

Social network analysis in child and adolescent physical activity research: A systematic literature review

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Background



Physical activity is positively linked to increased cognitive functioning and reduced depressive symptoms and risk of diabetes



Only 59.3% of children and 27.5% of adolescents meet recommendations



Significantly impacted by social connections through social support, co-participation, and social norms



Social Network Analysis is a set of tools and theories to analyze patterns in social structure (connections, behaviors, and outcomes)

1) Focused on children (ages 5-11 years) or adolescents (ages 12-17 years)¹

2) Include a measure of PA

3) Include a measure of social connection in which alters were nominated

4) Perform an analysis between network data and PA

Search Criteria

Records identified through database searching (n = 11,824)

Abstracts reviewed (n = 138)

Full-text articles reviewed (n = 46)

Final Sample (n = 30)

Key Findings

Cross-Sectional
(n=18)


- Homophily
- Composition

Longitudinal
(n=9)

- Selection / Influence

Intervention
(n=3)

- Opinion leaders
- Intervention effects moderated by peer behavior



Network
Generating
Prompts

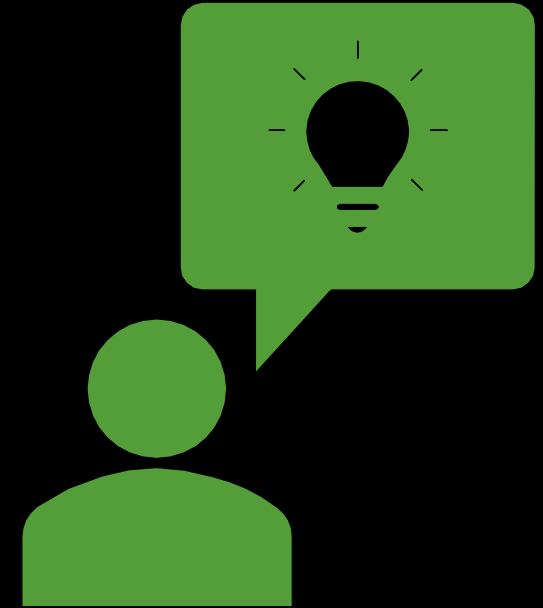
Minority
Networks

Interventions

Next Steps

Implications

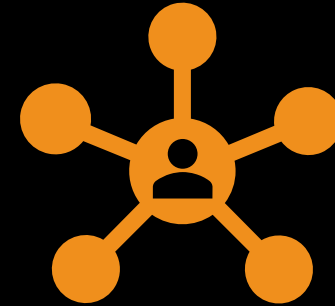
- Utilize network connections and concepts to more effectively make an impact.
- Programs which encourage children and adolescents to be physically active together - peer reinforcement.
- Helping children and adolescents find commonalities (homophily)



Conclusions



Network properties were important in describing and predicting PA among children and adolescents.



Researchers concerned with the social context of PA and play should look to utilize SNA.

“To speak of social life is to speak of the association between people – their associating in work and in play, in love and in war, to trade or to worship, to help or to hinder. It is in the social relations men establish that their interests find expression and their desires become realized.”

