
Evaluating a Model of Parental Influence on Youth Physical Activity

Stewart G. Trost, PhD, James F. Sallis, PhD, Russell R. Pate, PhD, Patty S. Freedson, PhD, Wendell C. Taylor, PhD, Marsha Dowda, DrPH

- Objective:** To test a conceptual model linking parental physical activity orientations, parental support for physical activity, and children's self-efficacy perceptions with physical activity participation.
- Participants and Setting:** The sample consisted of 380 students in grades 7 through 12 (mean age, 14.0 ± 1.6 years) and their parents. Data collection took place during the fall of 1996.
- Main Outcome Measures:** Parents completed a questionnaire assessing their physical activity habits, enjoyment of physical activity, beliefs regarding the importance of physical activity, and supportive behaviors for their child's physical activity. Students completed a 46-item inventory assessing physical activity during the previous 7 days and a 5-item physical activity self-efficacy scale. The model was tested via observed variable path analysis using structural equation modeling techniques (AMOS 4.0).
- Results:** An initial model, in which parent physical activity orientations predicted child physical activity via parental support and child self-efficacy, did not provide an acceptable fit to the data. Inclusion of a direct path from parental support to child physical activity and deletion of a nonsignificant path from parental physical activity to child physical activity significantly improved model fit. Standardized path coefficients for the revised model ranged from 0.17 to 0.24, and all were significant at the $p < 0.0001$ level.
- Conclusions:** Parental support was an important correlate of youth physical activity, acting directly or indirectly through its influence on self-efficacy. Physical activity interventions targeted at youth should include and evaluate the efficacy of individual-level and community-level strategies to increase parents' capacity to provide instrumental and motivational support for their children's physical activity.
- (Am J Prev Med 2003;25(4):277-282) © 2003 American Journal of Preventive Medicine
-

Introduction

Increasing the proportion of children and adolescents who engage in regular physical activity continues to be a public health priority.¹⁻³ Interventions should be based on empirical evidence of correlates of the behavior.⁴ Although there is a large literature on correlates of youth physical activity,⁵ most of the variance remains unexplained.

Family members, especially parents, play an important role in the development of children's health

behaviors.⁶ However, the mechanisms of parental influence remain understudied and poorly understood.^{6,7} According to Baranowski,⁸ parents can influence their children's health behaviors through a variety of mechanisms. These include genetics, direct modeling, rewarding desirable behaviors and punishing or ignoring undesirable behaviors, establishing or eliminating barriers, providing resources to perform the behavior, and employing authoritative parenting procedures to help the child develop self-control skills. Importantly, a comprehensive understanding of *how* parents influence their children's physical activity behavior is needed to inform the development of effective family-based physical activity interventions.^{4,9}

To date, most of the research pertaining to children's physical activity has focused on the direct modeling hypothesis. Many,¹⁰⁻¹⁹ but not all,²⁰⁻²⁴ of these studies have reported a positive correlation between the physical activity levels of parents and their children. However, when the influence of parental physical activity is considered alongside other forms of parental

From the School of Human Movement Studies, University of Queensland (Trost), Brisbane, Australia; Department of Psychology, San Diego State University (Sallis), San Diego, California; Department of Exercise Science, Norman J. Arnold School of Public Health, University of South Carolina (Pate, Dowda), Columbia, South Carolina; Department of Exercise Science, University of Massachusetts (Freedson), Amherst, Massachusetts; and Department of Behavioral Sciences, University of Texas-Houston Health Science Center (Taylor), Houston, Texas

Address correspondence and reprint requests to: Stewart G. Trost, PhD, School of Human Movement Studies, University of Queensland, Brisbane QLD 4072, Australia. E-mail: strost@hms.uq.edu.au.

influence, the importance of modeling is diminished and other constructs, such as parental beliefs about physical activity and parental encouragement, emerge as more important predictors.^{25,26} Moreover, studies have shown that child-level psychosocial correlates of activity behavior (e.g., perceived competence) should also be taken into account when examining the links between parental and child physical activity.^{27,28}

The purpose of the present study was to test a conceptual model linking parental physical activity orientations (parental physical activity, parental enjoyment of physical activity, and perceived importance of physical activity) and parental instrumental support for physical activity with children's self-efficacy perceptions and physical activity participation.²⁹ Age and gender were included as covariates. It was hypothesized that the relationship between parental physical activity orientations and children's physical activity behaviors would be mediated by the level of parental support and the children's resultant self-efficacy perceptions. The direct modeling hypothesis was also tested by evaluating the direct relationship between parental and child physical activity.

