Identifying Social Network Characteristics Associated With Youth Physical Activity Skill Competency at a Summer Care Program

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While literature suggests that youth physical activity (PA) behaviors are affected by network influences, less is known about network influences on perceived skill competency, a component of physical literacy and self-efficacy. This study aims to provide an understanding of potential network characteristics which are associated with youth PA skill competency. Youth (n = 158) between the ages of 8 and 12 years recruited from two summer care programs (i.e., Boys & Girls Clubs) participated in researcher-administered surveys. Youth self-reported their age, sex, involvement in team sports, weekly PA, and skill competency assessed using a version of the PLAYself measure. Youth were also asked to report up to five people in the summer program and five out of the program with whom they interacted the most. Linear regression was used to evaluate associations between skill competency and demographics, PA, and social network characteristics. Skill competency was significantly associated (R^2 = .17) with age (β = –.06, p = .01), sex (β = –.06, p = .01), sports team involvement (β = .16, $p < .001$), and weekly PA (β = –.20, $p < .001$). Skill competency was also significantly associated with the number of connections with whom the youth played frequently (β = .09, $p < .001$), the number of connections that helped the youth to be active (β = .18, $p < .001$), and the heterogeneity of the type of relationships within the youth's network (β = .11, $p < .001$). Skill competency scores were significantly associated with both individual variables and social network composition. In addition, youth with networks comprising several types of relationships (heterogeneity) reported a significantly high skill competency. PA interventions can be most effective when considering the reinforcing aspects of networks and skill competency.

Keywords: physical activity; social networks; self-efficacy; adolescents; social influence; friends; summer care program

Engaging in physical activity (PA) regularly in adolescence has shown positive effects on executive functions, attention, and academic performance (de Greeff et al., 2018). The recommended PA for youth is 60 min daily of moderate to vigorous exercise (Piercy et al., 2018). Despite the many benefits of engaging in PA, studies report youth show significantly low levels of PA across the globe (Aubert et al., 2022). Youth perceive one of the barriers to participating in PA is the negative PA experiences at school and physical education (Shepherd et al., 2006). Meanwhile, perceived

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benefits of participating in PA are positive physical education experiences, personal factors (fun, perceived competence), support of family and friends, and access to PA programs (Allender et al., 2006, 2007; Shepherd et al., 2006). Perceived physical skill competency, or confidence in one's ability to perform movements related to physical activities, is significantly associated with increased youth PA (Inchley et al., 2011). In this way, physical skill competency is similar to self-efficacy, but further narrows the definition to specify skills related to PA (Rodgers et al., 2014). Fostering physical skill competency could translate to improved health and well-being (Powell et al., 2018). Furthermore, understanding the social dynamics around skill competency may provide insights on how to improve these feelings in youth.

School environments offer many opportunities for students to be physically active during the school day (Lewallen et al., 2015). School days (i.e., typical weekday) are fundamentally different from less-structured days, such as weekend days or summer days, due to the fact that they consistently contain a daily structure and routine with intentional (e.g., recess, physical education, before/after school programs, organized sports programs) and unintentional (e.g., regular transitions between activities, walking to school) PA opportunities for the majority of youth through the school day (Brazendale et al., 2017). In contrast, youth are often less physically active during summer compared to school (McCue et al., 2013). In addition, youth participate in more screen time, minimize consistent sleep schedules, and increase access to unhealthier foods at home during the summer (Brazendale et al., 2017). Consistently, during summer days, youth PA has been found to decrease by 18% when compared with school days (Volmut et al., 2020). Programs with PA programming, such as summer care programs, can provide opportunities to increase youth PA during this time of decline (Beets et al., 2016).

