

Family Physical Activity Planning and Child Physical Activity Outcomes: A Randomized Trial



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Introduction: Regular moderate-to-vigorous physical activity and high physical fitness are extremely important to the health of children and track to positive health profiles in adulthood. Family-based interventions to improve moderate-to-vigorous physical activity are essential given that children live within a structure of parental influence. The purpose of this study was to examine the effect of a parent planning skills intervention to support child physical activity on the subsequent moderate-to-vigorous physical activity (primary outcome) and fitness of their children across 26 weeks (primary endpoint).

Study design: Two-arm randomized trial with physical activity assessment at baseline 6 weeks, 13 weeks, and 26 weeks and fitness and BMI tests at baseline and 26 weeks from 2012 and 2017.

Setting/participants: One hundred and two children (aged 6–12 years) who were below international physical activity recommendations at baseline were recruited through advertisements.

Intervention: Participants received a planning plus education intervention ($n=52$) or an education-only intervention ($n=50$).

Main outcome measures: Moderate-to-vigorous physical activity was assessed via accelerometry and fitness tests included aerobic fitness, muscular strength, flexibility. BMI was calculated by objectively assessed height and weight.

Results: Generalized linear mixed modeling conducted in 2019 showed that the patterns varied by condition over time ($\beta=-0.05$, $p<0.05$), where children in the planning intervention significantly increased moderate-to-vigorous physical activity compared with the education condition at 6 weeks and 13 weeks but not at 26 weeks. Aerobic fitness ($p=0.04$, $d=0.26$) was the only significant health-related physical fitness change between the two groups and favored the planning group over the education group.

Conclusions: There was initial efficacy of the planning intervention, but effectiveness waned by 26 weeks. These changes appeared to be sufficient for modest changes in aerobic fitness. Future research should aim to improve the maintenance of these early positive changes and assist parents in planning for activities that also include opportunities to improve child musculoskeletal fitness.

Trial registration: This study is registered at www.clinicaltrials.gov NCT01882192.

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INTRODUCTION

Children who engage in regular moderate-to-vigorous physical activity (MVPA) are more likely to display better body composition, cardiorespiratory and musculoskeletal fitness, academic achievement and cognition, prosocial behaviors, cardiovascular and metabolic health, and overall mental health.^{1–5} Furthermore, better child health-related physical fitness outcomes (e.g., body composition, aerobic and musculoskeletal fitness) predict favorable adult health outcomes,^{6,7} and regular physical activity (PA) in childhood is associated with regular PA patterns in adulthood^{8,9} and lowered risk of chronic disease.^{10,11} Unfortunately, less than 20% of children adhere to the public health target of 60 minutes of MVPA per day,¹² making the promotion of PA during childhood a public health priority.

Children spend considerable time under parental care, so family-based PA promotion initiatives appear important to successful intervention.^{13–15} Indeed, it has been suggested that parents are the “gatekeepers” of child PA¹⁶ and thus need to be the focal point of contact to change child behavior. Parental support represents the functional characteristics associated with interactions between a parent and their children in promoting health behaviors.^{17,18} Observational studies have shown that parental support is a reliable correlate of child PA,¹⁹ and a recent meta-analysis of 18 intervention studies showed a standardized mean difference of 0.29 (95% CI=0.14, 0.45) in favor of the intervention group over the control group in changes in child PA.²⁰ Despite this evidence for the utility of family-based interventions of child PA, Brown et al.²⁰ noted considerable heterogeneity in the findings and several limitations. Certain targets for intervention do not appear to be as effective as others. For example, educating parents about the health benefits of child PA has not been effective for increasing child PA.^{20–22} Moreover, parents often have very high intentions to assist their children in being physically active, but this goes unrealized among nearly half of them.^{23,24}

Interventions targeting more rational parental antecedents that focused on “why” children should engage in regular PA have had less success than interventions that empowered parents with skills on “how” to enact PA change in their children.²⁰ This mimics more recent advances in theory that move beyond basic intention formation approaches,²⁵ such as the Health Action Process Approach²⁶ and the Multi-Process Action Control Approach^{27,28} where the binding of intention to behavior is considered a consequence of sound planning and self-regulation tactics.²⁹ Brown

and colleagues²⁰ noted that more studies that examine planning and self-regulation approaches are needed to replicate the present small number of studies in family-based PA interventions.

