4		863	1	4	2.62	3	1.07
	Partner's physical activity parenting*	Possible range 0-7		873	0	7	2.89	2.5	1.72
	Number of children in the family	Number		987	1	8	2.29	2	0.99
	Child's birth order	Possible range 1-3		954	1	3	1.75	2	0.76

Environmental factors								
Residential density	Possible range 1-4		993	1	4	2.31	2	0.97
Access to sport and outdoor facilities	Total of accessible facilities		991	1	15	10.48	11	1.39
Type of the living house	Possible range 1-3		991	1	3	2.26	3	0.87
Access to electronic devices≠	Total of accessible electronic devices		972	0	5	0.55	0	0.92

Residential density = 1) metropolitan area, 2) city, 3) rural area or 4) countryside; access to sport and outdoor facilities = list of ten physical activity and sport facilities and an open space for facilities not listed; type of house = 1) blocks of flats, 2) terraced house or 3) detached house; access to electronic devices = list of TV, game console, computer, smartphone, tablet, Ipad or other smart device and an open space for devices not listed

* Statistically significant difference between mothers and fathers at the level of $p < .05$

≠ Statistically significant difference between girls and boys at the level of $p < .05$

Table 3. Child-, family- and environment-specific factors associated with physical activity parenting

Variables	MODEL 1 (*n* = 621)		MODEL 2 (*n* = 781)	
	Standardized *B* (95 % CI)	*P*	Standardized *B* (95 % CI)	*P*
CHILD FACTORS				
Sex	-0.04 (-0.08 - 0.01)	0.095		
Age (years)	-0.1 (-0.17 - -0.04)	**0.002**	-0.1 (-0.14 - -0.06)	**0.000**
BMI SDS	0 (-0.04 - 0.05)	0.876		
Outdoor time	0.1 (0.05 - 0.15)	**0.000**	0.1 (0.06 - 0.14)	**0.000**
Organised physical activity or sports participation rate	0.04 (0 - 0.09)	0.078		
Sedentary time	0 (-0.05 - 0.05)	0.988		
Media time	-0.02 (-0.07 - 0.02)	0.327		
Movement skills compared to peers	-0.02 (-0.06 - 0.03)	0.416		
Physical activity enjoyment	0.04 (-0.01 - 0.08)	0.098	0.04 (0 - 0.09)	**0.035**
Fundamental motor skills	0 (-0.06 - 0.07)	0.928		
Physical activity and sport facility use	0.04 (-0.03 - 0.1)	0.245	0.06 (0.01 - 0.1)	**0.015**
Temperament	0.07 (0.02 - 0.12)	**0.003**	0.08 (0.04 - 0.12)	**0.000**
FAMILY FACTORS				
Respondent's sex	-0.02 (-0.06 - 0.03)	0.516		
Respondent's age	0.02 (-0.04 - 0.07)	0.562		
Respondent's education	-0.02 (-0.08 - 0.03)	0.399	-0.03 (-0.08 - 0.01)	0.107
Family income level	-0.01 (-0.07 - 0.05)	0.759		
Family status	-0.06 (-0.3 - 0.19)	0.636		

Respondent's exercise frequency	0.14 (0.09 - 0.19)	**0.000**	0.13 (0.09 - 0.17)	**0.000**
Partner's exercise frequency	-0.03 (-0.08 - 0.02)	0.218		
Partner's physical activity parenting	0.7 (0.65 - 0.76)	**0.000**	0.68 (0.64 - 0.73)	**0.000**
Child's birth order	-0.08 (-0.13 - - 0.04)	**0.000**	-0.1 (-0.14 - - 0.06)	**0.000**
ENVIRONMENTAL FACTORS				
Residential density	0.01 (-0.05 - 0.06)	0.773		
Access to physical activity and sport facilities	0.02 (-0.04 - 0.08)	0.569		
Type of house	-0.01 (-0.06 - 0.04)	0.689		
Access to electronic devices	-0.03 (-0.07 - 0.02)	0.294		

R^2 = .015, child-level variability; R^2 = .052, family-level variability. Statistically significant values are shown in bold.