Peter M. Blau

Exchange and Power in Social Life, 1964

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Citation	Study Design	Age Group	PA Measure	Network Measure	Findings
(Ali, Amialchuk, & Heiland, 2011) ³⁵	Longitudinal	Adolescent	Self-Reported	Sociocentric	Significant positive association between individuals’ and friends’ PA behaviors.
(de la Haye, Robins, Mohr, & Wilson, 2010) ³³	Cross-Sectional	Adolescent	Self-Reported	Sociocentric	There was no evidence that friends were similar in non-organized PA. Boys who did the most organized PA tended to be the most popular.
(de la Haye, Robins, Mohr, & Wilson, 2011) ³⁶	Longitudinal	Adolescent	Self-Reported	Sociocentric	Participants tended to befriend peers with similar levels of PA and then emulated their friends’ behaviors.
(Garcia et al., 2017) ⁴⁰	Cross-Sectional	Adolescent	Accelerometer (Ego) Self-Reported (Alter)	Egocentric	Friends influenced whether adolescents engaged in screen time behaviors, with active friends encouraging less screen time.
(Garcia, Sirard, Deutsch, & Weltman, 2016) ⁴¹	Cross-Sectional	Adolescent	Accelerometer (Ego) Self-Reported (Alter)	Egocentric	Greater levels of friends’ MVPA was associated with greater levels of MVPA in both males and females. Greater levels of friends’ screen time were associated with greater levels of screen time in males. Females preferred activity with a close friend while males preferred to be active with a group.
(Garcia et al., 2018) ⁴²	Cross-Sectional	Adolescent	Accelerometer (Ego) Self-Reported (Alter)	Egocentric	Normal weight adolescent’s PA was associated with friends’ PA.
(Gesell, Tesdahl, & Ruchman, 2012) ³⁰	Longitudinal	Child	Accelerometer	Sociocentric	Children did not form or dissolve friendships based on PA levels, but existing friendships heavily influenced children’s level of PA. The strongest influence on the amount of time children spent in moderate-to-vigorous activity in the afterschool hours was the activity level of their immediate friends.
(Henry, Gesell, & Ip, 2016) ⁵³	Longitudinal	Child	Accelerometer	Sociocentric	There was heterogeneity in the effect of PA on the formation and dissolution processes, both across time and between networks.
(Jago et al., 2011) ³⁷	Cross-Sectional	Child	Accelerometer	Best Friend Dyads	For girls, mean MVPA was associated with frequency of activity of best friend. Boys’ mean MVPA was associated with their best friend's mean MVPA.
(Larson, Wall, Story, & Neumark-Sztainer, 2013) ⁴³	Cross-Sectional	Adolescent	Self-Reported	Sociocentric	Across models, peer environments (e.g., higher proportion of male friends who were overweight) were consistently associated with higher BMI z-scores among both boys and girls. Among girls, lower PA among female friends was consistently associated with higher BMI z-scores.
(Livesey, Lum Mow, Toshack, Zheng, 2011) ³⁹	Cross-Sectional	Child	Self-Reported	Sociocentric	Children with poor motor performance were less preferred by their peers in both play and classroom settings.
(Long, Barrett, & Lockhart, 2017) ⁴⁴	Longitudinal	Adolescent	Self-Reported	Sociocentric	No selection effect was found for PA; conversely, assimilation to friends' behavior occurred.
(Lopes, Gabbard, & Rodrigues, 2013) ⁴⁵	Cross-Sectional	Adolescent	Self-Reported	Best Friend Dyads	High degree of similarity between best friend dyad in PA, except for walking. The age and sex of the best friend were important predictors of PA but reciprocity in friendship was not.
(Lopes, Gabbard, & Rodrigues, 2016) ⁴⁶	Cross-Sectional	Adolescent	Self-Reported	Best Friend Dyads	Significant similarities between reciprocal best friend dyads for PA and sitting time, and for sitting time in non-reciprocal best friends.
(Macdonald-Wallis, Jago, Page, Brockman, & Thompson, 2011) ³⁸	Cross-Sectional	Child	Accelerometer	Sociocentric	Spatial autocorrelation of mean MVPA (I = .346) in the data, indicating that children clustered in friendship groups with similar activity levels.