Research studies have suggested that social connections play a significant role in youth PA (Prochnow, Delgado, et al., 2020). The social connections among youth can help to understand their health behaviors (Prochnow, Delgado, et al., 2020). Social network analysis (SNA) is a set of approaches that define the meaning of connections and describe the influence of social influences within a network (Valente et al., 2010). Friendships have been shown to play an important role in shaping PA behaviors; conversely, PA has also been known to shape friendship selection (Macdonald-Wallis et al., 2012). Specifically, social network concepts of homophily and heterogeneity are common network structures that researchers highlight to define and analyze networks. Homophily is defined as the tendency for people to affiliate and associate with others like themselves (Valente et al., 2010). For example, individuals are more likely to become friends based on similarities in sex, ethnicity, socioeconomic status, religion, and behavior (McPherson et al., 2006). Heterogeneity, on the other hand, is a measure of variety or variability in the connections present within a network (Jadbabaie et al., 2013; Uchino et al., 2004; Valente et al., 2010). Helping youth find commonalities (homophily) or learn from differences (heterogeneity) could increase the likelihood that they will choose to continue being physically active. Adolescence is a sensitive period that triggers or enables a shift in health behavior due to family, friends, and educational experiences. Health behavior in adolescence is influenced by neighborhood and school environment, as well as family and friends' influences (Blum et al., 2012). Furthermore, these influences can be conceptualized as social support and expectations of certain behaviors through interpersonal relationships based on an ecological perspective (Heaney & Israel, 2008). Therefore, such network diversity can bring in different ideas, resources, and new perspectives to make the individual feel more encouraged and confident in their ability to be physically active.

PURPOSE

The composition of youth social network and social connections can affect the way they think and behave (McCarty et al., 2019). While literature suggests that youth PA behaviors are affected by network influences (Prochnow, Delgado, et al., 2020), less is known about network influences on perceived PA skill competency. This study aimed to determine network characteristics which are associated with PA skill competency for youth. In summer care programs, a better understanding of how social networks may influence PA skill competency could shed light on how the programs' practitioners may help foster and improve skill competency through programming and social reinforcement.

METHOD

Design and Sample

All data were collected at two summer care programs (i.e., Boys & Girls Clubs), and youth participating in this study were 8–12 years old. All youth between the ages of 8 and 12 years were invited to participate in the study. This age was selected to correspond to age groupings at these summer programs. Programs were based in Wisconsin and Texas. Parents/guardians were informed of the study and were able to withdraw their youth from the study at any time. Youth were asked to provide written assent prior to participating. All youth

were able to participate in researcher-administered surveys at the beginning of the summer care program. This study was approved by the Institutional Review Board of the referent University prior to the start of the study.

Demographic Information

Demographic information was collected by self-report survey, including age (in years), sex (boy or girl), race, and ethnicity. Respondents were also asked to report how many sports teams they were involved with over the last year from response options of 0, 1, 2, and 3 or more.

Physical Activity

A portion of the World Health Organization's Health Behavior School Aged Children survey was used to assess PA (Booth et al., 2001). Youth were asked to report how often they engaged in PA each week. Youth were given examples of PA such as sports, dance, or any active play that makes them sweat or breathe hard. The youth was then asked, "How many hours are you usually physically active in your free time, so much that you get out of breath or sweat each week?" A Likert-type scale was used with the following response options which were then coded 0 to 5, respectively: "none," "about half an hour per week," "about one hour per week," "about 2–3 hours per week," "about 4–6 hours per week," or "about 7 hours per week or more."

Perceived Skill Competency

Perceived skill competency was measured by an adaptation of the PLAYself physical literacy assessment form (Cairney et al., 2016). The PLAYself assesses youth perceived skill competence in a variety of settings. Youth were asked to report "how good do you feel you are at physical activities . . ." with specific items for locations such as at school, outdoors, on the playground, and in your yard (outside your home). Youth could respond "never tried," "not so good," "okay," "very good," or "excellent," which were then coded 0 to 4, respectively. Items were summed to provide a scale sum score, with a possible range of 0 to 16.