Methods

Sample

The study was part of the Amherst Health and Activity Study, a cross-sectional observational study examining age and gender differences in physical activity and the correlates of physical activity.^{30,31} Data collection took place during fall 1996. Subjects were recruited from the junior and senior high school located in Amherst MA. All 1712 students enrolled in physical education were provided with a packet containing study information, an informed consent document, and a questionnaire. Of this number, 612 (approximately 36%) returned a signed informed consent and a completed questionnaire. To ensure that only one questionnaire was completed per household, surveys completed for additional siblings were excluded from the sample ($n=77$), providing an "initial" sample of 535 students in grades 5 through 12 and their parent(s). After further deletions for missing or incomplete data, the available sample size was reduced to 418. Because 91% of the remaining parental questionnaires provided information on both parents (living together or separately), participants with responses from only one parent or guardian were excluded. The "final" sample consisted of 380 children and their two parents. The demographic characteristics of the initial and final samples are shown in Table 1. The initial and final samples were comparable with respect to age, gender, race/ethnicity, parental age, and parental education.

Parental Measures

Parents or caregivers completed a brief questionnaire assessing sociodemographic information and previously studied parental correlates of physical activity behavior. Responses from both parents were averaged to create a composite parental score for each variable. The measures were taken

Table 1. Demographics of initial and final study sample

Variable	Initial sample ($n=535$)	Final sample ($n=380$)
Age (years)	14.0 \pm 1.6	14.0 \pm 1.6
% female	54.2	55.0
% white	78.1	84.2
Mother's age (%)		
≤25 years	4.7	2.7
25–34 years	5.1	3.7
35–44 years	49.1	49.1
45–54 years	39.0	42.2
≥55 years	2.1	2.3
Father's age (%)		
≤25 years	3.9	2.7
25–34 years	4.6	3.8
35–44 years	33.7	33.4
45–54 years	51.5	53.7
≥55 years	6.2	6.3
Mother's education		
≤High school	10.9	10.3
Some college, no degree	12.1	12.0
College degree	31.3	30.4
Postgraduate degree	45.8	47.3
Father's education		
≤High school	8.9	8.1
Some college, no degree	11.3	9.4
College degree	25.6	25.8
Postgraduate degree	54.2	56.7

from the International Life Sciences Institute national phone survey.³²

Parental physical activity. Each parent reported the number of days in the past week they "walked for exercise"; "did heavy house cleaning, gardening, or yard work for at least 20 minutes at a time"; and "exercised or participated in sports activities that made you sweat or breathe hard." Responses to each item were averaged to create a composite parental physical activity score. The 1-week test–retest reliability for this measure was $R=0.78$.

Parental support for physical activity. This scale consisted of five items assessing the weekly frequency with which parents "encouraged their child to do physical activities or play sports"; "done a physical activity or played sports with their child"; "provided transportation so their child could go to a place where he or she can do physical activities or play sports"; "watched their child participate in physical activity or sport"; and "told their child that physical activity is good for his or her health." Responses were recorded on a five-point scale with endpoints ranging from none to daily. The internal consistency of the parental support scale, as measured by Cronbach alpha, was 0.78. The 1-week test–retest reliability for this measure was $R=0.81$.

Importance of physical activity. Parents indicated how important it was for their child to participate in physical activities and/or sports. Responses were recorded on a five-point Likert scale, with endpoints of very unimportant to very important. The 1-week test–retest reliability for this measure was $R=0.67$.

Parental enjoyment of physical activity. Parents indicated how much they enjoyed physical activity or exercise. A five-

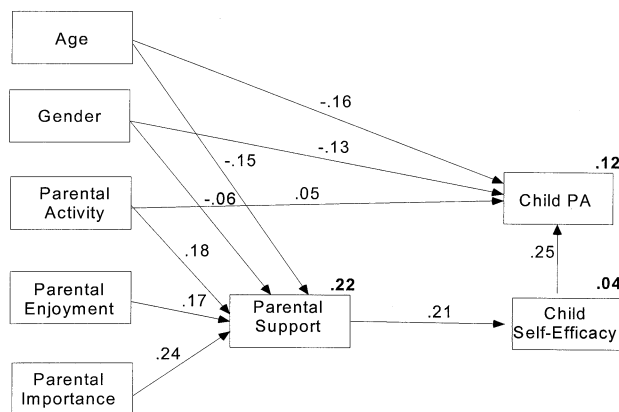


Figure 1. Standardized parameter estimates for proposed theoretical model: "Model 1."

