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REGULAR ARTICLE

Cultivation and Enabling Effects of Social Support and Self-Efficacy in Parent–Child Dyads

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Abstract

Background There are two alternative mechanisms, elucidating the reciprocal relationship between self-efficacy and social support when explaining health outcomes: self-efficacy beliefs may operate as the establisher of social support (*the cultivation model*) or social support may enable the formation of self-efficacy beliefs (*the enabling model*).

Purpose In line with the cultivation hypothesis, it was tested if self-efficacy (measured in parents and children) would indirectly predict parental and child moderate-to-vigorous physical activity (MVPA), via the mediator, social support (parent-provided, child-received). In line with the enabling hypothesis, it was tested if social support would predict MVPA indirectly, via the mediator, self-efficacy.

Methods A total of 879 parent–child dyads (1758 individuals; 52.4% girls, aged 5–11 years old, 83.2% mothers) provided self-reports at the baseline (T1) and the 7- to 8-month follow-up (T2). Body weight and height were measured objectively. Manifest path analyses were performed, controlling for the baseline levels of the mediator and dependent variables.

Results A similar number of significant simple indirect effects was found for the cultivation and the enabling model. Across the models, the indirect effects followed similar patterns: (a) within-individual indirect effects in children; (b) across-individual indirect effects, with the independent variable measured in children and the mediator/dependent variables measured in parents (e.g., child self-efficacy predicted parental support provision and, indirectly, parental MVPA); (c) across-individual indirect effects, accounting for self-efficacy and MVPA measured in children, combined with parental reports of social support.

Conclusions The findings provide support for both cultivation and enabling models in the context of MVPA among parent–child dyads.

Keywords: Social support · Self-efficacy · Dyads · Physical activity · Parent · Child

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Background

Children aged 5–17 years old should engage in ≥60 min of moderate-to-vigorous intensity physical activity (MVPA) daily whereas adults should perform ≥150 min of physical activity (PA) of at least moderate intensity or at least 75 min of vigorous PA per week [1]. MVPA is related to several favorable health and behavioral outcomes measured among children and adults, such as lower rates of obesity, better physical fitness, cardiovascular health, and musculoskeletal health [2, 3]. According to population surveys only 2.0%–14.7% of girls and 9.5%–34.1% of boys aged 2–11 in Europe [4] and about 24% of 6- to 17-year-olds in the USA meet the MVPA recommendations [5]. In high-income countries (including high-income European countries such as France or Germany; the USA; Canada; high-income Asian countries such as Japan), the prevalence of physical inactivity among adults has grown from 31.6% in 2001 to 37.2% in 2016 [6]. Efforts to increase MVPA levels may include identifying modifiable psycho-social determinants or mechanisms that explain changes in MVPA in children and adults [7]. Such determinants may include social support and self-efficacy as their key role in health behavior change is well theoretically and empirically established [8, 9].

Social cognitive theory (SCT; [10]) has been broadly used to describe and examine the interpersonal influences on behavior change, such as parent–child interaction, when predicting child PA. Also according to socio-ecological models of PA and nutrition [11, 12], environmental factors such as school, local community, or policy characteristics operate together with parental factors or practices (e.g., social support provision) in predicting child health behavior, including PA. A review of 19 studies confirmed a strong positive association between parental support for PA and child PA [8]. However, 16 out of 19 studies that examined the parental support—child PA relationship had a cross-sectional design. Edwardson and Gorely [13] systematically reviewed 96 cross-sectional and longitudinal studies, conducted among children (aged 6–11) and adolescents (aged 12–18). Results showed that parental influence on PA (such as support for PA) has especially strong effects on PA of younger children; however, this association was based on cross-sectional findings (11 longitudinal studies produced mixed findings) only. A meta-analysis of 112 studies (94 of 115 included samples were cross-sectional) yielded that the relationship between overall parental support and child PA was of moderate size (r = .38) and the effect sizes for various support behaviors (such as praise, encouragement, and transportation) ranged between r of .15 and .34 [14]. However, child age group (2–5.4 vs. 5.5–12.4 vs. 12.5–19 years old) did not moderate the parental support behaviors—child PA association. In summary, although the associations are well established, particularly in younger children, the evidence is limited due to the cross-sectional character of a vast majority of existing studies.

One of the possible mechanisms underlying the parental influence and child PA association may include the formation of child self-efficacy beliefs. According to the youth PA model [15], parental factors may predict child PA indirectly, through child self-competence beliefs [16]. For example, supporting child PA such as facilitating access to places where children can be active may operate through child self-perceptions, such as perceived ability or self-efficacy to be active [15] and in turn explains child PA. Such perceptions of ability or competence to tackle challenges, also known as self-efficacy beliefs, are the central determinants of behavior change in SCT [10].

According to one of the SCT developments [17], self-efficacy may operate directly or indirectly in evoking behavior change. Similarly, facilitating factors such as social support are considered to operate directly, and indirectly, through self-efficacy [17]. There are two proposed alternative mechanisms explaining the reciprocal relationship between self-efficacy and social support when explaining health outcomes [18, 19]. First, self-efficacy beliefs may operate as the establisher of social support (*the cultivation hypothesis*). For instance, a highly self-efficacious child might be more effective in eliciting support for PA from parents when facing challenging demands. Second, the reverse pathway assumes that social support enables the formation of self-efficacy through encouragement, facilitating the belief that one is capable of making the change (*the enabling hypothesis*). For example, parental support provision for child PA (e.g., a parent assures their child that they can learn new sports even if it is difficult or tiring) enables the formulation of child self-efficacy toward PA [18, 19]. It is also possible that parental provision of social support to children may enhance parental self-efficacy. For instance, the provision of PA support by parents to their children (e.g., encouraging a child to be as physically active as a parent) may remind parents of their own mastery experiences (being physically active), which in turn may foster parental self-efficacy.

Only few studies tested the enabling and cultivation hypotheses in longitudinal settings, with findings supporting either the cultivation [20, 21] or the enabling hypothesis [22, 23]. The effects were tested among diverse populations and health outcomes, such as pelvic-floor exercise among prostate cancer patients [20] or posttraumatic growth among health care workers [23]. To date, research investigating the enabling and cultivation hypotheses focused on adults. In contrast, numerous studies showed direct links between social support, self-efficacy, and PA levels in adults and children, as well as in parent–child dyads [24–27]. Therefore, our study will investigate if the cultivation and enabling effects could be observed in parents and their 5- to 11-year-old children, accounting for parental and children beliefs, support perceptions, and MVPA.