A second limitation highlighted by Brown et al.²⁰ was that the outcome used in family-based interventions has often been self-reported child PA, which has noteworthy biases.^{30,31} More recent family-based intervention studies have incorporated direct measures of child PA (e.g., accelerometry), with several showing null results^{32–35} and suggesting that positive effects in the early literature may not generalize to more rigorous measurement. Continued experimentation with direct PA measures is warranted.

Finally, Brown and colleagues²⁰ noted that 85% of family-based PA interventions were shorter than 3 months in duration (half were 1 month in duration) and thus only provide evidence of short-term impact. If the goal of family-based PA planning is to establish patterns of behavior, then longer follow-up is needed to understand the effect of interventions.

With these limitations in mind, the primary objective of this study was to employ a randomized trial to examine the short- and long-term effects of a family self-regulatory planning intervention with an emphasis on supporting child MVPA compared with an education-only intervention. The trial targeted low-active children aged 6–12 years and included directly assessed MVPA at 6 weeks, 13 weeks, and 26 weeks. Based on the preliminary findings of Brown et al.²⁰ and past empirical findings,^{23,24,36} it was hypothesized that the self-regulatory planning condition would result in greater child MVPA than the education-only group over 26 weeks. It was further hypothesized, however, that the effect may diminish over time and thus the assessment at 26 weeks would show less effectiveness than the more proximal assessments at 6 and 13 weeks.³⁷

A secondary objective of this study was to examine whether the effect of the family self-regulatory planning intervention would also result in improvements in PA-related child fitness and BMI measures from baseline to 26 weeks. It was hypothesized that children in the planning group would have higher fitness scores and lower BMI than those in the education group.

METHODS

The full detailed methods for this study have been reported elsewhere.³⁷ The study was approved by the University of Victoria Human Research Ethics Board and parents (written consent) and their children (verbal consent) provided informed consent before being enrolled. The design, conduct, and reporting of the trial followed CONSORT guidelines.³⁸

A two-arm parallel-design randomized trial was conducted where participants were randomized using an online program, Research Randomizer. This program provided a simple randomization that allowed for allocation of participants to one of two groups after baseline assessment as follows: (1) family PA planning plus information/education or (2) PA information/education only. Participants were allocated to these conditions using a 1:1 ratio and subsequently assessed at 6 weeks (PA), 13 weeks (PA), and 26 weeks (PA, fitness). Participants were aware of the condition they were in but blind to the other condition. Initial recruiters were blinded to treatment allocation as this was concealed by a trial coordinator (who performed the randomization). Fitness testers were blind to the condition the families were randomized to; however, the intervention delivery team was aware of the condition, so they could deliver appropriate intervention materials. Rolling recruitment began in June 2012 and was completed in April 2017.

Study Population

Participants were recruited in greater Victoria, British Columbia, Canada, through advertisements and booths at local markets and recreation centers, materials passed out at local schools, and referrals. Families received a Can\$25 grocery store gift card if they referred another family that enrolled in the study.

Participants were children, aged 6–12 years, from single or dual parent families. Children were included in the study if they did not meet PA guidelines of at least 60 minutes of MVPA per day.³⁹ The initial screening involved defining Canadian PA guidelines for parents and then asking whether their children met this target (i.e., *Over the past three months, has your child[ren] engaged in at least 60 minutes of moderate or vigorous activity each day?*). Examples of moderate/vigorous activities were provided. This inclusion criterion was validated using the baseline PA assessment of the children via accelerometry. Though all children aged 6–12 years in a family were invited to participate in the intervention, only one child was designated as the target child for measurement a priori (chosen at random in cases in which multiple children met inclusion criteria).

