Short Communication

Enjoyment, self-efficacy, and physical activity within parent-adolescent dyads: Application of the actor-partner interdependence model

Ryan D. Burns[*]

Department of Health, Kinesiology, and Recreation, University of Utah, Salt Lake City, UT, USA

ABSTRACT

It is unclear the role of salient psychosocial variables, such as physical activity (PA) enjoyment and self-efficacy, has on PA within parent-adolescent dyads. The purpose of this study was to examine the interdependent relationships among enjoyment, efficacy, and self-reported PA within parent-adolescent dyads using the Actor-Partner Interdependence Model (APIM). The sample consisted of 1854 parent-adolescent dyads enrolled in the Family Life, Activity, Sun, Health, and Eating (FLASHE) Study. A panel research organization invited panel members balanced to the US population on sex, Census division, household income and size, and race/ethnicity. Panel members were screened for eligibility and web-based surveys were administered to each selected parent-adolescent dyad. Each individual answered questions pertaining to PA enjoyment, PA self-efficacy, and reported weekly PA using validated questionnaires. Interrelationships among the observed variables were analyzed using APIM via a partially recursive path analysis. There was a significant correlation between parent and adolescent PA ($r = 0.15$, $p < 0.001$). Psychosocial variables explained more variance in adolescent PA ($R^2 = 0.252$) than parent PA ($R^2 = 0.037$) and the strongest standardized path coefficients were adolescent enjoyment (b = 0.24; 95%CI: 0.18–0.29; $p < 0.001$) and self-efficacy (b = 0.27; 95%CI: 0.22–0.32; $p < 0.001$) predicting adolescent PA. Adolescent- and parent-driven effects (0.7%–6.5%) and actor-driven effects (3.3%–5.7%) explained the majority of the systematic dyadic covariance in self-reported PA. There is a relatively strong association between adolescent enjoyment and self-efficacy with adolescent PA and the relationship between parent and adolescent self-reported PA is partially explained by parent and adolescent psychosocial variables and actor-driven effects within APIM.

1. Introduction

Physical activity (PA) is related within parent-adolescent dyads due to similarity of environment, thoughts, and affect (Waters et al., 2003; Beets et al., 2010). It has been found that parent-child relationships that foster encouragement/social support correlate with PA (de la Haye et al., n.d.; Belanger-Gravel et al., 2015). Additionally, sedentary times and PA were found to correlate within mother-child dyads and perceived barriers of PA associate with perceived weight among parent-adolescent dyads (Song et al., 2017; Wiseman et al., 2018). Dyadic interventions to promote PA have also shown to yield significant pooled effects (Carr et al., 2019). Further understanding of the complexities of PA behavior and its psychosocial correlates within parent-adolescent dyads is needed for PA promotion and for derivation of family-based PA interventions.

The determinants of PA participation are complex and psychosocial constructs may play a moderating or mediating role. Two pertinent psychosocial constructs are PA self-efficacy and PA enjoyment. Self-efficacy has been shown to be a significant correlate of PA within parent-adolescent dyads and PA enjoyment contributes to intrinsic motivation and has consistently been shown to correlate with PA and other psychosocial constructs (Rutkowski and Connelly, 2012a; Sallis et al., 2000; Cairney et al., 2012). However, it is unclear the role of these psychosocial constructs on correlated PA within parent-adolescent dyads. Fortunately, the Family, Life, Activity, Sun, Health, and Eating (FLASHE) Study provides useful publicly available cross-sectional data that can aid in elucidating these interrelationships (National Cancer Institute, 2018). Data from the FLASHE study captures the interdependence and homogeneity within parent-adolescent dyads that need to be captured due to the similarity in thoughts, behavior, and affect (Kenny et al., 2006). The Actor-Partner Interdependence Model (APIM) considers dyadic interdependence and allows for the analysis of simultaneously estimated actor and partner effects within parent-adolescent dyads, which is precluded using traditional analytical

[*] 1850 East 250 South Room 251, Salt Lake City, UT 84112, USA.
E-mail address: ryan.d.burns@utah.edu.

approaches (Kenny et al., 2006). APIM effects not only can help explain variance in each of the observed outcomes (i.e., parent and adolescent PA) but can also help explain the dyadic covariance (correlation) between parent and adolescent PA (Kenny et al., 2006).