Previous research using the same data as the present study showed that parental and child perceptions of transportation support provision and receipt may have different effects on child health outcomes [24]. For instance, parental perceptions of transport provision explained child body mass indirectly, with child PA operating as the mediator, whereas there was no effect of child perceptions of transport provision on child PA or body mass [24]. It is unclear, however, how more complex indicators of parental support provision (e.g., accounting for emotional and practical support) would relate to child and parental MVPA, and how these indicators may be linked with parental and child self-efficacy beliefs. Furthermore, most of the studies which investigated associations between parental support or self-efficacy and child PA in dyads analyzed child or parental perceptions only [25–27]. Addressing these gaps in research, this study will account for both child and parent self-efficacy reports, parental reports of support provision and child reports of support receipt.

The original enabling and cultivation hypotheses [18, 19] focused on perceived support or social support receipt as the factor which fosters self-efficacy or results from strong self-efficacy beliefs. However, in the context of parent–child dyads, it may be assumed that provision of social support by a parent to a child may play a similar role (enhancing parental self-efficacy about their own ability to exercise; being prompted by parental self-efficacy about their own PA). In contrast, a parent who receives support from a 5- to 11-year-old child may interpret such act as a proof of a lack of capability to deal with barriers at a level expected from an adult, which in turn may negatively affect parental self-efficacy. Prior research, conducted in heterosexual couples (adult–adult dyads), has shown that support provision may be dependent on providers' self-efficacy regarding the target behavior [21]. Surprisingly, little is known about the role of providers' self-efficacy in terms of their capability to provide support [28, 29]. Likewise, providing support was shown to be linked with higher behavior-specific self-efficacy in providers [30]. On the other hand, provision of support to close others was repeatedly shown to be associated with beneficial effects on provider's health-related behaviors [31].

The Study Aims

This prospective study investigated the cultivation and enabling hypotheses [18, 19] in the dyadic context of parents supporting their 5- to 11-year-old children and child/parental MVPA. In line with the cultivation hypothesis, it was tested whether self-efficacy beliefs (parental self-efficacy for PA, child self-efficacy for PA, measured at Time 1 [T1]) predicted MVPA (measured at Time 2 [T2] in parents and children) indirectly, via the mediators, that is, parental support provision and child support receipt (measured at T2). In line with the enabling hypothesis, it was tested whether social support (parental support provision and child support receipt, measured at T1) indirectly predicted MVPA (T2; measured in parents and children), via the mediators, parental and child self-efficacy (T2).

It was hypothesized that the indirect (mediated) effects of the respective independent variables (two types of social support for the cultivation hypothesis; two types of self-efficacy for the enabling hypothesis) may occur in an across-individual (e.g., parental self-efficacy may predict child support receipt, and, in turn, parental MVPA) or in a within-individual manner (e.g., child self-efficacy may predict child support receipt and, in turn, child MVPA). The hypothesized associations were tested with independent variables and mediators (self-efficacy and social support indicators) measured in a way that is PA-specific. In particular, the hypothesized enabling and cultivation models included beliefs about the ability to engage in MVPA (parents, children), parental support provision, child support receipt, and parental and child MVPA.

Methods

Participants

Parent–child dyads were invited to participate in the study. Parents (99.6%) or legal guardians (0.4%) who were the main caregivers regarding the time spent with their child and co-organizing child PA. Children with physical impairments leading to major movement disabilities (e.g., cerebral palsy) were excluded. No additional exclusion criteria were applied. Data were collected as a part of a larger study testing parental and child psycho-social determinants of body mass [24, 32–34].

At T1 (the baseline), 879 dyads (1,758 individuals) participated in the study. Parents (N = 879) were women (83.2%) and men (16.8%), aged between 24 and 68 years old (M = 36.65, SD = 6.10), with body mass index (BMI) ranging from 16.14 to 41.61 (M = 24.43, SD = 3.94). The majority (60.1%) had normal body weight, 29.1% were overweight, 8.9% were obese, and 1.9% were underweight. The majority of parents had either higher education (39.8%) or secondary education (28.9%), whereas the rest declared vocational (14.4%), post-secondary (11.9%), or primary education (5.0%). More than a half of the parents (56.1%) evaluated that their perceived economic status was similar to the economic status of the average family in Poland, the remainder indicated their economic status to be slightly better (24.8%), better (7.7%), slightly worse (8.1%), or worse (3.3%). Children (N = 879) were girls (52.4%) and boys (47.6%), aged between 5 and 11 years old (M = 8.46, SD = 1.34). Children aged 5 years old constituted 0.7% of the children sample, 9.8% were 6 years old, whereas the majority was 7- to 11-years-old children (89.5%). Accounting for the International Obesity Task Force (IOTF) cutoff points [35], 67.9% of children had normal body weight, 17.7% were overweight, 7.3% were obese, and 7.1% were underweight. All parent and child participants were Caucasian (as 98% of Poland's population) [36].

At T2 (the 7- to 8-month follow-up), 603 dyads (1,206 individuals) agreed to participate. The full information maximum likelihood (FIML) procedure was used to account for data missing due to the longitudinal dropout at T2; thus, data collected from 879 dyads (1,758 individuals) were included in the analyses.

Procedure

Data were collected twice, at the baseline (T1) and the 7- to 8-month follow-up (T2), as a part of a larger study [24, 32–34]. Potential participants were approached between 2011 and 2015 in schools and general practitioners' offices in six regions of Poland. Two schools (out of 27 approached) and two practitioners' offices (out of 12 approached) did not agree to contribute to the collection of data. The study was advertised during group meetings for teachers and parents, during school classes, and in the waiting rooms of general practitioners' offices. Those who were interested in participation familiarized themselves with the study aims and procedures and approached the research team to indicate their willingness to take part. Next, they were informed about the study details and the research schedule. Informed consent was collected from parents (about their own and child participation) and children provided their assent. De-identified codes were used to ensure anonymity across the measurement points. Younger children (aged 5–8) were interviewed using a structured interview schedule. Older children (aged 9–11) and parents completed a questionnaire unless they preferred being interviewed. Parents and children completed the questionnaires separately.

A qualitative pilot study including 18 children (aged 5–11 years old) was conducted before the data collection to check the comprehension of the items of the measures used in the study. Children were asked to explain the instructions and items in their own words and to indicate any phrases that they did not understand. The pilot study indicated that, using provided instructions and items, children were able to correctly classify their behaviors referring to moderate and vigorous PA, as well as assess parental support receipt and their own self-efficacy. Additionally, in all cases, interviewers asked children to signal when they were not sure if they understood the words used by the interviewer. In cases children signaled a lack of clarity, the interviewer discussed the item with the child.