Measures

More details of the intervention can be found in a previous publication.³⁷ To summarize, intervention materials were delivered in person by a research assistant after the 1-week baseline accelerometry assessment. Both conditions received the Canadian PA guidelines⁴⁰ handout recommending a goal of 60 minutes of MVPA daily for children. Intensity was discussed as to what constituted MVPA and examples were provided.

The PA information/education-only condition received a booklet outlining the benefits of PA for the whole family² and common barriers reported by families as well as examples for how to overcome those barriers.^{40,41}

For the planning condition, in addition to the provided information/education material, families also received a workbook on planning family PA and a dry erase calendar.⁴¹ The workbook included brainstorming exercises for families to plan for their PA and focused on skill training for implementation intentions and action planning as well as coping planning and traditional goal setting (Appendix Table 1, available online).^{42–46} Check-in sessions were conducted with all families at 6 weeks and 13 weeks and coincided with MVPA measurement. The check-in sessions included

discussion on whether families have been using the materials, if they have been able to incorporate PA, if they have been experiencing any challenges, and how they might overcome those challenges, and for the intervention group, if they have used the planning materials.

The primary outcome of the study was minutes per week of MVPA measured via accelerometry. The primary endpoint was the full 26 weeks of the trial, with secondary endpoints at the 6-week and 13-week assessments. The Actigraph GT3X accelerometer enabled for single axis was used to assess the participants. Participants wore the accelerometer on an elastic belt above the right hip for 7 consecutive days for at least 10 hours a day, removing it only for sleep, water activities, or showering. Logbooks were used to confirm the accelerometer data matched participant activity reports.

ActiLife software, version 6.11.9, was used to initialize, download, and analyze the data. The accelerometers were initialized to collect prefiltered data at a sample rate of 30 Hz for the children and were downloaded into 10-second epochs to capture the sporadic nature of child PA.^{47–49} A minimum of 4 days with at least 600 minutes per day including at least 1 weekend day of valid wear time were included in analysis based on recommended best practice.^{49,50} For determining valid wear time, the algorithm of Troiano et al.⁵¹ was used, which defines nonwear time as a period of at least 60 consecutive minutes of 0 counts, with an allowance for 1 to 2 minutes of counts between 0 and 100. These periods of nonwear time were subtracted from total wear time. Child MVPA was determined using the cut points of Evenson and colleagues⁵² based on recommendations from Trost et al.⁵³ Data were modeled so that all participants had a complete 7-day data set. This was conducted by taking the average of the valid days and inputting those averages for the missing days.⁵⁴ Forty-two percent of the sample had 7 complete days of wear time averaged across the four assessment times (28% had 6 days, 15% had 5 days, and 15% had 4 days).

The secondary outcomes of the trial were fitness and body composition. Children's waist circumference was measured, along with height and weight, which were used to calculate BMI. A steady state walking treadmill test⁵⁵ was used to calculate a predicted maximal aerobic power (VO₂ max). Push-ups, sit and reach flexibility, and partial curl-ups were measured to determine musculoskeletal fitness using the protocols established by Gledhill and Jamnik.^{56,57}

The study followed procedures established in a prior pilot study⁴¹ as a guide for recruitment, study protocol, and assessment. The lead trial coordinator conducted study protocol quality control training and crosschecks with all research assistants to ensure standardization. This study was advertised as a family-based intervention, although child MVPA was considered the critical outcome of interest across the study data collection and during advertisement. Only the child outcomes are reported in this paper. After interested parents contacted the researcher and were determined to be initially eligible to participate in the study, the trial coordinator scheduled a baseline assessment at the University of Victoria laboratory. The baseline assessment included a parent-reported questionnaire with factors such as background demographic information (age, sex, gender, ethnicity, education, income, marital status, employment status), a fitness test, and getting set up with an accelerometer for the 7-day assessment protocol.