Prior research has shown the positive associations between PA enjoyment and self-efficacy with adolescent PA (Garcia et al., 2016; Rutkowski and Connelly, 2012b). However, examinations of psychosocial factors with PA within parent-adolescent dyads using APIM has been limited. Using FLASHE data, APIM was used to examine how parent and adolescent beliefs associate with health behaviors and the moderating effect of parenting style (Joyal-Desmarais et al., 2019; Lenne et al., 2019). Specifically, this previous work examined self-efficacy and enjoyment within a larger context to determine associations with various parent-adolescent health behaviors, including PA (Joyal-Desmarais et al., 2019; Lenne et al., 2019). However, no study has examined how only the psychosocial variables of PA enjoyment and self-efficacy within dyads associate specifically with parent PA, adolescent PA, and the correlation of PA within dyads. Doing so will provide additional information on how the complex interrelationships specifically between PA enjoyment and self-efficacy associate with parent and adolescent PA and correlated PA behavior. Therefore, the aims of this study were to examine the interdependent relationships among PA enjoyment, efficacy, and self-reported PA within parent-adolescent dyads and to examine the utility for APIM effects to explain the dyadic correlation between parent and adolescent PA. It was hypothesized that both psychosocial variables would significantly predict adolescent and parent PA, there would be statistically significant actor and partner effects, and that actor-driven and partner-driven APIM effects would yield similar explanatory utility on PA dyadic covariance.

2. Methods

2.1. Participants

A non-probability sample of dyads from the US was recruited. Ipsos, a panel research organization, invited individuals to join its panel through print ads, internet banner ads, random digit dialing omnibus surveys, and panelist referrals (Oh et al., 2017). A sample of panel members who were balanced to the US population on sex, Census division, household income and size, and race/ethnicity were screened for eligibility. Within each eligible household, one adolescent (12–17 years old) was selected. A total of 1945 dyads fully enrolled (Oh et al., 2017). The FLASHE study received approval from the Office of Management and Budget, the NIH Institutional Review Board, and the Westat Institutional Review Board (Oh et al., 2017).

2.2. Procedures

Web-based PA surveys were administered to each dyad member (Oh et al., 2017; Saint-Maurice et al., 2017). Each individual was linked to one other individual by a common dyad numerical identifier. The two dependent variables were self-reported weekly adolescent and parent PA. Adolescent (i.e., "Teen") weekly PA was calculated using the validated Youth Activity Profile (YAP) (Saint-Maurice et al., 2017). The adolescent PA score was the aggregated YAP raw score across school, out-of-school, and weekend time intervals and parent weekly PA was calculated using the validated International Physical Activity Questionnaire (IPAQ)-Short Form (Craig et al., 2003). Parent PA scoring was MET-minutes per week, calculated using the suggested procedures provided on the IPAQ Short Form (Craig et al., 2003). Despite adolescent and parent PA being different outcome measures, use of standardized coefficients negates the need for PA scores to be on the same scale. The independent variables were PA enjoyment and efficacy, both scored on a 1–5 Likert Scale (1 = "Strongly Disagree", 5 = "Strongly Agree"). The enjoyment score was an average across two items asking "If I were to be physically active most days, it would: Be fun" and "I

don't like to exercise". The latter enjoyment item was reverse coded for analysis. The efficacy question was "I feel confident in my ability to exercise regularly". One item each was used for both constructs so that the same items were used for both partners and to keep item total homogenous between constructs. A total of 1854 parent-adolescent dyads were included in the following APIM analyses (95.3% of enrolled dyads).