At T1, children answered questions about their own self-efficacy, support receipt, and MVPA, while parents provided data on their own self-efficacy, support provision, MVPA, education, and perceived economic status. Participants' body weight and height were measured with certified scales and rods. At T2, study personnel revisited the data collection locations after contacting parents by phone to repeat the measurements.

The study was approved by Internal Review Board at the SWPS University of Social Sciences and Humanities, Wroclaw, Poland. All procedures were in accordance with the ethical standards of the institutional research ethics committee and in line with the 1964 Helsinki declaration and its later amendments.

Materials

Means, standard deviations, and reliability coefficients for all measures are presented in Supplementary Table S1. The questionnaires were translated from English to Polish by two translators separately and then compared to produce a consensus questionnaire [37].

Social Support Provision and Receipt (T1 and T2)

Perceived parental provision of PA support (henceforth parental support provision) and perceived child receipt of PA support (henceforth child support receipt) were measured with five items each (based on Ref. [13]). Parents were asked about different types of support (encouragement, transport, organization, and supervision) they can provide for their child to be more physically active, for example, "I encourage my child to play sports or be physically active." Children were asked about the support they get from their parents, for example, "My parents encourage me to play sports or be physically active." The responses ranged from 1 (*definitely not*) to 4 (*definitely yes*). The higher total scores represent the higher parental support provision or child support receipt. The mean levels of parental support provision were $M = 15.57$, $SD = 3.35$ at T1, and $M = 15.82$, $SD = 3.10$ at T2. The average levels of child support receipt were $M = 14.41$, $SD = 3.75$ at T1, and $M = 14.71$, $SD = 3.37$ at T2.

Self-efficacy (T1 and T2)

Two types of self-efficacy were measured with three items each. Parental self-efficacy for PA (henceforth parental self-efficacy) and child self-efficacy for PA (henceforth child self-efficacy) were based on the Multidimensional Self-Efficacy for Exercise Scale (MSES; [38]). When assessing both parental and child self-efficacy for PA, participants were asked how confident are they that they are able to: "exercise (so that I am sweating and my heart beats faster) each day for at least 30 minutes," "exercise when you feel you have too much work/homework to do," and "exercise when you are too tired." The responses ranged from 1 (*not confident at all*) to 4 (*completely confident*). The higher total scores represent stronger parental or child self-efficacy. Mean levels of parental self-efficacy were *M* = 7.54, *SD* = 2.24 at T1, and *M* = 7.45, *SD* = 1.93 at T2. The mean levels of child self-efficacy were *M* = 8.38, *SD* = 2.12 at T1, and *M* = 8.58, *SD* = 1.91 at T2.

Moderate-to-Vigorous PA (T1 and T2)

Parental and child MVPA levels were assessed by the Godin Leisure-Time Exercise Questionnaire [39] that was found to have acceptable validity and reliability among adults [39] and 7- to 15-year-olds [40]. Originally, the measure includes three items; one item referring to light-intensity PA was excluded in the present study. Participants were asked to provide an open-ended response about the daily number of any "vigorous (heart beats faster, you are sweating) physical activity sessions lasting at least 15 minutes," and "moderate (not so exhausting) physical activity sessions lasting at least 15 minutes" during last week. Verbal instructions at the beginning of the interview (or filling out the questionnaire) were provided to clarify the differences between moderate and vigorous PA, with a reference to heart beating, sweating, and ability to talk while exercising. This was followed by examples of moderate-intensity PA and vigorous-intensity PA. The MVPA index (accounted for PA bouts [15 min] and the metabolic values of PA per week) was calculated using the following formula: MVPA score = 9 × (vigorous bouts per week) + 5 × (moderate bouts per week) [39]. The average levels of parental MVPA were *M* = 21.95, *SD* = 19.32 (T1), and *M* = 22.13, *SD* = 16.96 (T2). The mean levels of child MVPA were *M* = 44.64, *SD* = 27.36 (T1), and *M* = 46.49, *SD* = 25.11 (T2).

Body Weight and Height (T1 and T2)

Parental and child body weight and height were assessed objectively with standard medically approved telescopic height measuring rods and floor scales (scale type: BF-100 or BF-25; Beurer, Germany, measurement error <5%). For parents, BMI was calculated using body weight and height: BMI = weight (kg)/height^2 (m^2). For children, age- and gender-specific BMI *z*-score values were calculated with WHO AnthroPlus [41]. The average levels of parental BMI were *M* = 24.44, *SD* = 3.91 at T1, and *M* = 24.45, *SD* = 3.95 at T2. The average levels of child BMI *z*-score were *M* = 0.44, *SD* = 1.24 at T1, and *M* = 0.30, *SD* = 1.24 at T2.

At T1, parental education and economic status were additionally assessed. Perceived economic status was assessed with one item, "Comparing to the average economic situation of families in the country, how would you rate the economic situation of your family," with responses ranging from 1 (*much below the average*) to 5 (*much above the average*). Parental education was measured with a 5-point scale (primary, uncompleted secondary/vocational, secondary, ≤3 years of higher education, ≥4 years of higher education).

Data Analysis

The G*Power calculator [42] (simulating a multiple regression model) was used to determine the sample size. Previous dyadic research testing cultivation and enabling hypotheses yielded small effects [20, 21]. Assuming small effect sizes (f^2 values between 0.020 and 0.025), power of 0.80, Type I error rate of 0.05, and accounting for potential confounders (listed below), the determined sample size was between 800 and 1,000 dyads. Analyses were performed using SPSS version 24 and IBM AMOS 25. Path analyses with maximum likelihood estimation were conducted [43]. The hypothesized tested models accounted for the two measurement points only; therefore, they represented a so-called half-longitudinal design [44]. The mediation effects of the half-longitudinal design [44] were obtained by controlling the effects of the T1 version of the mediator on the T2 mediator and the effects of the T1 version of the dependent variable on the T2-dependent variable. Several model-data fit indices were applied. The cutoff point of ≤0.08 for the root mean square error of approximation (RMSEA) was used [43]. The cutoff point ≥0.95, indicating good model-data fit, was applied for the comparative fit index (CFI), Tucker-Lewis index (TLI), and the normed fit index (NFI) [43]. The indirect effects were evaluated with their unstandardized effect coefficients, after applying 10,000 bootstraps (95% CI).