After baseline assessment, participants were provided with an accelerometer for each family member and a researcher provided verbal instructions for device wear and ensured the belts were the appropriate size for participants. After the completion of the accelerometry assessment, participants were randomized to one of the two conditions. Following randomization, the trial coordinator scheduled a baseline session with the family to deliver the study materials. At 6 weeks and 13 weeks, a member of the research team met with families to drop off accelerometers and conduct a check-in session. As an incentive for families to complete all assessments, an honorarium was provided upon pick-up of the accelerometers starting at Can\$25 at baseline and increasing by Can\$5 at each time point. In addition to the follow-up testing at 26 weeks, parents and children assigned to the planning intervention condition completed brief study satisfaction questions.⁴¹

Statistical Analysis

Given the nested structure of the data (i.e., repeated assessments nested within participants), generalized linear mixed modeling was used in SPSS, version 25.0. Power analysis (0.80) of a trend with four repeated assessments, one between-group factor, an estimated small–medium effect size based on the authors' prior pilot study⁴¹ and recent meta-analysis of the family PA intervention literature,²⁰ with an alpha of 0.05, suggested that a sample size of 96 could detect the primary hypothesis.⁵⁸ The analyses, conducted in October 2018, used a four-step process. First, a model was entered with a random intercept (i.e., the baseline score for a given MVPA outcome) and a fixed linear trend (i.e., coded 0=baseline, 6=6 weeks, 13=13 weeks, and 26=26 weeks to reflect the weekly change over the 26-week period). The second model entered a random intercept and random linear trend. The third model added a fixed quadratic trend and the fourth model added a random quadratic trend. These analyses were used to determine if there was significant variation across participants in the intercept, linear, or quadratic trends. Once this was determined, the final models entered condition (0=education; 1=planning plus education) to predict the intercept, linear, and quadratic trends. Finally, once the main analysis was completed, three separate models were run with the linear trend centered at 6 weeks, 13 weeks, and 26 weeks. This allowed a condition effect to be examined at each time via the condition X-intercept interaction. Identical exploratory analyses were also conducted for moderate PA (MPA) and vigorous PA (VPA) to decompose the MVPA results.

For the secondary fitness outcomes, changes in fitness from baseline to 6 months were investigated using an analysis of covariance, controlling for baseline, between subject conditions (education, education plus planning).

Descriptive statistics were generated for end of study process evaluation questions. The open-ended question about barriers was categorized and coded into common themes.⁵⁹ Total frequency of the themes and the percentage of endorsement were also calculated as an estimate of commonality across responses.

RESULTS

One hundred and eighty-eight parents contacted the research team about participating in the study. Of these, 36 children were ineligible (over MVPA guidelines) and 47 families were uninterested. The 102 participants

who met study inclusion criteria and completed baseline assessments were randomly assigned to one of the two conditions (Figure 1; planning plus education, $n=52$; education, $n=50$). Of these, 42 participants in the planning plus education group and 38 education group participants completed the study to the 26-week endpoint (22% attrition). This included a gradual continuous dropout across the 6-week (8% attrition), 3-month (7% attrition), and 6-month (7% attrition) assessment times, with the most common reasons being lack of interest to continue (41%), changes in family circumstances such as divorce (18%), and a child's refusal to wear the accelerometer (14%). These attrition numbers were not significantly different ($p>0.05$) across the groups. No participants cited harms associated with the study.

Children were on average aged 8.93 (SD=2.08) years, 52% were female, and were primarily white (Appendix Table 2, available online). Participating families identified as dual parent (55.6%) and single parent (44.4%), and 29% of these families also included siblings who participated in the intervention. Most parents were college educated (64%), married/common law (70%), had moderate-to-high incomes (56% >Can\$74,000), and were employed (72%). Child accelerometry assessment at baseline indicated 49.12 (SD=17.91) minutes of daily MVPA among the sample.