Network Data

Youth were asked to report the names of up to five peers at the summer care program (in-program) and up to five people outside the program (out of program) with whom they interacted the most. In SNA, these people listed as members of the youth's network are termed "alters." Youth answered several questions regarding each alter they listed, including the alter's sex ("boy" or "girl"), age, relationship ("sibling," "friend," "mother," "father," "relative"), where the alter's live ("in household," "in neighborhood," "outside neighborhood," or "I don't know"), how often the youth actively played with each alter ("often," "sometimes," "rarely"), how many hours the youth thought each alter was active each week ("none," "about half an hour per week," "about one hour per week," "about 2–3 hours per week," "about 4–6 hours per week," or "about 7 hours per week or more"), and if the alter helped the youth to be active ("yes," "no"). These network questions were developed from previous studies and experience (Prochnow et al., 2021a, 2021b; Prochnow, Patterson, Bridges Hamilton, & Umstattd Meyer, 2022; Prochnow, Patterson, Meyer, & Umstattd Meyer, 2022; Prochnow, Patterson, & Umstattd Meyer, 2020; Prochnow, Patterson, Umstattd Meyer, et al., 2022).

DATA ANALYSIS

Network composition variables were created for each youth to show social norm of PA (average PA hours per week perceived in network), social support (number of alters that helped the youth to be active), co-participation (number of frequent play partners in network), preference for same sex alters (percent of network of the same sex as youth), and variety in social connection (heterogeneity of relationships present within the network). A linear regression model was used to examine significant associations between youth perceived skill competency and age, sex, grades, self-reported PA, participation in team sports, and the network composition variables listed above. Data analysis was conducted with IBM SPSS v. 28 (IBM, Chicago, IL, USA).

RESULTS

In total, 158 youth responded to the survey, 46.8% were boys (n = 74) and 53.2% were girls (n = 84), with a mean age of 10.04 years (SD = 1.26). In this sample, 34.7% of the youth identified as Black or African American (n = 84), 24.4% as White (n = 51), 10.2% as multiracial (n = 18), and 3.2% as other (n = 5). In addition, 26.9% of youth identified as Hispanic and/or Latinx (n = 58). Regarding team sport participation, 24.0% (n = 50) of youth reported no team sport participation, 21.8% (n = 42) participated in one team, and 17.3% (n = 33) participated in two or more teams. Youth reported a mean perceived skill competency sum of 11.54 (SD = 2.47) and a mean weekly PA of 3.25 (SD = 1.41), which indicates youth reported just over 2 to 3 hours of PA per week. Sample characteristics can be found in Table 1.

TABLE 1
Sample Characteristics (n = 158 Adolescents)

Variable name	*n*	*%*	*M*	*SD*
Age			10.04	1.26
Gender				
Boy	74	46.8%		
Girl	84	53.2%		
Race				
White	51	24.4%		
Black or African American	84	34.7%		
Other	5	3.2 %		
Multiracial	18	10.2%		
Ethnicity				
Hispanic	58	26.9%		
Non-Hispanic	100	38.8%		
Self-reported weekly PA				
None	3	1.9%		
About half an hour per week	24	13.2%		
About 1 hr per week	18	10.2%		
About 2–3 hr per week	48	23.3%		
About 4–6 hr per week	26	14.1%		
About 7 hr per week or more	39	19.8%		
Team sport participation				
0 teams	50	24.0%		
1 team	42	21.8%		
2 teams	33	17.3%		
3 or more teams	33	17.3%		
Skill competency			11.54	2.47

Note. PA = physical activity; *M*= mean; *SD* = standard deviation.

TABLE 2
Alter-Level Characteristics (n = 1,066, Mean of Alters per Network = 675)

Variable name	*n*	*%*
Alter gender		
Boy	543	50.9%
Girl	522	49%
Alter relation		
Mother	36	3.4%
Father	22	2.1%
Sibling	165	15.5%
Friend	652	61.2%
Relative	190	17.8%
Alter play		
Often	152	14.3%
Sometimes	353	33.1%
Rarely	560	52.5%
Alter active		
None	81	7.6%
About half an hour	136	12.8%
About 1 hr	172	16.1%
About 2–3 hr	245	23.0%
About 4–6 hr	179	16.8%
About 7 hr or more	252	23.6%
Alter helps		
Yes	782	73.4%
No	283	26.6%

Note. M = mean; *SD* = standard deviation.