2.3. Statistical analysis

A Pearson product-moment correlation was used to determine the standardized covariance between adolescent and parent PA. APIM was conducted using a partially recursive path analysis with correlated errors constructed using STATA's "sem builder". Maximum likelihood with missing data was used to estimate the model. Path models were constructed incorporating parent and adolescent PA enjoyment, efficacy, and self-reported PA using the total sample and within sex groups to test for effect modification. All models were adjusted for adolescent age. Parent age, BMI, and race/ethnicity were found not to be predictors of teen or parent PA; therefore, they were not included as covariates. All path coefficients were standardized and computed with 95% Confidence Intervals. Equation-level goodness of fit information was obtained using post-estimation coefficients of determination (R^2) using STATA's "estat eqgof" command.

Four cumulative APIM effects were calculated per model to help explain dyadic covariance in PA. These four cumulative APIM effects consisted of teen-driven effects, parent-driven effects, actor-driven effects, and partner-driven effects. Teen-driven effects are the relationships between an adolescent's psychosocial variable score and his or her own PA score and his or her parent's PA score. APIM teen-driven effects were calculated by multiplying the teen standardized path coefficients within a respective predictor variable. Parent-driven effects are the relationships between a parent's psychosocial variable score and his or her own PA score and his or her child's PA score. APIM parent-driven effects were calculated by multiplying the parent standardized path coefficients within a respective predictor variable. An actor-driven effect is the relationship between an individual's psychosocial variable score and his or her own PA score. APIM actor-driven effects were calculated by multiplying a predictor variable's standardized covariance between teens and parents and the actor standardized path coefficients within a respective predictor variable. A partner effect is the relationship between an individual's psychosocial variable score and his or her partner's PA score. APIM partner-driven effects were calculated by multiplying a predictor variable's standardized covariance between teens' and parents' and the partner standardized path coefficients within a respective predictor variable. Calculation of these 4 APIM effects can help identify if PA dyadic covariance is explained more by teen-driven or parent-driven relationships and if PA dyadic covariance is explained more by actor-driven or partner-driven relationships. Conceptualization and further explanation of the calculation of these 4 APIM effects are provided on the US National Cancer Institute's FLASHE website. All analyses had an initial alpha level of $p < 0.05$ and were carried out using STATA v15.0 statistical software package (College Station, Texas, USA).

3. Results

Descriptive statistics are reported in Supplementary Table 1. Using the total sample, the bivariate correlation in self-reported PA within parent and adolescent dyads was positive, small in magnitude, but statistically significant ($r = 0.15$, $p < 0.001$). The bivariate correlation in PA between parents and adolescents was stronger in girls ($r = 0.20$, $p < 0.001$) than in boys ($r = 0.11$, $p < 0.001$).