No transformations on these data were performed as they had acceptable skewness/kurtosis values (i.e., <2.0) and were normally distributed. The unadjusted means are presented in Table 1. Based on the preliminary analyses for MVPA, the final model included a random intercept with fixed linear and quadratic trends. Results in Table 2 show that baseline activity scores were similar for both conditions. Moreover, the main effects for the linear and quadratic trends were not significant. However, condition significantly ($p<0.05$) predicted the linear and quadratic trend. The follow-up analyses showed that the planning plus education group engaged in significantly more MVPA at 6 weeks ($\beta=9.15$, $p<0.01$) and 13 weeks ($\beta=11.85$, $p<0.01$), but there was no condition effect at 26 weeks ($\beta=7.04$, $p>0.05$).

The MVPA findings were further decomposed to MPA and VPA subcomponents. Both sets of data showed normality. Results from Table 2 show that the baseline activity scores were similar for both conditions (Table 1 provides unadjusted means). Condition significantly ($p<0.05$) predicted the linear and quadratic trends for MPA, but not for VPA. Follow-up analyses showed that the planning plus education group engaged in significantly more MPA at 6 weeks ($\beta=6.76$, $p<0.01$), and 13 weeks ($\beta=8.53$, $p<0.01$) than did the education group but there was no condition effect at 26 weeks ($\beta=4.66$,