Missing data (including data missing due to dropouts at T2) were accounted for by using a FIML procedure [43]. Little's MCAR test indicated that the missing data patterns were systematic, Little's $\chi^2(1{,}405) = 1{,}570.57$, $p < .001$. Mardia's coefficient of multivariate normality indicated moderate non-normality (44.71 for the cultivation model; 49.78 for the enabling model).

The Cultivation Hypothesis Model

The cultivation model assumed that the independent variables, the two types of self-efficacy (T1; parental, child) would predict the mediators, support provision, and receipt (T2; parent, child), which in turn would predict parental and child MVPA (T2). In line with the Actor–Partner Interdependence Model with Mediators [45], the model was fully saturated in terms of the associations between the independent, mediator, and dependent variables and their respective covariances (e.g., the residuals of the parental and child

MVPA were assumed to covary). However, not all control variables included in the model were assumed to covary (e.g., parental age and gender were not assumed to covary).

Several indirect effects were tested: (a) assuming within-individual effects, with the independent, mediator, and dependent variables measured in one person; (b) assuming across-individual effects, with at least one variable in the chain of "the independent variable → the mediator → the dependent variable" measured in one person and at least one variable in this chain measured in the other person. In line with Lederman *et al.*'s [45] proposal for the actor–partner interdependence model with mediators, the total effects, total indirect effects, simple indirect effects, and direct effects were calculated, assuming that the analyzed dyads are distinguishable in the present study. These effects were calculated using the user-defined estimands function in AMOS 25 [46].

The following covariates were accounted for: T1 indicators of the proposed mediators, the T1 indicators of the proposed dependent variables, parental and child age and gender (T1), child BMI *z*-score (T1 and T2), parental BMI (T1 and T2). All parental and child cognitions, as well as MVPA measured at T1, were assumed to covary, as suggested by the actor–partner interdependence model [47]. The residuals of the mediators were also assumed to covary, as were the residuals of the outcomes. Covariances for the cultivation hypothesis model are presented in Supplementary Table S2.

Additional analyses for the fully saturated model were performed (accounting for covariances between the independent, outcome, and mediator variables, as well as between all covariates; see Supplementary Tables S7, S9, and S10). Finally, sensitivity analyses were conducted to assess the robustness of the findings [48]. It was tested whether the pattern of the associations is similar in the hypothesized model compared to the model controlling for parental education and economic status (T1).

The Enabling Hypothesis Model

The enabling model assumed that support provision and receipt (T1; parent, child) would predict self-efficacy variables (i.e., the mediators; T2; parent, child), which in turn would predict MVPA (T2; parent, child). In line with the actor–partner interdependence model with mediators [45], the model was fully saturated (similar assumptions were made as those included in the cultivation hypothesis model). The model accounted for the T1 indicators of the proposed mediators, the T1 indicators of the proposed dependent variables, parental and child age (T1), parental and child gender, child BMI *z*-score (T1 and T2), parental BMI (T1 and T2). All parental and child cognitions, as well as MVPA measured at T1, were assumed to covary. The residuals of the mediators were also assumed to covary, as were the residuals of the outcomes. Covariances for the enabling hypothesis model are presented in Supplementary Table S3. Additional analyses for the fully saturated model were performed (see Supplementary Tables S8, S9, and S11). Sensitivity analyses [48] were conducted, controlling for the parental education and economic status (T1).

Results

Preliminary Analyses

Parents who completed T1 and T2 measurements did not differ from dropouts in terms of self-efficacy, support provision, MVPA, BMI, age, education, perceived economic status, all *F*s < 2.31, *p*s > .129, or gender, $\chi^2(1) = 0.94$, $p = .332$. Children who participated at both T1 and T2 measurements did not differ from dropouts in terms of self-efficacy, support receipt, MVPA, BMI *z*-score*, or age, all F*s < 3.37, *p*s > .101, or gender, $\chi^2(1) = 0.69$, $p = .405$. Child dropouts and child completers differed in terms of age, $F(1, 878) = 19.46$, $p < .001$, with child dropouts being older ($M = 8.52$, $SD = 1.51$) than completers ($M = 8.44$, $SD = 1.25$, Cohen's $d = 0.06$ [95% CI: −0.03, 0.15]). MVPA remained unchanged between T1 and T2 among children, $t(1, 878) = 0.33$, $p = .745$, and among parents, $t(1, 878) = 1.81$, $p = .070$. The size of the recruited sample size ($N = 879$) allowed for detecting small effects in the hypothesized models ($f^2 = 0.023$). Bivariate correlations between study variables (for the total sample of $N = 879$ dyads) are presented in Supplementary Table S1.

Findings for the Cultivation Hypothesis Model

The hypothesized model, calculated for $N = 879$ dyads, had a good fit, with $\chi^2(96) = 317.75$, $p < .001$, χ^2/df = 3.310, NFI = 0.961, TLI = 0.956, CFI = 0.973, RMSEA = 0.051 (95% CI: 0.045, 0.058). Direct associations between the independent variables (T1), mediators (T2), and the dependent variables (T2) are presented in Fig. 1 and Supplementary Table S4. The variables in the model explained 18.0% variance of child MVPA (T2) and 41.1% of parental MVPA (T2).

The analysis of the hypothesized cultivation model (Table 1) showed that three (out of eight) simple indirect effects were significant: a within-individual effect, (a) a higher level of child self-efficacy (T1) predicted a higher level of child support receipt (T2), which in turn predicted a higher level of child MVPA (T2); and two across-individual effects, (b) a higher level of child self-efficacy