$\chi^2=31.99$, $df=8$, $p<0.001$, GFI (goodness-of-fit index)=0.98, AGFI (adjusted goodness-of-fit index)=0.91, RMSEA (root mean square of approximation)=0.09 [90% confidence interval 0.058–0.122], NFI (normed fit index)=0.89, CFI (comparative fit index)=0.91, PNFI (parsimonious normed fit index)=0.26).

PA, physical activity.

point Likert scale was used, with endpoints ranging from *not enjoyable* to *very enjoyable*. The 1-week test-retest reliability for this measure was $R=0.76$.

Child Measures

Child physical activity. Children's participation in physical activity was measured using a modification of the method described by Sallis et al.³³ Participants were presented with a list of 46 commonly performed activities and asked to recall the number of times in the past 7 days they had performed each activity. Using *The Compendium of Physical Activities*,³⁴ each activity was assigned a metabolic equivalent (MET) value/weighting. A weekly activity index was then calculated by multiplying the weekly frequency of each activity by its corresponding MET weighting, and summing the products. In a reliability study conducted with an independent sample of 57 children, the 1-week test-retest reliability for this measure was 0.79.

Physical activity self-efficacy. This scale consisted of five items measuring children's confidence in their ability to overcome common barriers to participating in physical activity, including "getting up early, even on weekends," "feeling sad or highly stressed," "when family or friends demand more time from you," "when you have a lot of homework to do," and "setting aside time for regular exercise." Responses were recorded on a five-point scale, with endpoints ranging from "I'm sure I can't" to "I'm sure I can." The internal consistency of the child self-efficacy scale, as measured by Cronbach's alpha, was 0.85. The 1-week test-retest reliability for this measure was $R=0.89$.

Statistical Analysis

Whole sample and gender-specific means and standard deviations were calculated for the study variables. The proposed theoretical model (Figure 1) was tested via observed variable

Table 2. Descriptive statistics for study variables

Variable	Final sample (n=380)	Boys (n=171)	Girls (n=209)
Child physical activity index	44.4±73.5	156.3±74.6	134.7±71.6*
Parental physical activity	4.4±2.9	4.4±2.7	4.3±3.0
Parental support	1.6±0.9	1.7±0.8	1.5±0.9*
Parental importance	3.6±1.1	3.7±1.0	3.5±1.2*
Parental enjoyment	4.2±0.9	4.3±0.8	4.1±1.0
Self-efficacy	3.5±0.9	3.5±0.8	3.5±0.9

*Significant gender difference, $p<0.05$.

path analysis using maximum likelihood parameter estimation (AMOS 4.0). Model fit was based on generally accepted thresholds for the chi-square index, goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), root mean square of approximation (RMSEA), normed-fit index (NFI), comparative fit index (CFI), and parsimonious normed-fit index (PNFI). The chi-square index provides a test of the null hypothesis that the reproduced covariance matrix has the specified model structure (i.e., that the model "fits the data"). If the null hypothesis is "correct," then the obtained chi-square value should be small, and the p value associated with the chi-square should be relatively large ($p>0.05$). The GFI is a measure of the relative amount of the sample covariance matrix accounted for by the model and is independent of the sample size. The GFI ranges from 0 to 1, with values exceeding 0.9 indicating a good fit to the data. The AGFI adjusts the GFI for the degrees of freedom in the model. The AGFI also ranges from 0 to 1, with values above 0.9 indicating a good fit to the data. The RMSEA assesses closeness of fit, with values approximating 0.08, 0.05, and 0 indicating reasonable, close, and exact fits, respectively. The NFI is an alternative to the chi-square index; values of this index may range from 0 to 1, with values over 0.9 indicative of an acceptable fit. The CFI provides an assessment of comparative fit independent of sample size. Values of the CFI will always lie between 0 and 1, with values over 0.9 indicating a good fit. The PNFI adjusts the NFI for model parsimony. The PNFI ranges between 0 and 1, with higher values indicating a more parsimonious fit. Unlike the other fit indices, there is no standard for how "high" the index should be. It is used to compare two competing theoretical models.