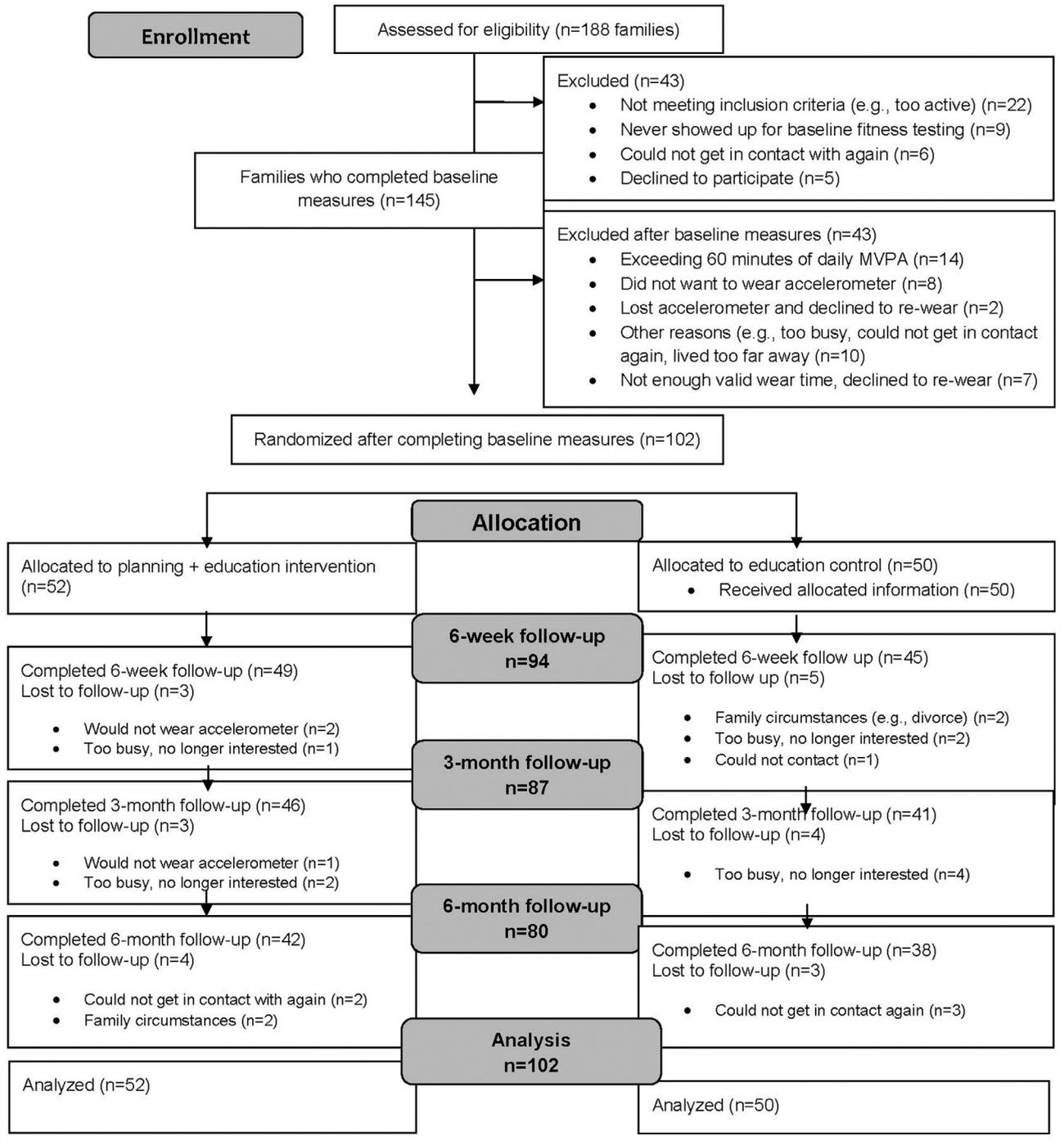


Figure 1. CONSORT flow diagram.

MVPA, moderate-to-vigorous physical activity.

$p > 0.05$). There were no condition effects at any time point for VPA (baseline: $\beta = 0.73$, $p > 0.05$; 6 weeks: $\beta = 2.37$, $p > 0.05$; 13 weeks: $\beta = 3.21$, $p > 0.05$; 26 weeks: $\beta = 2.51$, $p > 0.05$).

All health-related physical fitness test data were normally distributed (e.g., skewness < 1.8) but 22% of these data were missing at the 26-week follow-up

assessment. These data were missing completely at random (Little's test (9)=13.57, $p = 0.13$). A more specific analysis of dummy coding a "missingness" variable and testing for the association with various baseline variables and missing data showed no association with parent/child demographics, fitness, or behavior variables ($p > 0.05$). Thus, an imputation approach

Table 1. Descriptive Statistics for Physical Activity Variables Over Time by Condition

Variable	Baseline, mean (SD)	6 weeks, mean (SD)	13 weeks, mean (SD)	26 weeks, mean (SD)
Moderate PA				
Planning	35.37 (11.14)	38.58 (12.83)	39.65 (11.42)	39.50 (11.33)
Education	32.75 (12.03)	31.85 (11.21)	30.10 (9.50)	33.36 (10.83)
Vigorous PA				
Planning	15.54 (7.88)	16.17 (10.29)	19.69 (10.58)	18.38 (9.97)
Education	14.72 (9.54)	14.05 (8.90)	14.52 (7.65)	15.09 (9.34)
MVPA				
Planning	50.91 (16.66)	54.75 (21.45)	59.62 (16.28)	57.88 (17.82)
Education	47.67 (19.24)	46.03 (18.75)	44.62 (15.50)	48.44 (19.10)

Note: Results are presented unadjusted for the linear and quadratic trends. MVPA, moderate-to-vigorous physical activity; PA, physical activity.

was conducted using the expectation-maximization algorithm.^{60,61} A significant increase in estimated maximal aerobic power (VO₂ max) was found in the planning plus education group compared with the education-only group from baseline to 26 weeks (Table 3). No other fitness tests showed significant differences from baseline between conditions.