Youth reported 1,066 alters in their networks and had a mean of 6.75 alters per youth. Out of these alters, 50.9% (n = 543) were boys while 49% (n = 522) were girls. Alters consisted of 3.4% (n = 36) mothers, 2.1% (n = 22) fathers, 15.5% (n = 165) siblings, 61.2% (n = 652) friends, and 17.8% (n = 190) other relatives. Youth reported that they rarely actively played with 52.5% (n = 560) of alters reported. Furthermore, youth reported that 73.4% (n = 782) alters helped them to be physically active. Additional network details can be found in Table 2.

A significant model was found explaining 17.1% of the variance (R^2 = .17). Skill competency was significantly associated with age (β = –.06, p = .01), sex (β = –.06, p = .01), sports team involvement (β = .16, $p < .001$), and weekly PA (β = –.20, $p < .001$). Skill competence was also significantly associated with the number of alters with whom the youth played frequently (β = .09, $p < .001$), the number of alters that helped the youth to be physically active (β = .18, $p < .001$), and the heterogeneity of the type of relationships within the youth's network (β = .11, $p < .001$). See Table 3 for regression models.

DISCUSSION

This study aimed to expand on the significance of social connection and to give knowledge of possible network variables linked with youth PA skill competency. Findings from this study indicated that youth who were younger, boys, played team sports, and had diverse networks were more likely to report higher PA skill competency.

TABLE 3
Linear Regression Model Results Describing Skill Competency Among Adolescents

Predictors	β	*t*	*p*
Individual variables			
Age	-.06	-2.57	.01*
Sex (boy referent group)	-.06	-2.49	.01*
Physical activity	.20	7.68	<.001*
Team sport participation (0 referent group)	.16	6.17	<.001*
Network variables			
Average physical activity	.02	0.71	.48
Number of often active play partners	.09	3.49	<.001*
Number of alters that help	.18	7.44	<.001*
Sex homophily	-.05	-1.86	.06
Relationship heterophily	.11	4.81	<.001*

*$p < .05$.

Our findings suggest that youth who reported connections with alters who helped them to be active and frequently play together also reported high skill competency. Past research aligns with our findings that identify a link between social support, social norms, and co-participation with increased PA levels. For example, an increase in active friends was significantly associated with a higher probability of being physically active (Arango-Paternina et al., 2021). This may suggest that increasing daily PA of popular youth in these networks may have the potential to also improve skill competency in others through social influence (Zhang et al., 2015). Practitioners of summer care programs should understand the process by which they choose alters within the network and establish an efficient intervention strategy in the environment in which the intervention will be implemented. The effectiveness of peer selection in networks also affects the programs that aim to increase PA (Gesell et al., 2012).

Youth who had social connections encompassing a variety of relationship types—including mothers, fathers, friends, and extended family members—were more likely to rate themselves as highly competent in physical activities. Having a heterogeneous mix of individuals providing support, modeling active behaviors, sharing knowledge, and offering encouragement appears to reinforce positive perceptions of capability among adolescents (Blum et al., 2012). The diversity introduces different perspectives: parents may provide logistical support like transportation and equipment that allows youths to hone athletic skills, friends may motivate through co-participation and healthy competition, and relatives may share tips from their own experiences being active (Heaney & Israel, 2008). With several sources of input around PA, adolescents may receive more constructive feedback to aid ongoing development as well as hear more messages that empower them to feel skilled. In addition, seeing diverse social contacts enthusiastic about their participation gives adolescents representatives to identify with and draw inspiration from, further bolstering their self-assessments of competence. Intentional reinforcement of PA skill competency from a variety of relationships—not just peers—can shape adolescents' mindsets and confidence in their abilities.