Results

Descriptive statistics for the study variables are shown in Table 2. On average, boys reported significantly more physical activity than girls. Parents reported significantly higher levels of support and perceived importance for boys compared to girls. Overall, the level of parent support was low, with parents encouraging, providing transport, or performing physical activity with their child less than twice per week on average.

The result of the initial path analysis is shown in Figure 2. For ease of reading, the correlations among the exogenous variables (age, gender, parental activity, parental enjoyment, and parental importance) are not

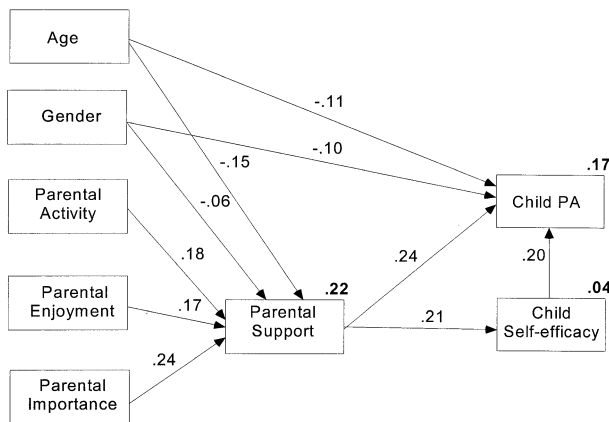


Figure 2. Standardized parameter estimates for the modified theoretical model: “Model 2.” $\chi^2=10.33$, $df=8$, $p<0.24$, GFI (goodness-of-fit index)=0.99, AGFI (adjusted goodness-of-fit index)=0.97, RMSEA (root mean square of approximation)=0.02 [90% confidence interval 0.000–0.070], NFI (normed fit index)=0.97, CFI (comparative fit index)=0.99, PNFI (parsimonious normed fit index)=0.28). PA, physical activity.

included in the figure but are displayed in Table 3. In accordance with the proposed theoretical model, parental physical activity orientations were positively associated with parental support ($\beta=0.17$ – 0.25 , $p<0.0001$), parental support was associated with self-efficacy ($\beta=0.21$, $p<0.0001$), with self-efficacy associated with children’s physical activity ($\beta=0.25$, $p<0.0001$). However, the proposed model did not represent an acceptable fit to the data ($\chi^2=31.99$, $df=8$, $p<0.001$, GFI=0.98, AGFI=0.91, RMSEA=0.09 [90% confidence interval (CI) 0.058–0.122], NFI=0.89, CFI=0.91, PNFI=0.26). Notably, the direct path from parental physical activity to child physical activity was nonsignificant ($\beta=0.05$, $p=0.28$), and modification indices suggested a need for a direct path from parental support to child physical activity.

Because both modifications could be justified on theoretical grounds, the path linking parental and child physical activity was deleted and a direct path from parental support to child physical activity was added. The resultant “model 2” demonstrated an excellent fit to the data ($\chi^2=10.33$, $DF=8$, $p=0.24$, GFI=0.99, AGFI=0.97, RMSEA=0.02 [90% CI=0.000–

0.070], NFI=0.97, CFI=0.99, PNFI=0.28) (Figure 2). Standardized path coefficients for the parental influence variables ranged from 0.17 to 0.24, and all were significant at the $p<0.0001$ level. Age, gender, parental physical activity, parental enjoyment of physical activity, and importance of physical activity accounted for 22% of the variance in parental support, with parental support in turn accounting for 4% of the variance in children’s physical activity self-efficacy. Collectively, age, gender, parental support, and child self-efficacy accounted for 17% of the variance in child physical activity.