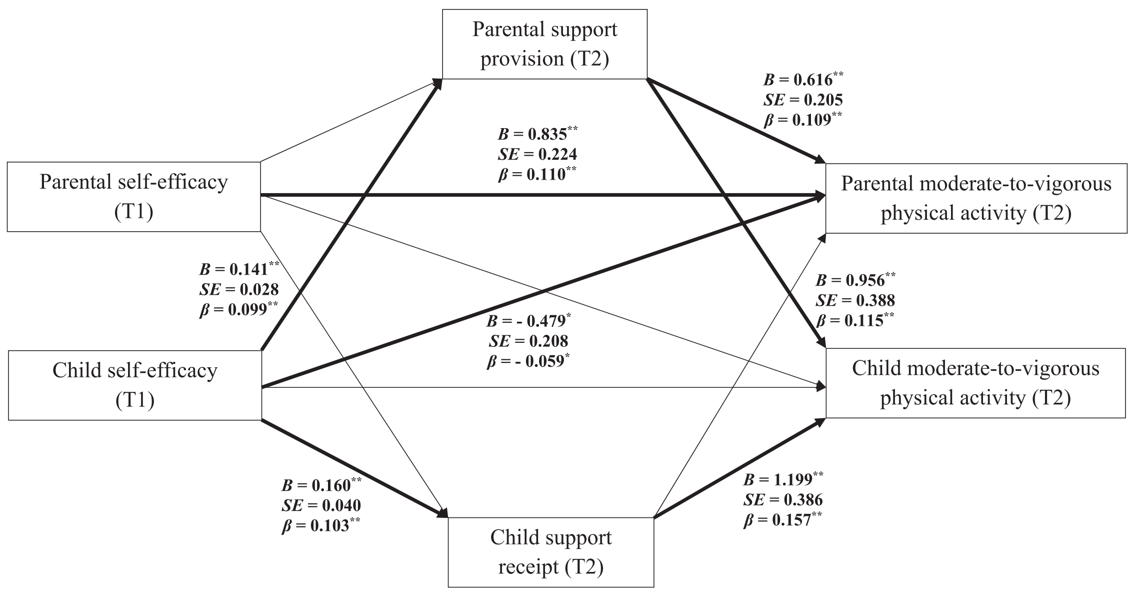

Fig. 1. Associations for the hypothesized cultivation model (N = 879 parent–child dyads). *Note.* ** $p < .01$; * $p < .05$. Only significant effect coefficients (unstandardized, B and standardized, β) are presented along bold arrows. All parental and child predictors and T1 mediators (control variables) were assumed to covary. Residuals of the mediator (T2) were assumed to covary; residuals of the outcome variable, MVPA (T2) were assumed to covary. For clarity, the effects of T1 mediators and T1 dependent variables, as well as the associations between covariates are not displayed. The covariates include: parental and child MVPA at T1, parental and child social support at T1, parental BMI, child BMI z-score, parental and child age and gender. For values of all path, correlation, and covariance coefficients, see Supplementary Table S2.

(T1) predicted a higher level of parental support provision (T2), which in turn predicted a higher level of child MVPA (T2), and (c) a higher level of child self-efficacy (T1) predicted a higher level of parental support provision (T2), which in turn predicted a higher level of parental MVPA (T2).

Sensitivity analysis, accounting for parental education and perceived economic status, indicated a similar pattern of significant simple indirect effects, thus, the robustness of the findings (Supplementary Table S5). Additional analyses, conducted for the fully saturated cultivation model, also yielded a similar pattern of simple indirect effects (see Supplementary Table S10).

Findings for the Enabling Hypothesis Model

The hypothesized model, calculated for N = 879 dyads, presented with a good fit, with $\chi^2(95) = 258.55$, $p < .001$, $\chi^2/df = 2.722$, NFI = 0.966, TLI = 0.965, CFI = 0.978, RMSEA = 0.044 (95% CI [0.038, 0.051]). Direct associations between the independent variables (T1), mediators (T2), and the dependent variables (T2) are reported in Fig. 2 and Supplementary Table S4. The variables in the model explained 19.8% variance of child MVPA (T2) and 41.4% parental MVPA (T2).

The analysis of the hypothesized enabling model (Table 2) indicated that three (out of eight) simple indirect effects were significant: one within-individual effect, (a) a higher level of child support receipt (T1) predicted a higher level of child self-efficacy (T2), which in turn predicted a higher level of child MVPA (T2); and two across-individual effects, (b) a higher level of parental support provision (T1) predicted a higher level of child self-efficacy (T2), which in turn predicted a higher level of child MVPA (T2), and (c) a higher level of child support receipt (T1) predicted a higher level of parental self-efficacy (T2), which in turn predicted a higher level of parental MVPA (T2).

Sensitivity analysis, accounting for parental education and perceived economic status, indicated that the findings were robust: a similar pattern of significant indirect effects was found (Supplementary Table S6). Additional analyses, conducted for the fully saturated enabling model, also yielded a similar pattern of simple indirect effects (see Supplementary Table S11).

Discussion

This study tested two competing hypotheses. In line with the cultivation hypothesis, it was investigated whether self-efficacy beliefs (reported by parents and children) would predict MVPA (measured in parents and children) indirectly, via the mediators, that is, the social support indicators (parental support provision and child support receipt). In line with the enabling hypothesis, it was tested whether social support (reported by parents and children) would indirectly predict MVPA (measured in

Table 1 Indirect, Direct, and Total Effects for the Hypothesized Cultivation Model in the Sample of 879 Parent–Child Dyads