Among the children in the planning plus education condition, 32 participants (76%) reported that they learned more about why PA was good for them. Nine children reported a *maybe* response and only one child reported *no* to this question. Seventy-four percent of these children ($n=17$ for *yes* and $n=14$ for *a bit*) reported that their family used the planning material in the intervention. Finally, 55% of children reported that they thought their family had increased PA since starting the study, while an additional 30% indicated *maybe* to this question. Among the parents, 29% said they had thoroughly reread the intervention material since the booster sessions with the trial coordinator and another 69% reported they had skimmed through it. Only one parent indicated they had not attended to the intervention material. However, only 50% of parents reported that they used the planning material regularly. Reasons for not using the planning material among the 21 parents who reported this showed that 19% of parents used their own planning material, and thus 60%

of the parents in the planning group employed planning tactics over the 26 weeks of the trial. The parents who reported not using the material cited limited time (29%), too much effort (10%), forgetfulness (10%), lack of interest in the supplied planning material (10%), or that they were not a family who plans (10%). Overall, 76% of parents rated the planning material provided as useful (i.e., regardless of whether they actually used it regularly).

DISCUSSION

The results show significant changes in MVPA at 6 weeks and 13 weeks favoring the planning plus education condition over the education-only condition but not at the hypothesized primary endpoint for the trial of 26 weeks post-intervention, whereby children in both conditions were approaching their baseline values. The findings demonstrate a drop-off in effectiveness over time, which was predicted.

These findings provide helpful theoretic and practical evidence for family-based intervention. First, the results highlight the importance of longer-term assessments in family-based interventions because initial effectiveness may not reflect longer-term outcomes. Family-based PA interventions for children have mainly been of short duration^{20,21}; thus, mapping out longer-term trajectories

Table 2. Results From Generalized Linear Mixed Models^a

Variable	Moderate PA, beta (95% CI)	Vigorous PA, beta (95% CI)	MVPA, beta (95% CI)
Intercept	32.87 (29.48, 36.24)	14.67 (12.03, 17.30)	47.74 (42.36, 53.13)
Condition	2.54 (−2.05, 7.13)	0.73 (−2.63, 4.10)	3.04 (−4.07, 10.15)
Linear trend	−0.26 (−0.74, 0.23)	0.06 (−0.34, 0.47)	−0.22 (−1.01, 0.56)
Condition	0.91** (0.27, 1.55)	0.34 (−0.26, 0.94)	1.30* (0.24, 2.37)
Quadratic trend	0.01 (−0.01, 0.03)	−0.001 (−0.02, 0.02)	0.01 (−0.02, 0.05)
Condition	−0.03** (−0.06, −0.01)	−0.01 (−0.04, 0.01)	−0.05* (−0.09, −0.004)

Note: Boldface indicates statistical significance (* $p<0.05$, ** $p<0.01$).

^a $n=102$.

MVPA, moderate-to-vigorous physical activity; PA, physical activity.

Table 3. Effects of Family Physical Activity Planning or Education Interventions on Changes in Fitness in Children^a

Variable	Baseline, mean (SD)	Post-study, mean (SD)	Mean change, mean (95% CI)	Between-group difference, mean(95% CI)	p-value	Cohen's d
BMI						
Planning group	17.30 (3.24)	17.80 (3.28)	0.50 (0.27, 0.73)	0.09 (−0.28, 0.46)	0.62	0.03
Education group	18.99 (4.05)	19.39 (4.16)	0.39 (0.11, 0.67)			
VO ₂ max						
Planning group	36.35 (11.06)	39.88 (10.51)	3.53 (1.49, 5.58)	2.78 (0.07, 5.49)	0.04	0.26
Education group	33.25 (10.70)	34.75 (10.82)	1.51 (−0.55, 3.56)			
Push-ups						
Planning group	2.88 (3.80)	4.04 (4.13)	1.16 (0.35, 1.97)	0.54 (−0.61, 1.68)	0.35	0.14
Education group	2.05 (3.69)	2.92 (3.63)	0.87 (−0.06, 1.80)			
Sit and reach						
Planning group	28.90 (7.95)	29.23 (7.88)	0.32 (−0.92, 1.56)	−0.37 (−2.41, 1.67)	0.72	−0.05
Education group	26.75 (7.73)	28.07 (7.24)	1.31 (−0.56, 3.18)			
Curl-ups						
Planning group	9.79 (7.48)	12.44 (8.21)	2.65 (0.78, 4.52)	−1.66 (−4.22, 0.90)	0.20	−0.21
Education group	7.13 (7.88)	12.27 (8.36)	5.14 (3.17, 7.11)			