Discussion

Parental support for physical activity has been identified as a key correlate of children’s physical activity behavior.^{5,35} However, relatively little is known about the factors that promote parental support, and it remains unclear whether this construct influences child physical activity directly or indirectly through its effect on proximal psychosocial variables, such as self-efficacy for physical activity. The present study tested a conceptual model in which parental support for physical activity and child self-efficacy perceptions mediated the relationship between parental physical activity orientations and child physical activity behavior. In support of this model, parental physical activity behavior, parental enjoyment of physical activity, and perceived importance of physical activity were positively associated with parental support. Parental support, in turn, was related to child physical activity both directly and indirectly through its positive association with child self-efficacy perceptions. Thus, the relationship between parental support and child physical activity was only partially mediated by child self-efficacy perceptions. Notably, parental physical activity did not directly influence child physical activity.

The present findings did not provide direct support for the frequently studied modeling hypothesis. Parental modeling may be an insufficient influence on youth physical activity because parent activity by itself does not remove important barriers. For example, parent modeling does not help the child develop activity skills, provide contact with active peers, or take the child to an appropriate location for physical activity. Instrumental parental supportive behaviors, consisting of transporting the child, observing activity, and encouraging the child, appeared to be necessary. Although it might be expected that parental modeling of physical activity would be enough to boost the child’s self-efficacy, it was actually the parents’ supportive behaviors that were related to their children’s confidence levels.

The observed path coefficients and explanatory power of this final model were consistent with previous studies examining parental influence from a multidimensional perspective. Holding constant the effects of

Table 3. Correlation among exogenous variables included in Models 1 and 2

Exogenous variables	1	2	3	4	5
Age	1.00				
Gender	0.11*	1.00			
Parental activity	−0.15*	−0.01	1.00		
Parental enjoyment	−0.27*	−0.09	0.37*	1.00	
Parental importance	−0.18*	−0.12*	0.05	0.13*	1.00

*Significant at $p<0.05$.

the other independent variables, a one-standard-deviation increase in parental support was associated with a 0.28 increase in children's physical activity behavior (directly and indirectly via the influence of self-efficacy). Considering the large standard deviation in self-reported physical activity among youth, this effect is of strong public health significance.

Dempsey et al.²⁵ examined the relative influence of parental physical activity behavior and parental beliefs regarding physical activity on children's participation in moderate-to-vigorous physical activity (MVPA). Parental beliefs—in particular, parents' perception of their child's physical activity competence ($\beta = 0.28$)—accounted for 6% of the variance in child MVPA. Notably, we found no evidence of a positive relationship between parental physical activity behavior and child MVPA.

Brustad²⁶ evaluated the relative contributions of parental physical activity behavior, parental enjoyment of physical activity, and parental encouragement of physical activity in predicting children's perceived competence and attraction to physical activity. Among boys and girls, parental enjoyment of physical activity and parental encouragement made significant contributions to the prediction of child physical activity variables. Parental physical activity behavior, however, was not associated with any of the child physical activity variables. Kimiecik and Horn²⁸ also compared the relative contributions of parental activity behavior and parental beliefs regarding their child's physical activity in the prediction of children's physical activity behavior. Neither the mother's nor the father's level of physical activity was associated with child MVPA. In contrast, parental beliefs regarding physical activity accounted for about 27% of the variance in children's MVPA. Collectively, these findings reinforce the notion that parents must be more than active role models if their child is to lead a physically active lifestyle.

Of the three parental physical activity orientations examined in this study, perceived importance of physical activity had the strongest association with parental support for physical activity. Thus, consistent with the central tenets of the major attitude-behavior theories (theory of reasoned action/planned behavior, social cognitive theory), parents were more likely to provide the support necessary for participation in physical activity if they valued the outcomes associated with regular physical activity. Interestingly, perceived importance of physical activity was unrelated to parental physical activity behavior ($r = 0.05$) or parental enjoyment of physical activity ($r = 0.13$). Thus, the supportive parents within this sample rated physical activity participation as very important for their child irrespective of their current physical activity behavior. This observation may be of some significance, considering that approximately 30% of adult Americans report no participation in physical activity.³

The present study had several limitations that warrant consideration. First, the cross-sectional nature of this study precluded our ability to infer causal relationships between the hypothesized parent- and child-level determinants and concurrently measured physical activity behavior. The specified theoretical model was only one "plausible" model of the data, and the direction of regression paths was theoretical and not temporal. Consequently, it is likely that an equally well-fitting model would have resulted if the direction of the paths were reversed. Second, because the analyses relied on self-reported data from individuals within the same family, we were unable to fully discount the possibility of social desirability or recall bias. Third, this study focused specifically on parental influences related to physical activity behavior. It is likely that other important influences on physical activity such as peer support would contribute significantly to the prediction of children's activity behavior. Last, because the sample was mostly white and contained an unusually large number of highly educated parents, these findings may not be fully generalizable to all families. Nevertheless, within the limitations of the study design, the findings provide important information that could be used to design more effective family-based physical activity interventions.