Simple indirect effects, total indirect effect, direct effect, total effect		Estimate	SE	95% BCI	
				Lower	Higher
Simple indirect effects	Self-efficacy (P, T1) → Support (P, T2) → MVPA (P, T2)	−0.027	0.021	−0.081	0.005
	Self-efficacy (P, T1) → Support (Ch, T2) → MVPA (P, T2)	−0.007	0.014	−0.050	0.013
Direct effect	Self-efficacy (P, T1) → MVPA (P, T2)	**0.835**	**0.224**	**0.398**	**1.277**
Total indirect effect	Self-efficacy (P, T1) → Support (P, T2) → MVPA (P, T2) + Self-efficacy (P, T1) → Support (Ch, T2) → MVPA (P, T2)	**0.801**	**0.227**	**0.363**	**1.250**
Total effect	Self-efficacy (P, T1) → Support (P, T2) → MVPA (P, T2) + Self-efficacy (P, T1) → Support (Ch, T2) → MVPA (P, T2) + Self-efficacy (P, T1) → MVPA (P, T2)	−0.034	0.027	−0.097	0.010
Simple indirect effects	Self-efficacy (Ch, T1) → Support (Ch, T2) → MVPA (Ch, T2)	**0.192**	**0.082**	**0.061**	**0.388**
	Self-efficacy (Ch, T1) → Support (P, T2) → MVPA (Ch, T2)	**0.134**	**0.062**	**0.034**	**0.281**
Direct effect	Self-efficacy (Ch, T1) → MVPA (Ch, T2)	0.723	0.401	−0.055	1.530
Total indirect effect	Self-efficacy (Ch, T1) → Support (Ch, T2) → MVPA (Ch, T2) + Self-efficacy (Ch, T1) → Support (P, T2) → MVPA (Ch, T2)	**1.049**	**0.396**	**0.271**	**1.841**
Total effect	Self-efficacy (Ch, T1) → Support (Ch, T2) → MVPA (Ch, T2) + Self-efficacy (Ch, T1) → Support (P, T2) → MVPA (Ch, T2) + Self-efficacy (Ch, T1) → MVPA (Ch, T2)	**0.326**	**0.078**	**0.195**	**0.506**
Simple indirect effects	Self-efficacy (Ch, T1) → Support (Ch, T2) → MVPA (P, T2)	−0.018	0.034	−0.092	0.044
	Self-efficacy (Ch, T1) → Support (P, T2) → MVPA (P, T2)	**0.087**	**0.034**	**0.032**	**0.166**
Direct effect	Self-efficacy (Ch, T1) → MVPA (P, T2)	**−0.479**	**0.208**	**−0.894**	**−0.082**
Total indirect effect	Self-efficacy (Ch, T1) → Support (Ch, T2) → MVPA (P, T2) + Self-efficacy (Ch, T1) → Support (P, T2) → MVPA (P, T2)	**−0.410**	**0.202**	**−0.814**	**−0.027**
Total effect	Self-efficacy (Ch, T1) → Support (Ch, T2) → MVPA (P, T2) + Self-efficacy (Ch, T1) → Support (P, T2) → MVPA (P, T2) + Self-efficacy (Ch, T1) → MVPA (P, T2)	**0.069**	**0.032**	**0.010**	**0.136**
Simple indirect effects	Self-efficacy (P, T1) → Support (P, T2) → MVPA (Ch, T2)	−0.420	0.033	−0.132	0.005
	Self-efficacy (P, T1) → Support (Ch, T2) → MVPA (Ch, T2)	0.069	0.049	−0.001	0.200
Direct effect	Self-efficacy (P, T1) → MVPA (Ch, T2)	0.611	0.385	−0.094	1.412
Total indirect effect	Self-efficacy (P, T1) → Support (P, T2) → MVPA (Ch, T2) + Self-efficacy (P, T1) → Support (Ch, T2) → MVPA (Ch, T2)	0.639	0.388	−0.069	1.446
Total effect	Self-efficacy (P, T1) → Support (P, T2) → MVPA (Ch, T2) + Self-efficacy (P, T1) → Support (Ch, T2) → MVPA (Ch, T2) + Self-efficacy (P, T1) → MVPA (Ch, T2)	0.027	0.067	−0.094	0.169

Note. Values of indirect effect estimates presented in bold are significant at $p < .05$. Each bootstrap was based on 10,000 repetitions.

BCI Bias-corrected confidence intervals. BCI that do not include zero indicate a significant indirect effect; *BMI* body mass index *z*-score (children) and body mass index (parents); *Ch* Child; *MVPA* moderate-to-vigorous physical activity; *P* Parent; *PA* physical activity; *Support* social support provision (parents) and support receipt (children); *T1* Time 1, the baseline; *T2* Time 2, the 7- to 8-month follow-up.

parents and children), via the mediators, parental and child self-efficacy beliefs. The findings provide support for the cultivation and enabling hypotheses in the context of MVPA in parent–child dyads. Both cultivation and enabling hypotheses were corroborated by within-child indirect effects and specific across-individual indirect effects. Both parental and child MVPA were indirectly explained by self-efficacy and social support, respectively. In general, the results are in line with an extension of SCT [18, 19], indicating that self-efficacy may operate as the establisher of support (*the cultivation hypothesis*) and that support enables the formation of self-efficacy through encouraging, facilitating the beliefs that one is capable of making the change (*the enabling hypothesis*).

The results emphasize the role of parental and child perceptions of parental support for child PA and self-efficacy for PA among younger children (aged 5–11), and the interdependency of these perceptions [47]. The cultivation or enabling effects were not tested before in the context of young child PA and accounting for a dyadic perspective. To date, the existing evidence indicated that adolescent self-efficacy may play a role as a mediator between perceptions of family support and PA in

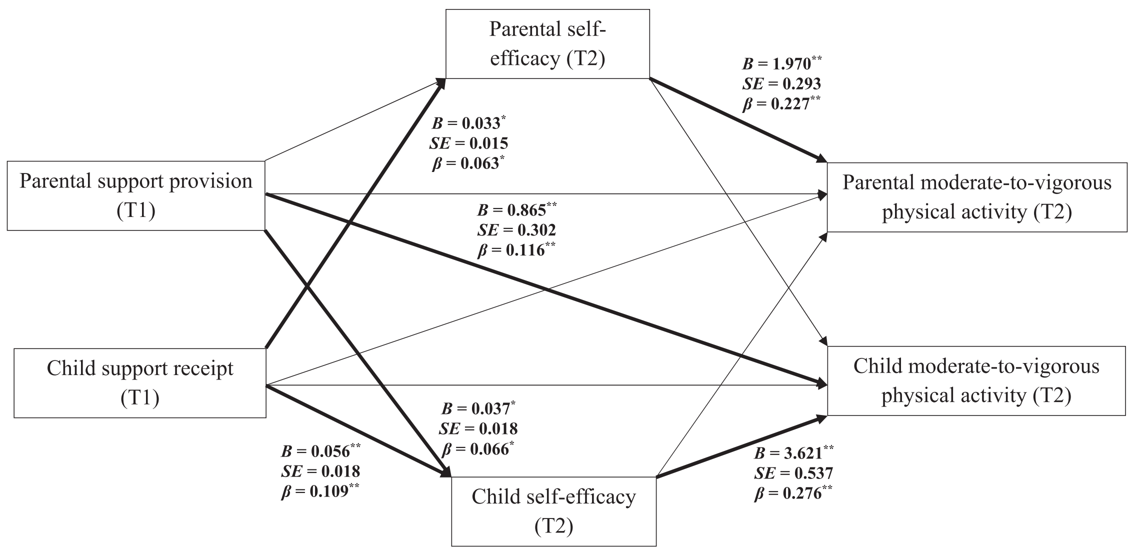

Fig. 2. Associations for the hypothesized enabling model (N = 879 parent–child dyads). *Note.* ** p < .01; * p < .05. Only significant effect coefficients (unstandardized, B and standardized, β) are presented along bold arrows. All parental and child predictors and T1 mediators (control variable) were assumed to covary. Residuals of the mediator (T2) were assumed to covary; residuals of the outcome variable, MVPA (T2) were assumed to covary. For clarity, the effects of the T1 mediators and T1 dependent variables, as well as the associations between covariates are not displayed. The covariates include: parental and child MVPA at T1, parental and child self-efficacy at T1, parental BMI, child BMI z-score, parental and child age, and gender. For values of all path, correlation, and covariance coefficients see Supplementary Table S3.

adolescents (the enabling hypothesis, within-individual perspective; [49, 50]), but, to the best of our knowledge, there is no evidence for the cultivation hypothesis explaining child (and/or parental) PA. Previous dyadic research explaining joint PA performed by parents with children aged 9–11 years old showed that a majority of within-individual and across-individual effects between cognitive predictors (subjective norms, perceived behavioral control, and attitudes) and intention to exercise were non-significant [51]. Cook *et al.* [51] also found that the majority (7 out of 8) of within-individual and across-individual associations between the cognitive constructs and physical co-activity (reported by parents) were non-significant. However, the likelihood of obtaining significant effects was probably lowered by small sample sizes enrolled by Cook et al. (48 father–child dyads and 65 mother–child dyads; [51]). The present study indicates that the across-individual effects of social-cognitive predictors on PA reported by parents and children are significant yet small, hence less likely to be detected in small samples.