IMPLICATIONS FOR PRACTICE

This study highlights several implications for summer care programs and other practitioners aiming to promote and develop PA skill competency in adolescents through programming and social reinforcement. First, understanding and facilitating diverse social connections related to PA may be an effective strategy. Programs could integrate activities that bring together adolescents across different ages, backgrounds, sports interests, and so on. Facilitating connections with various types of relationships (friends, family members, coaches, etc.) around PA may also foster skill competency. In addition, intentionally promoting peer support and co-participation in PA aligns with these findings. Programs could designate peer mentors, implement a "buddy system," highlight peer role models, and explicitly encourage adolescents to invite others to be active

together. Highlighting the social benefits and making PA a collaborative activity could enhance perceptions of competency. Furthermore, skill-building could be an intentional component of PA programming. Programs could incorporate skill-based games, challenges related to fundamental movement skills, and opportunities to try new sports/activities. Giving adolescents tools to feel competent and confident in PA skills is key. Feedback and encouragement from program leaders and peers around skill development creates a supportive environment. Finally, equipping adolescents with strategies to navigate barriers and build self-efficacy related to PA skills is warranted. Discussing challenges openly, problem-solving solutions, celebrating small wins, and facilitating mastery experiences gives adolescents agency in becoming more competent movers. Summer care programs are well suited to foster these competencies.

LIMITATIONS

Allowing participants to complete a self-reported survey factored into this study limitations. Self-reported surveys have a limitation in which variables are over- and/or under-estimated. Participants' perceptions of themselves being physically active might be reported higher than their peers to document themselves as if they are more engaged or vice versa. Regarding nominated peers, participants could only nominate up to five people in the summer care program and five people out of the program. This may limit children with expansive networks and introduce an artificial constraint on the data; however, limited nominations have been used in the past as a way to reduce respondent burden while eliciting the most salient connections.

CONCLUSION

In conclusion, this study provides valuable insight into the importance of social networks in shaping PA skill competency among adolescents. The results highlight that both individual activity patterns and social dynamics affect perceived competence. Moving forward, additional research should further explore the mechanisms through which diverse social relationships and networks tangibly influence competency beliefs. Quantifying the roles that social support, modeling, access to resources, motivation, and information sharing play can aid targeted interventions. Studies could also track how interventions promoting collaborative participation for PA affect perceived and actual skill development over time compared to individual practice. Experimental designs parsing how competence evolves across ages and stages as new connections emerge may clarify ideal timing for interventions. Longitudinal data can also capture bidirectional effects between social networks and skill competency. On the applied side, community programs aiming to bolster PA skills among youth should consider network-based initiatives that leverage peer support through joint participation, integrate skill-building games, promote relationships with adult role models, and teach self-efficacy strategies. Partnerships between schools, families, sports leagues, summer camps, and other youth-serving agencies to reinforce active skill development across settings may prove impactful. Overall, this research spotlights that PA competence relies on both individual and social factors. Amplifying future explorations of how to cultivate supportive social ecosystems for enhancing skill-related assets can maximize health promotion among adolescent populations.

Institutional Review Board

This study was approved by the Baylor University Institutional Review Board.

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REFERENCES

Allender, S., Cowburn, G., Cavill, N., Foster, C., & Pearce Smith, N. (2007). *Physical activity and children: Review 3: The views of children on the barriers and facilitators to participation in physical activity: A review of qualitative studies*. Deakin University.

Allender, S., Cowburn, G., & Foster, C. (2006). Understanding participation in sport and physical activity among children and adults: A review of qualitative studies. *Health Education Research*, *21*(6), 826–835.

Arango-Paternina, C. M., Cardona-Gómez, J., Arboleda-Serna, V. H., & Muñoz-Rodríguez, D. I. (2021). *Friends, physical activity, and sedentary behavior in university students: A social network analysis*. http://www.scielo.org.co/pdf/rfmun/v70n1/0120-0011-rfmun-70-01-e208.pdf

Aubert, S., Barnes, J. D., Demchenko, I., Hawthorne, M., Abdeta, C., Abi Nader, P., Sala, J. C. A., Aguilar-Farias, N., Aznar, S., & Bakalár, P. (2022). Global matrix 4.0 physical activity report card grades for children and adolescents: Results and analyses from 57 countries. *Journal of Physical Activity and Health*, *19*(11), 700–728.

Beets, M. W., Okely, A., Weaver, R. G., Webster, C., Lubans, D., Brusseau, T., Carson, R., & Cliff, D. P. (2016). The theory of expanded, extended, and enhanced opportunities for youth physical activity promotion. *International Journal of Behavioral Nutrition and Physical Activity*, *13*(1), Article 120. https://doi.org/10.1186/s12966-016-0442-2

Blum, R. W., Bastos, F. I., Kabiru, C. W., & Le, L. C. (2012). Adolescent health in the 21st century. *The Lancet*, *379*(9826), 1567–1568.