The findings in relation to parental support suggest that intervention programs should adopt strategies that will increase the frequency with which parents and caregivers (1) transport their child to and from physical activity venues, (2) watch their child participate in sport or physical activity, (3) participate in sport and physical activity with their child, and (4) positively reinforce their child for participating in sport or physical activity. At the individual level, educational programs to improve parents' decision-making and time-management skills would be appropriate. However, the long-term impact of such programs would most likely be, at best, modest without concomitant community-level initiatives to promote improved access to quality physical activity programs and facilities.³⁶ Our observation that perceived importance of physical activity was a stronger correlate of parental support than either parental physical activity or parental enjoyment of physical activity suggests that informed but inactive parents can support their children's physical activity as well as active parents can. Hence, interventions to educate parents and caregivers about the importance of regular physical activity during childhood and adolescence are warranted.

In summary, parental support for physical activity mediated the relationship between parental physical activity beliefs and behavior and children's physical activity behavior. The effect of parental support on child physical activity was partially mediated by children's self-efficacy perceptions. Parental physical activity was not directly associated with child physical activity and was unrelated to parents' rating of how important

regular physical activity was for their children. Future physical activity interventions targeted at children and adolescents should include and evaluate the efficacy of individual-level and community-level strategies to increase parents' capacity to provide instrumental and motivational support for physical activity.

This study was funded by a grant from the Cowles Media Foundation.