(Marks, de la Haye, Barnett, & Allender, 2015) ⁵⁵	Cross-Sectional	Child and Adolescent	Accelerometer, Self- report	Egocentric	Perceived activity levels of friends, and friendships with very frequent interaction were associated with outside-of-school PA and/or sedentary/screen time. A higher number of friends and greater proportion of same sex friends were associated with boys engaging in more moderate-to-vigorous PA outside of school hours. PA intensity during school-day breaks was positively associated with having a greater proportion of friends who played sports for girls.
(Marks, de la Haye, Barnett, & Allender, 2018) ⁴⁷	Longitudinal	Adolescent	Self-Reported	Egocentric	Number of friends positively associated with PA intensity (males) and screen time (females).
(Martin-Matillas et al. 2011) ⁴⁸	Cross-Sectional	Adolescent	Self-Reported	Egocentric	Father’s and older brother’s PA were associated with boys’ PA. When both parents reported being active, boys had nearly two times higher odds of being active and girls had nearly three times higher odds of being active.
(Ommundsen, Gundersen, & Mjaavatn, 2010) ³⁴	Longitudinal	Child	Accelerometer	Sociocentric	1st grade motor proficiency and objectively measured PA, but not weight status was predictive of 4th grade social standing among pupils in class. Being physically active in the 1st grade seems more important for social standing among peers in 4th grade for 1st grade girls than for boys.
(Raudsepp & Viira, 2000) ²⁹	Cross-Sectional	Adolescent	Self-Reported	Egocentric	PA of the father, older brother, and best friend were associated with a higher activity level of adolescents
(Salway, Sebire, Solomon-Moore, Thompson, & Jago, 2018) ⁵⁴	Cross-Sectional	Child	Accelerometer	Sociocentric	PA and sedentary time of boys and girls are associated with same-sex friendship networks. The correlation between friends was stronger for boys than girls, and stronger for MVPA than for sedentary time.
(Sawka et al., 2014) ⁴⁹	Cross-Sectional	Adolescent	Self-Reported	Sociocentric	Adolescents with no friendship nominations participated in less MVPA. For boys and girls, a 10% increase in active friends was positively associated with achievement of 60 minutes/day of MVPA. Boys in higher density networks were more likely to participate in over 2 hours/day of sedentary behavior.
(Schofield, Mummery, Schofield, & Hopkins, 2007) ³²	Cross-Sectional	Adolescent	Pedometer	Sociocentric	The relationship between an individual girl and her first-nominated reciprocal friend's PA level was moderate, when the friendship was nonreciprocal it was trivial. Friends' PA levels explained between 27% and 32% of an individual's PA.
(Shin et al., 2014) ²²	Intervention	Child	Self-Reported	Sociocentric	Program participation effects were moderated by peer influence, but only when unhealthy peer influence was present.
(Simpkins, Schaefer, Price, & Vest, 2013) ⁵⁰	Longitudinal	Adolescent	Self-Reported	Sociocentric	Friendships were more likely among adolescents who engaged in greater PA and who were similar to one another in BMI and PA
(Sirard et al., 2013) ⁵¹	Cross-Sectional	Adolescent	Self-Reported	Sociocentric	PA for female adolescents was associated with their friends' PA, including their male and female best friends. Male adolescents' PA was associated with their female friends' PA. Female adolescents' screen time was associated with their male and female friends' screen time, but not with that of their best friends.
(van Woudenberg et al., 2018) ⁵⁶	Intervention	Child and Adolescent	Accelerometer	Sociocentric	In the intervention condition, the most influential adolescents (based on peer nominations of classmates) in each classroom were trained to promote PA among their classmates. No intervention effect was observed.
(Voorhees et al., 2005) ⁵²	Cross-Sectional	Adolescent	Self-Reported	Egocentric	Frequency of PA with friends was an important correlate of PA among the peer network variables for adolescent girls.
(Yli-Piipari, Jaakkola, Liukkonen, Kiuru, & Watt, 2011) ³¹	Longitudinal	Adolescent	Self-Reported	Sociocentric	Adolescent peer groups were moderately homogeneous in terms of PA. Girls' peer groups were more homogeneous than those of boys.
(Zhang, Shoham, Tesdahl, & Gesell, 2015) ⁵⁷	Intervention	Simulation	Accelerometer	Sociocentric	The intervention that targeted opinion leaders was effective in increasing the average level of PA across the entire network. However, the intervention that targeted the most