Booth, M., Okely, A., Chey, T., & Bauman, A. (2001). The reliability and validity of the physical activity questions in the WHO health

behaviour in schoolchildren (HBSC) survey: A population study. *British Journal of Sports Medicine*, *35*(4), 263–267. https://doi.org/10.1136/bjsm.35.4.263

Brazendale, K., Beets, M. W., Weaver, R. G., Pate, R. R., Turner-McGrievy, G. M., Kaczynski, A. T., Chandler, J. L., Bohnert, A., & von Hippel, P. T. (2017). Understanding differences between summer vs. school obesogenic behaviors of children: The structured days hypothesis. *International Journal of Behavioral Nutrition and Physical Activity*, *14*(1), Article 100. https://doi.org/10.1186/s12966-017-0555-2

Cairney, J., Bedard, C., Dudley, D., & Kriellaars, D. (2016). Towards a physical literacy framework to guide the design, implementation and evaluation of early childhood movement-based interventions targeting cognitive development. *Annals of Sports Medicine and Research*, *3*(4), 1073–1071.

de Greeff, J. W., Bosker, R. J., Oosterlaan, J., Visscher, C., & Hartman, E. (2018). Effects of physical activity on executive functions, attention and academic performance in preadolescent children: A meta-analysis. *Journal of Science and Medicine*, *21*(5), 501–507. https://doi.org/10.1016/j.jsams.2017.09.595

Gesell, S. B., Tesdahl, E., & Ruchman, E. (2012). The distribution of physical activity in an after-school friendship network. *Pediatrics*, *129*(6), 1064–1071.

Heaney, C. A., & Israel, B. A. (2008). Social networks and social support. Health behavior and health education: Theory, research, and practice. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.), *Health behavior and health education: Theory, research, and practice* (4th ed., pp. 189–210). Jossey-Bass.

Inchley, J., Kirby, J., & Currie, C. (2011). Longitudinal changes in physical self-perceptions and associations with physical activity during adolescence. *Pediatric Exercise Science*, *23*(2), 237–249. https://doi.org/10.1123/pes.23.2.237

Jadbabaie, A., Molavi, P., & Tahbaz-Salehi, A. (2013). *Information heterogeneity and the speed of learning in social networks*. Columbia Business School Research Paper. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2266979

Lewallen, T. C., Hunt, H., Potts-Datema, W., Zaza, S., & Giles, W. (2015). The whole school, whole community, whole child model: A new approach for improving educational attainment and healthy development for students. *Journal of School Health*, *85*(11), 729–739.

Macdonald-Wallis, K., Jago, R., & Sterne, J. A. C. (2012). Social network analysis of childhood and youth physical activity: A systematic review. *American Journal of Preventive Medicine*, *43*(6), 636–642. https://doi.org/https://doi.org/10.1016/j.amepre.2012.08.021

McCarty, C., Lubbers, M. J., Vacca, R., & Molina, J. L. (2019). *Conducting personal network research: A practical guide*. Guilford Publications.

McCue, M. C., Marlatt, K. L., & Sirard, J. (2013). Examination of changes in youth diet and physical activity over the summer vacation period. *Internet Journal of Allied Health Sciences and Practice*, *11*(1), Article 8.

McPherson, M., Brashears, M. E., & Smith-Lovin, L. (2006). Social isolation in America: Changes in core discussion networks over two decades. *American Sociological Review*, *71*, 353–375. https://doi.org/10.1177/000312240607100301

Piercy, K. L., Troiano, R. P., Ballard, R. M., Carlson, S. A., Fulton, J. E., Galuska, D. A., George, S. M., & Olson, R. D. (2018). The physical activity guidelines for Americans. *Journal of the American Medical Association*, *320*(19), 2020–2028.