References

- Centers for Disease Control and Prevention. Guidelines for school and community programs to promote lifelong physical activity among young people. *MMWR Morb Mortal Wkly Rep* 1997;46:1-36.
- Biddle S, Cavill N, Sallis JF. Policy framework for young people and health-enhancing physical activity. In: Biddle S, Sallis JF, Cavill N, eds. *Young and active*. London: Health Education Authority, 1997:3-16.
- U.S. Department of Health and Human Services (USDHHS). *Physical activity and health: a report of the Surgeon General*. Atlanta GA: USDHHS, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996.
- Sallis JF, Owen N, Fotheringham MJ. Behavioral epidemiology: a systematic framework to classify phases of research on health promotion and disease prevention. *Ann Behav Med* 2000;22:294-8.
- Sallis JF, Prochaska JJ, Taylor WC. A review of correlates of physical activity of children and adolescents. *Med Sci Sports Exerc* 2000;32:963-75.
- Taylor WC, Baranowski T, Sallis JF. Family determinants of childhood physical activity: a social cognitive model. In: Dishman RK, ed. *Advances in exercise adherence*. Champaign IL: Human Kinetics, 1994:319-42.
- Prochaska JJ, Rodgers MW, Sallis JF. Association of parent and peer support with adolescent physical activity. *Res Q Exerc Sport* 2002;73:206-10.
- Baranowski T. Families and health actions. In: Gochman DS, ed. *Handbook of health behavior research I: personal and social determinants*. New York: Plenum Press, 1997:179-206.
- Baranowski T, Anderson C, Carmack C. Mediating variable framework in physical activity interventions. How are we doing? How might we do better? *Am J Prev Med* 1998;15:266-97.
- Freedson P, Evenson S. Familial aggregation in physical activity. *Res Q Exerc Sport* 1991;62:384-9.
- Simonen RL, Perusse L, Rankinen T, Rice T, Rao DC, Bouchard C. Familial aggregation of physical activity levels in the Quebec family study. *Med Sci Sports Exerc* 2002;34:1137-42.
- Perusse L, Tremblay A, Leblanc C, Bouchard C. Genetic and environmental influences on level of habitual physical activity and exercise participation. *Am J Epidemiol* 1989;129:1012-22.
- Godin G, Shephard RJ, Colantonio A. Children's perception of parental exercise: influence of sex and age. *Percept Motor Skills* 1986;62:511-6.
- Godin G, Shephard RJ. Psychosocial factors influencing intentions to exercise of young students from grades 7 to 9. *Res Q Exerc Sport* 1986;57:41-52.
- Moore LL, Lombardi D, White MJ, Campbell JL, Oliveria SA, Ellison RC. Influence of parents' physical activity levels on young children. *J Pediatr* 1991;118:215-9.
- Sallis JF, Patterson TL, McKenzie TL, Nader PR. Family variables and physical activity in preschool children. *J Dev Behav Pediatr* 1988;9:57-61.
- Sallis JF, Alcaraz JE, McKenzie TL, et al. Parental behavior in relation to physical activity and fitness in 9-year-old children. *Am J Dis Children* 1992;146:1383-8.
- Anderssen N, Wold B. Parental and peer influences on leisure-time physical activity in young adolescents. *Res Q Exerc Sport* 1992;63:341-8.
- Yang X, Telama R, Laakso L. Parents' physical activity, socioeconomic status and education as predictors of physical activity and sport among children and youth—a 12-year follow-up study. *Int Rev Soc Sport* 1996;31:273-88.
- McMurray RG, Bradley CB, Harrell JS, Bernthal PR, Frauman AC, Bangdiwala SI. Parental influences on childhood fitness and activity patterns. *Res Q Exerc Sport* 1993;64:249-55.
- DiLorenzo TM, Stuckey-Ropp JS, Van Der Wal JS, Gotham HJ. Determinants of exercise among children. II. A longitudinal analysis. *Prev Med* 1998;27:470-7.
- Godin G, Shephard RJ, Colantonio A. Children's perception of parental exercise: influence of sex and age. *Percept Mot Skills* 1986;62:511-16.
- Trost SG, Pate RR, Saunders R, Ward DS, Dowda M, Felton G. A prospective study of the determinants of physical activity in rural fifth-grade children. *Prev Med* 1997;26:257-63.
- Zakarian JM, Hovell MF, Hofstetter CR, Sallis JF, Keating KJ. Correlates of vigorous exercise in a predominantly low SES and minority high school population. *Prev Med* 1994;23:314-21.
- Dempsey JM, Kimiecik JC, Horn TS. Parental influence on children's moderate to vigorous physical activity participation: an expectancy-value approach. *Pediatr Exerc Sci* 1993;5:151-67.
- Brustad RJ. Attraction to physical activity in urban schoolchildren: parental socialization and gender influences. *Res Q Exerc Sport* 1996;67:316-23.
- Kimiecik JC, Horn TS, Shurin CS. Relationship among children's beliefs, perception of their parents' beliefs, and their moderate-to-vigorous physical activity. *Res Q Exerc Sport* 1996;67:324-36.
- Kimiecik JC, Horn TS. Parental beliefs and children's moderate-to-vigorous physical activity. *Res Q Exerc Sport* 1998;69:163-75.
- Brustad RJ. Who will go out and play? Parental and psychological influences on children's attraction to physical activity. *Pediatr Exerc Sci* 1993;5:210-23.
- Trost SG, Pate RR, Sallis JF, et al. Age and gender differences in objectively measured physical activity in youth. *Med Sci Sports Exerc* 2002;34:350-5.
- Sallis JF, Taylor WC, Dowda M, Freedson PS, Pate RR. Correlates of vigorous physical activity for children in grades 1 through 12: comparing parent-reported and objectively measured physical activity. *Pediatr Exerc Sci* 2002;14:30-44.
- Sallis JF, Prochaska JJ, Taylor WC, Hill JO, Geraci JC. Correlates of physical activity in a national sample of girls and boys in grades 4 through 12. *Health Psychol* 1999;18:410-5.
- Sallis JF, Condon SA, Goggin KJ, Roby JJ, Kolody B, Alcaraz JE. The development of self-administered physical activity surveys for 4th grade students. *Res Q Exerc Sport* 1993;64:25-31.
- Ainsworth BE, Haskell WL, Leon AS, et al. Compendium of physical activities: classifications of energy costs of human physical activities. *Med Sci Sports Exerc* 1993;25:71-80.
- Kohl HW III, Hobbs KE. Development of physical activity behaviors among children and adolescents. *Pediatrics* 1998;101:549-54.
- Kahn EB, Ramsay LT, Brownson RC, et al. The effectiveness of interventions to increase physical activity: a systematic review. *Am J Prev Med* 2002;22(suppl 4):73-107.