Across the cultivation and enabling models, a specific pattern of associations was observed. The analysis of indirect effects corroborated both enabling and cultivation hypotheses for (a) within-individual indirect effects in children; (b) across-individual indirect effects, where the independent variable was measured in the child, whereas the mediator and the dependent variables were measured in parents (e.g., child self-efficacy predicted parental support provision and, indirectly, parental MVPA), (c) across-individual indirect effects, accounting for self-efficacy and MVPA measured in children, combined with parental reports of social support. Furthermore, the direct effects obtained for child and parental MVPA in the cultivation model could be interpreted as confirming the couple patterns [45]. In line with the actor-partner interdependence model [45], the couple patterns occur if the outcome variable is predicted by a variable measured in the actor and the partner. In the cultivation model, child MVPA (T2) was predicted by parental and child support (T2), suggesting the couple pattern, whereas parental MVPA (T2) was predicted by parental and child self-efficacy (T1), implying yet another couple pattern. In contrast, the support for the couple patterns in explaining MVPA by means of the enabling model was limited.

To date, studies accounting for both cultivation and enabling effects either provided support for the enabling hypothesis only, but not the cultivation hypothesis (across-individual: no studies found; within-individual: [22]) or for cultivation hypothesis only, but not the enabling hypothesis (across- and within-individual: [20, 21]). These discrepancies in research testing either cultivation or enabling hypothesis were explained by differences in the investigated outcomes (e.g., quality of life vs. health behaviors) and the type of the target population (e.g., patients with a chronic illness or healthy individuals). For example, a dyadic study involving patients and health behavior outcomes yielded support for the cultivation hypothesis only (the outcome: health behavior [20]) whereas research accounting for a within-individual perspective and non-behavioral outcomes

Table 2 Indirect, Direct, and Total Effects for the Hypothesized Enabling Model in the Sample of N = 879 Parent–Child Dyads

Simple indirect effects, total indirect effect, direct effect, total effect		Estimate	SE	95%BCI	
				Lower	Higher
Simple indirect effects	Support (P, T1) → Self-efficacy (P, T2) → MVPA (P, T2)	0.021	0.035	−0.046	0.095
	Support (P, T1) → Self-efficacy (Ch, T2) → MVPA (P, T2)	0.009	0.013	−0.009	0.044
Direct effect	Support (P, T1) → MVPA (P, T2)	−0.011	0.149	−0.303	0.282
Total indirect effect	Support (P, T1) → Self-efficacy (P, T2) → MVPA (P, T2) + Support (P, T1) → Self-efficacy (Ch, T2) → MVPA (P, T2)	0.018	0.157	−0.294	0.325
Total effect	Support (P, T1) → Self-efficacy (P, T2) → MVPA (P, T2) + Support (P, T1) → Self-efficacy (Ch, T2) → MVPA (P, T2) + Support (P, T1) → MVPA (P, T2)	0.029	0.038	−0.042	0.108
Simple indirect effects	Support (Ch, T1) → Self-efficacy (Ch, T2) → MVPA (Ch, T2)	**0.203**	**0.073**	**0.078**	**0.365**
	Support (Ch, T1) → Self-efficacy (P, T2) → MVPA (Ch, T2)	−0.009	0.015	−0.050	0.014
Direct effect	Support (Ch, T1) → MVPA (Ch, T2)	0.158	0.282	−0.439	0.681
Total indirect effect	Support (Ch, T1) → Self-efficacy (Ch, T2) → MVPA (Ch, T2) + Support (Ch, T1) → Self-efficacy (P, T2) → MVPA (Ch, T2)	0.351	0.281	−0.242	0.873
Total effect	Support (Ch, T1) → Self-efficacy (Ch, T2) → MVPA (Ch, T2) + Support (Ch, T1) → Self-efficacy (P, T2) → MVPA (Ch, T2) + Support (Ch, T1) → MVPA (Ch, T2)	**0.194**	**0.074**	**0.066**	**0.354**
Simple indirect effects	Support (Ch, T1) → Self-efficacy (Ch, T2) → MVPA (P, T2)	0.013	0.017	−0.016	0.054
	Support (Ch, T1) → Self-efficacy (P, T2) → MVPA (P, T2)	**0.065**	**0.032**	**0.007**	**0.133**
Direct effect	Support (Ch, T1) → MVPA (P, T2)	0.057	0.152	−0.243	0.357
Total indirect effect	Support (Ch, T1) → Self-efficacy (Ch, T2) → MVPA (P, T2) + Support (Ch, T1) → Self-efficacy (P, T2) → MVPA (P, T2)	0.134	0.155	−0.171	0.441
Total effect	Support (Ch, T1) → Self-efficacy (Ch, T2) → MVPA (P, T2) + Support (Ch, T1) → Self-efficacy (P, T2) → MVPA (P, T2) + Support (Ch, T1) → MVPA (P, T2)	**0.078**	**0.035**	**0.014**	**0.149**
Simple indirect effects	Support (P, T1) → Self-efficacy (P, T2) → MVPA (Ch, T2)	−0.003	0.010	−0.041	0.007
	Support (P, T1) → Self-efficacy (Ch, T2) → MVPA (Ch, T2)	**0.135**	**0.068**	**0.012**	**0.284**
Direct effect	Support (P, T1) → MVPA (Ch, T2)	**0.865**	**0.302**	**0.288**	**1.477**
Total indirect effect	Support (P, T1) → Self-efficacy (P, T2) → MVPA (Ch, T2) + Support (P, T1) → Self-efficacy (Ch, T2) → MVPA (Ch, T2)	**0.997**	**0.313**	**0.404**	**1.642**
Total effect	Support (P, T1) → Self-efficacy (P, T2) → MVPA (Ch, T2) + Support (P, T1) → Self-efficacy (Ch, T2) → MVPA (Ch, T2) + Support (P, T1) → MVPA (Ch, T2)	**0.132**	**0.069**	**0.007**	**0.282**

Note. Values of indirect effect estimates presented in bold are significant at $p < .05$. Each bootstrap was based on 10,000 repetitions.