Powell, K. E., King, A. C., Buchner, D. M., Campbell, W. W., DiPietro, L., Erickson, K. I., Hillman, C. H., Jakicic, J. M., Janz, K. F., Katzmarzyk, P. T., Kraus, W. E., Macko, R. F., Marquez, D. X., McTiernan, A., Pate, R. R., Pescatello, L. S., & Whitt-Glover, M. C. (2018). The scientific foundation for the physical activity guidelines for Americans, 2nd edition. *Journal of Physical Activity and Health*, *16*(1), 1–11. https://doi.org/10.1123/jpah.2018-0618

Prochnow, T., Delgado, H., Patterson, M. S., & Umstattd Meyer, M. R. (2020). Social network analysis in child and adolescent physical activity research: A systematic literature review. *Journal of Physical Activity and Health*, *17*(2), 250–260. https://doi.org/10.1123/jpah.2019-0350

Prochnow, T., Patterson, M. S., Bridges Hamilton, C. N., Delgado, H., Craig, S., & Umstattd Meyer, M. R. (2021a). Network autocorrelation of perceived physical activity skill competence among adolescents at a summer care program: A pilot study. *American Journal of Health Promotion*, *35*(3), 430–433. https://doi.org/10.1177/0890117120958544

Prochnow, T., Patterson, M. S., Bridges Hamilton, C. N., Delgado, H., Craig, S., & Umstattd Meyer, M. R. (2021b). Sex differences in play networks and self-reported physical activity among children at summer care programs. *Child & Youth Services*, *42*(2), 136–149. https://doi.org/10.1080/0145935X.2021.1926228

Prochnow, T., Patterson, M. S., Bridges Hamilton, C. N., & Umstattd Meyer, M. R. (2022). Summer friends and physical activity: Social network effects on child self-reported physical activity at summer care programs. *Health Education & Behavior*, *49*(5), 770–779. https://doi.org/10.1177/10901981221076399

Prochnow, T., Patterson, M. S., Meyer, A. R., & Umstattd Meyer, M. R. (2022). Sport participation associations with child friend selection and physical activity while at summer care programs. *Research Quarterly for Exercise and Sport*, *93*(3), 479–487.

Prochnow, T., Patterson, M. S., & Umstattd Meyer, M. R. (2020). A social network analysis approach to group and individual perceptions of child physical activity. *Health Education Research*, *35*(6), 564–573. https://doi.org/10.1093/her/cyaa035

Prochnow, T., Patterson, M. S., Umstattd Meyer, M. R., Lightner, J., Gomez, L., & Sharkey, J. (2022). Conducting physical activity research on racially and ethnically diverse adolescents using social network analysis: Case studies for practical use. *International Journal of Environmental Research and Public Health*, *19*(18), Article 11545.

Rodgers, W. M., Markland, D., Selzler, A.-M., Murray, T. C., & Wilson, P. M. (2014). Distinguishing perceived competence and self-efficacy: An example from exercise. *Research Quarterly for Exercise and Sport*, *85*(4), 527–539. https://doi.org/10.1080/02701367.2014.961050

Shepherd, J., Harden, A., Rees, R., Brunton, G., Garcia, J., Oliver, S., & Oakley, A. (2006). Young people and healthy eating: A systematic review of research on barriers and facilitators. *Health Education Research*, *21*(2), 239–257.

Uchino, B. N., Holt-Lunstad, J., Smith, T. W., & Bloor, L. (2004). Heterogeneity in social networks: A comparison of different

models linking relationships to psychological outcomes. *Journal of Social and Clinical Psychology*, *23*(2), 123–139.

Valente, T. W. (2010). *Social networks and health: Models, methods, and applications*. Oxford University Press.

Volmut, T., Pišot, R., Planinšec, J., & Šimunič, B. (2020). Physical activity drops during summer holidays for 6- to 9-year-old children. *Front Public Health*, *8*, Article 631141. https://doi.org/10.3389/fpubh.2020.631141

Zhang, J., Shoham, D. A., Tesdahl, E., & Gesell, S. B. (2015). Network interventions on physical activity in an afterschool program: An agent-based social network study. *American Journal of Public Health, 105*(Suppl. 2), S236–S243.