Fig. 1 is the schematic diagram of the interdependent relationships between the psychosocial variables and self-reported PA within dyads for the total sample. Schematic diagrams within specific sex groups are
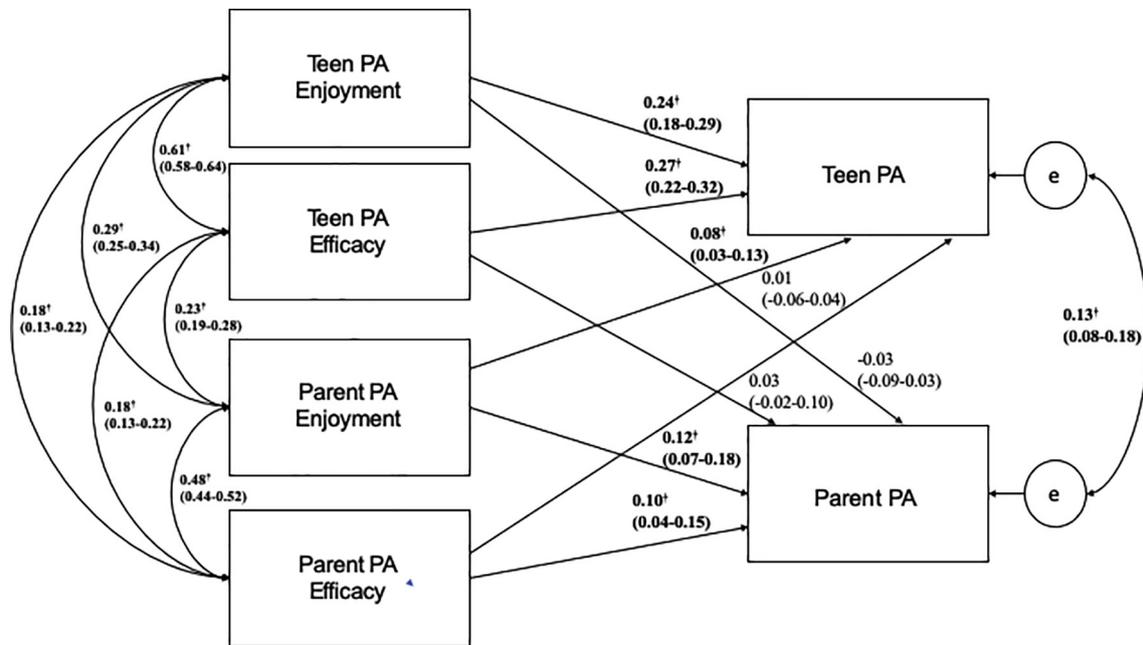
Fig. 1. Schematic diagram showing the dyadic interrelationships among adolescent and parent enjoyment, efficacy, and weekly self-reported physical activity using the total sample.

Note: PA stands for physical activity; all coefficients are standardized with 95% Confidence Intervals; bold and [†] denotes significant path coefficients, $p < 0.05$; model adjusted for adolescent age.

reported within the Supplementary Material. Using the total sample, the model explained approximately 25.2% of the variance in adolescent PA and 3.7% of the variance in parent PA. All actor path coefficients were statistically significant with the strongest coefficient being teen self-efficacy associating with teen PA ($p < 0.001$). There was one partner effect with parent PA enjoyment associating with teen PA ($p < 0.001$). The adolescent age covariate significantly associated with adolescent PA (b = −0.12, 95%CI: −0.17 to −0.08, $p < 0.001$), adolescent PA enjoyment (b = −0.09, 95%CI: −0.14 to −0.04, $p < 0.001$), and adolescent PA self-efficacy (b = −0.06, 95%CI: −0.10 to −0.01, $p = 0.024$), but did not significantly relate with parent variables. Most paths were not significantly moderated by sex (see Supplemental Figs. 1 and 2) and the magnitudes of explained variance on parent and adolescent PA were similar between sexes.

Table 1 reports the cumulative APIM effects for the total sample. Cumulative APIM effects explained 27.0% of the dyadic covariance in PA. In general, APIM effects were strongest for teen- and parent-driven effects and for actor-driven effects. Partner-driven effects explained very little variance in the dyadic covariance. APIM effects within specific sex groups are reported in Supplementary Table 2.

4. Discussion

Within the APIM model, all actor path coefficients were statistically significant. These findings are congruent with past research and indicate that an individual's PA enjoyment and/or self-efficacy associates stronger with their self-reported PA than their partners' enjoyment and/or self-efficacy (Cairney et al., 2012; Joyal-Desmarais et al., 2019; Lenne et al., 2019). Indeed, partner effects yielded little to no explanatory power on either adolescent or parent PA or on the dyadic covariance. There was only one observed partner effect with parent PA enjoyment positively associating with adolescent PA. These results suggest that targeting enjoyment on both the parent and adolescent may yield favorable effects on their own PA behavior, especially in adolescents. Additionally, the positive correlation between parent and adolescent PA enjoyment may have important implications for intervention design, as parents and adolescents may have similar

Table 1
APIM effects on the correlation between parent and adolescent self-reported physical activity (relative and absolute effects).