BCI Bias-corrected confidence intervals; BCI that do not include zero indicate a significant indirect effect; *BMI* body mass index *z*-score (children) and body mass index (parents); *Ch* Child; *MVPA* moderate-to-vigorous physical activity; *P* Parent; *PA* physical activity; *Support* social support provision (parents) and support receipt (children); *T1* Time 1, the baseline; *T2* Time 2, the 7- to 8-month follow-up.

supported the enabling hypothesis only (the outcomes: quality of life [22]; posttraumatic growth [23]).

We found that the proportion of variance explaining MVPA was higher among parents compared to children. The difference might be due to developmental changes in self-regulation capacities in children and relative stability of self-regulatory capacities in adults. Changes in self-regulatory cognitions (including self-efficacy beliefs) are likely to occur in childhood and adolescence; these changes are closely related to changes in cognitive development, especially the frontal lobe develops through childhood and thus, mental foundations for internal regulation also develop [52]. In sum, self-regulatory cognitions (such as self-efficacy) may have stable effects on PA among parents, whereas the effects of self-regulatory cognitions in childhood may have weaker effects on MVPA measured at relatively long follow-ups (e.g., 7–8 months). Second, the effects of parental support on child behavior are also changing from childhood to adolescence, with the role of parental influence declining over time [53]. Thus, child perceptions of parental support may have limited effects on child MVPA, measured at relatively long-term follow-ups

(7–8 months later). This may be why there were no direct effects of child support receipt (T1) on child MVPA (T2), and consequently, limited MVPA variance was explained among children.

The present study shows that confirming the cultivation or enabling hypothesis may depend on in whom the mediator and the behavioral outcome variables are measured. In particular, across the tests for cultivation and enabling hypotheses, indirect effects were non-significant when the mediator, measured in one dyad member was chained with the behavioral outcome, measured in the other member of the dyad (there was one exception in the cultivation model, with parental support provision mediating self-efficacy and MVPA measured in a child). Across the cultivation and enabling models, there were no significant indirect effects for a specific across-individual constellation, namely the mediator measured in the child chained with the outcome assessed in parents. In summary, both cultivation and enabling hypotheses may be true, except for a specific mediator—dependent variable chain.

The findings may have some implications for the development of MVPA promotion programs and the explanation of the mechanism underlying the effects of MVPA-promoting interventions. Systematic reviews indicated that parental involvement in MVPA promotion interventions for children is related to the higher effectiveness of such programs, as indicated by increased levels of child MVPA [54]. Our study showed that parents might also benefit from MVPA programs targeting their child's MVPA. In particular, enhancing child perceptions of self-efficacy or social support during an MVPA intervention (involving parent–child dyads) may result in higher MVPA in parents, with parental perceptions of social support provision or self-efficacy, respectively, operating as the mediators.

When interpreting the findings, some limitations of the study need to be considered. First, the use of a self-report measure for MVPA may have limited the validity of the outcomes due to a lack of accuracy of recall, memory, or social desirability effects [55]. Accelerometer-based measures of MVPA would be recommended; however, the use of such a measure in large samples may limit the feasibility of the study. Second, three measurement points are recommended to thoroughly test the mediation, with the independent variables, mediator variables, and dependent variables measured at three different time points to enable the assessment of temporal precedence [56]. The present study used a half-longitudinal approach [44], therefore any conclusions referring to the order in which the three variables operate should be cautious and confirmed in research with three measurement points. Third, mothers constituted the majority of the parental subsample which may have affected the results. It is possible that the indirect associations depended on parental gender [51], but besides controlling for the parental gender in the tested models the moderating effect of parental gender was not tested (due to a small size of father–child subsample). Thus, future research may clarify the roles of parent and child gender. Fourth, any generalization to ethnically diverse populations should be made with caution as the analyzed sample was ethnically homogeneous (all participants were Caucasian). Finally, several environmental factors that were previously found to influence PA levels (e.g., Ref. [57]) were not controlled in this study, and the inclusion of them is recommended in the future. Relatively low reliability obtained for MVPA measure might be considered one of the limitations. As the internal consistency coefficients (e.g., Cronbach's α) are largely affected by the length of the test, if the length is too short, the value of the reliability coefficient is reduced [58]. However, it might be the case that the activities related to the moderate and vigorous activity are rather distinct (e.g., one could consider running as exclusively vigorous activity, whereas walking as an exclusively moderate or light activity), and thus, the internal consistency (item equivalence) should not be expected to be high [59]. Therefore, we consider the obtained values of internal consistency as acceptable.

This study was part of a larger trial attempting to explain body mass changes in parent–child dyads [24, 32–34]. The studies overlap partially, as they share one common variable, MVPA, operating as either the mediator [24] or the outcome [32–34]. The previous studies using the same dataset had different aims than the present study, as they tested different theoretical models and investigated how MVPA was linked with various other constructs such as neophobia, PA enjoyment, perception of PA promotion at schools/local community, or parental transportation provision.

Concluding, this prospective study showed small, but consistent within-individual effects and several across-individual effects, linking social support, self-efficacy, and MVPA in parents and their 5- to 11-year-old children. The findings provide evidence for the assumption that provision and receipt of social support may prompt self-efficacy beliefs but the reverse pattern (self-efficacy beliefs helping an individual to provide or receive social support) may be also true.

Supplementary Material

Supplementary material is available at *Annals of Behavioral Medicine* online.

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Compliance with Ethical Standards

Authors' Statement of Conflict of Interest and Adherence to Ethical Standards The authors declare that they have no conflicts of interest with regard to this study.

Ethics Approval This study was approved by the Internal Review Board at the first author institution. All study procedures were carried out in accordance with the 1964 Helsinki declaration and its later amendments.

Authors' Contribution AB, KZ, and AL contributed to the conception and design of the study; KZ, AL, and AB contributed to the acquisition of the data and performed the analyses; the manuscript was written by KZ, AL, and AB; NK critically revised the article for intellectual content; all authors provided critical revisions and approved the final version for submission.

Informed consent Written informed consent was obtained from all participants.

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