Note: Between-group differences were adjusted for baseline values. There was a significant difference in BMI (planning < education group). $p < 0.05$ at baseline but no significant differences among other health-related fitness variables at baseline.

^a $n=102$.

VO₂ max, maximal oxygen uptake.

of these interventions helps identify boundary conditions of effectiveness.

The findings of this research show the promise of family-based intervention. From a theoretic perspective, the results of this trial support the short-term effectiveness of family planning over information/education-only approaches.^{20,21} The advancement beyond this approach may be needed, however, to sustain PA patterns. Rhodes and colleagues^{27,28,62} have suggested that the formation of parental support and subsequent child PA habits (i.e., cued behavioral response bonds with techniques focused on consistency of practice and salient precipitating cues) and identity (family self-categorization as active with techniques focused on affirmation and prioritization of PA over other activities) may be necessary to maintain behavior over the long term, given the fatigue that may occur with constant volitional self-regulation. This suggestion has been supported through observational research,²³ but not experimental testing. Thus, the supplementation of family planning interventions for PA with identity and habit formation techniques⁶³ may be a useful aim of future research.

Interestingly, the planning intervention affected only MPA and not VPA. Thus, changes in MVPA were driven exclusively by underlying changes in moderate-intensity activities. Although the two intensities were not distinguished in the intervention material, it is speculated this may be a consequence of the family-based PA approach (e.g., outdoor play, family walks). It may be prudent in future research to explore specific exemplars of higher intensity activities.

The results of this study also contain practical information relevant to future intervention development. For example, the process evaluation showed that acceptance and use of planning was not uniform in the intervention. Family-regulatory interventions such as this one may have upper limits regarding which families it can help. Broader socioecologic intervention (e.g., lower work hours or more occupational flexibility, greater access to recreation, low-cost activities) would likely be required to assist some families.⁶⁴

The results support the hypothesis of positive changes in aerobic fitness, albeit with very modest effects. It is important to highlight that marked and clinically relevant health benefits in both adults and children alike can be accrued with relatively small changes in PA behavior and fitness.^{65,66} There were no differences in other health-related variables between the groups. Both MVPA and high physical fitness are critical antecedents to both child health^{2,67} and lifelong adult health,⁶ so this demonstrates additional utility and relevance of the intervention. Still, given the benefits of musculoskeletal fitness in children and youth,⁶⁸ future applications of

similar family-based interventions may wish to provide more examples of activities that could affect this component of fitness.

Limitations

The sample of families was mainly white, middle-income, and educated. Though many of these features do represent Victoria,⁶⁹ generalizability to other contexts is unknown. Second, the intervention was fairly intense with face-to-face, laboratory, and home visits, suggesting that there may be barriers to expanding implementation. Replication and extension of this intervention with other platforms (e.g., mHealth, eHealth) appears prudent.

CONCLUSIONS

An intervention focused on family planning skills to support child MVPA resulted in significantly increased child MVPA compared with an education-only intervention. The MVPA, however, decreased over time with significant differences seen at 6 and 13 weeks disappearing by 26 weeks post-intervention. Change in aerobic fitness was the only significantly different fitness outcome that favored the planning group over the education group. The short-term efficacy of a family planning intervention was demonstrated. Research to improve the maintenance of short-term outcomes and assist parents in planning activities to increase child musculoskeletal fitness is needed.

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SUPPLEMENTAL MATERIALS

Supplemental materials associated with this article can be found in the online version at <https://doi.org/10.1016/j.amepre.2019.03.007>.

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