Predictor	Effect	Total sample model
Enjoyment	Teen-effect driven	4.9% (0.007)
	Parent-effect driven	6.5% (0.010)
	Actor-effect driven	5.7% (0.008)
	Partner-effect driven	0.5% (0.0007)
Self-efficacy	Teen-effect driven	5.5% (0.008)
	Parent-effect driven	0.7% (0.001)
	Actor-effect driven	3.3% (0.005)
	Partner-effect driven	0.0% (0.0000)
	Total APIM effect	27.0% (0.0397)
	Residual	73.0% (0.1073)
	Total	100% (0.147)

Note: APIM stands from Actor-Partner Interdependence Model.

perspectives on the enjoyment of PA and thus their enjoyment for PA may associate with PA behaviors. Indeed, child PA enjoyment has been shown to predict both parent PA enjoyment and child and parent PA longitudinally (Kruk et al., 2018).

In addition to adolescent PA enjoyment associating with adolescent PA, another relatively strong relationship was adolescent self-efficacy associating with adolescent PA. This is congruent with past research (Cairney et al., 2012; Rutkowski and Connelly, 2012b), and supports the importance of higher levels of self-efficacy in the promotion of PA in adolescents. Parent self-efficacy associated less strongly with parent PA. Because of the relative stronger associations observed in adolescents,

and the lack of partner effects using the self-efficacy predictor, and actor-driven effects explaining more dyadic covariance than partner-driven effects, targeting individual enjoyment and efficacy may be a better strategy than targeting an individual's partner for the promotion of PA, especially in adolescents where psychosocial variable explanatory power tended to be stronger. These observed relationships were not modified by sex, therefore dyadic PA interventions targeting the enjoyment and self-efficacy psychosocial variables may be similarly effective for both sexes.

Limitations to this study include a non-probability convenience sample, the use of self-report surveys, and a cross-sectional design that precludes causative effects. It is questionable if the results generalize to younger or older age groups. Furthermore, the use of more objective assessments of PA within longitudinal research designs may have merit for future research. Additionally, enjoyment and efficacy were assessed using 1–2 items rather than the use of scales, thus sensitivity is compromised. The psychosocial variable relationships with PA may also be moderated by time of day. Finally, other household influences were not explored including psychosocial influences of siblings and/or another parent or guardian.

5. Conclusion

This study supports that the psychosocial variables of PA enjoyment and self-efficacy may have a greater positive association on adolescent PA than parent PA and that the relationship in PA between parents and adolescents is partially explained by adolescent-driven effects, parent-driven effects, and actor effects within APIM.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2019.105756.

Declaration of Competing Interest

None declared.

Acknowledgments

References

Beets, M.W., Cardinal, B.J., Alderman, B.L., 2010. Parental social support and the physical activity-related behaviors of youth: a review. Health Educ. Behav. 37 (5), 621–644. https://doi.org/10.1177/1090198110363884.

Belanger-Gravel, A., Gauvin, L., Lagarde, F., Laferte, M., 2015. Correlates and moderators of physical activity in parent-tween dyads: a socio-ecological perspective. Public Health 129 (9), 1218–1223. https://doi.org/10.1016/j.puhe.2015.05.019.

Cairney, J., Kwan, M.Y.W., Velduizen, S., et al., 2012. Gender, perceived competence and the enjoyment of physical education in children: a longitudinal examination. Int. J. Behav. Nutr. Phys. Act. 9, 26. https://doi.org/10.1186/1479-5868-9-26.

Carr, R.M., Prestwich, A., Kwasnicka, D., et al., 2019. Dyadic interventions to promote physical activity and reduce sedentary behaviour: systematic review and meta-analysis. Health Psychol. Rev. 13 (1), 91–109. https://doi.org/10.1080/17437199.2018.1532312.

Craig, C.L., Marshall, A.L., Sjöström, M., et al., 2003. International physical activity questionnaire: 12-country reliability and validity. Med. Sci. Sports Exerc. 35 (8), 1381–1395. https://doi.org/10.1249/01.MSS.0000078924.61453.FB.

Garcia, J.M., Sirard, J.R., Larsen, R., et al., 2016. Social and psychological factors associated with adolescent physical activity. J. Phys. Act. Health 13 (9), 957–963. https://doi.org/10.1123/jpah.2015-0224.

de la Haye K, de Heer HD, Wilkinson AV, Koehly LM. Predictors of parent-child relationships that support physical activity in Mexican-American families. J. Behav. Med. 37(2):234–244. doi:https://doi.org/10.1007/s10865-012-9471-8.

Joyal-Desmarais K., Lenne RL, Panos ME, et al. Interpersonal effects of parents and adolescents on each other's health behaviours: a dyadic extension of the theory of planned behaviour. Psychol Health. 2019;8:1–21. doi:https://doi.org/10.1080/08870446.2018.1549733

Kenny, D.A., Kashy, D.A., Cook, W.L., 2006. Dyadic data analysis. Guilford, New York.

Kruk, M., Zarychta, K., Horodyska, K., et al., 2018. From enjoyment to physical activity or from physical activity to enjoyment? Longitudinal associations in parent-child dyads. Psychol. Health 33 (10), 1269–1283. https://doi.org/10.1080/08870446.2018.1489049.

Lenne, R.L., Joyal-Desmarais, K., Jones, R.E., et al., 2019. Parenting styles moderate how parent and adolescent beliefs shape each other's eating and physical activity: dyadic evidence from a cross-sectional, US National Survey. J Exp Soc Psychol. 81, 76–84. https://doi.org/10.1016/j.jesp.2018.06.003.

Masse, L.C., Lytle, L.A., 2017. Advancing knowledge of parent-child dyadic relationships about multiple cancer preventative health behaviors: The National Cancer Institute Family Life, Activity, Sun, Health, and Eating (FLASHE) Study. Am J Prev Med. 52 (6), 833–835.

Oh, A.Y., Davis, T., Dwyeer, L.A., et al., 2017. Recruitment, enrollment, and response of parent-adolescent dyads in the FLASHE study. Am. J. Prev. Med. 52 (6), 849–855. https://doi.org/10.1016/j.amepre.2016.11.028.

Rutkowski, E.M., Connelly, C.D., 2012a. Self-efficacy and physical activity in adolescent and parent dyads. J Spec Pediatr Nurs. 17 (1), 51–60. https://doi.org/10.1111/j.1744-6155.2011.00314.x.

Rutkowski, E.M., Connelly, C.D., 2012b. Self-efficacy and physical activity in adolescent and parent dyads. J Spec Pediatr Nurs. 17 (1), 51–60. https://doi.org/10.1111/j.1744-6155.2011.00314.x.

Saint-Maurice, P.F., Kim, Y., Hibbing, P., et al., 2017. Calibration and validation of the youth activity profile: the FLASHE study. Am. J. Prev. Med. 52 (6), 880–887. https://doi.org/10.1016/j.amepre.2016.12.010.

Sallis, J.F., Prochaska, J.J., Taylor, W.C., 2000. A review of correlates of physical activity of children and adolescents. Med. Sci. Sports Exerc. 32 (5), 963–975.

Song, M., Diekmann, N.F., Stoyles, S., et al., 2017. Associations between mother's and children's moderate-to-vigorous physical activity and sedentary time in the family context. Prev. Med. Rep. 8, 197–203. https://doi.org/10.1016/j.pmedr.2017.10.012.

Waters, E., Stewart-Brown, S., Fitzpatrick, R., 2003. Agreement between adolescent self-report and parent reports of health and well-being: results of an epidemiological study. Child Care Health Dev. 29 (6), 501–509. https://doi.org/10.1046/j.1365-2214.2003.00370.x.

Wiseman, K.P., Patel, M., Dwyer, L.A., Nebeling, L.C., 2018. Perceived weight and barriers to physical activity in parent–adolescent dyads. Health Psychol. 37 (8), 767–774. https://doi.org/10.1037/hea0000635.