HHS Public Access

Author manuscript

Health Place. Author manuscript; available in PMC 2016 November 18.

Published in final edited form as:

Health Place. 2015 November ; 36: 145–151. doi:10.1016/j.healthplace.2015.11.001.

Health implications of social networks for children living in public housing

Alene Kennedy-Hendricks, PhD[1], **Heather L. Schwartz, PhD**[2], **Beth Ann Griffin, PhD**[2], **Susan Burkhauser, MPhil**[2], **Harold D. Green Jr, PhD**[2], **David P. Kennedy, PhD**[2], and **Craig Evan Pollack, MD, MHS**[1,3]

[1]Department of Health Policy and Management, Johns Hopkins Bloomberg School of Public Health, 624 N. Broadway Street, Baltimore, MD 21205, United States

[2]RAND Corporation, 1776 Main St., Santa Monica, CA 90401, United States

[3]Johns Hopkins School of Medicine, Division of General Internal Medicine, 2024 E. Monument Street, Baltimore, MD 21287, United States

Abstract

This study sought to examine whether: (1) the health composition of the social networks of children living in subsidized housing within market rate developments (among higher-income neighbors) differs from the social network composition of children living in public housing developments (among lower-income neighbors); and (2) children's social network composition is associated with children's own health. We found no significant differences in the health characteristics of the social networks of children living in these different types of public housing. However, social network composition was significantly associated with several aspects of children's own health, suggesting the potential importance of social networks for the health of vulnerable populations.

Keywords

social networks; housing; children's health; health behaviors

INTRODUCTION

Social networks—the web of relationships among individuals—may be an important determinant of children's health and health behaviors. Previous studies have demonstrated a relationship between children's social networks and their alcohol consumption (Mundt, 2011), smoking (Go et al., 2012; Kirke, 2004; Seo and Huang, 2012), body weight and obesity (Cunningham et al., 2012; Renna et al., 2008; Shoham et al., 2012), exercise

Corresponding author: Alene Kennedy-Hendricks, Johns Hopkins School of Public Health, Department of Health Policy and Management, 624 N. Broadway Street, Room 311, Baltimore, MD 21205, alene@jhu.edu, Tel: 001-443-287-5324, Fax: 001-410-955-0476.

behaviors (Macdonald-Wallis et al., 2012, 2011; Maturo and Cunningham, 2013; Shoham et al., 2012), and diet (Bruening et al., 2012; de la Haye et al., 2010).

However, children's social networks do not form in isolation. Rather, the social connections that children form result from multiple, overlapping factors including the tendency for children to establish relationships with people who are similar to them, termed homophily (McPherson et al., 2001), and the increased likelihood of relationships forming due to recurring contact or geographic proximity (Hipp and Perrin, 2009; Preciado et al., 2012). While neighborhood environments and housing policies shape who children interact with on a daily basis, the extent to which these contextual factors influence social networks remains largely unknown (Hipp and Perrin, 2009; Sanbonmatsu et al., 2011).

Providing preliminary insight into these relationships, the U.S. Department of Housing and Urban Development's Moving to Opportunity for Fair Housing Demonstration (MTO) randomized families living in public housing to receive different forms of housing vouchers. While MTO did not include a formal enumeration of social networks, it found mixed effects on the social connections of children whose families moved to low-poverty neighborhoods (Sanbonmatsu et al., 2011). Male children whose families received housing vouchers to move to low-poverty neighborhoods were less likely to report having at least one close friend compared to those remaining in public housing developments in high-poverty neighborhoods; female youth whose families received a voucher to move to a low-poverty neighborhood were less likely to have close friends who had ever used drugs (Sanbonmatsu et al., 2011). This finding of a negative effect of moving to a low-poverty neighborhood on one aspect of boys' social networks but a positive effect on one aspect of girls' social networks indicates potentially important gender differences in how neighborhood environments and housing policy shape children's social networks. Furthermore, the directionality of these relationships are consistent with other research on MTO participants, which found positive mental health effects of moving to a low-poverty neighborhood among female children but negative impacts on the mental health of male children (Kessler et al., 2014).

Building on this prior research, we first examined whether different types of public housing were associated with the health composition of children's social networks (i.e., the health characteristics and behaviors of the members of children's social networks). Specifically, we leveraged a natural experiment to test whether the social networks of children living in public housing located among wealthier neighbors differed from the social networks of children living in developments in which all residents lived in public housing. This question has important implications for the ability of housing policies to shape children's social networks.

Housing policy's potential influence on the development of social networks may be an important pathway through which neighborhood environments influence health (Leventhal and Brooks-Gunn, 2003a, 2003b; Sampson et al., 2002). While a growing body of research has explored the implications of social networks for adults living in public housing (De Jesus et al., 2010; Flatt et al., 2012; Kleit and Carnegie, 2011; Pollack et al., 2014; Schwartz et al., 2014; Shelton et al., 2011), minimal research exists on the social networks of children

living in public housing (Kennedy-Hendricks et al., 2015). Yet evidence is growing that life opportunities are highly affected by where one grows up (Chetty et al., 2014, 2013). This emerging research suggests that low-income children living in communities segregated by economic class have less upward mobility on average and identifies social capital, which is determined by one's social network, as an important socio-environmental correlate of upward mobility (Chetty et al., 2014, 2013). One study of a court-ordered desegregation in Yonkers, New York, found that infrequent contact with neighbors was linked to more anxiety and depression in some children in families that moved (Fauth et al., 2007), raising the possibility that social networks shaped by neighborhood social environments have health implications for children. The scarcity of research on the link between social networks and health among children living in public housing represents a significant gap in the research on vulnerable populations. To this end, our second research objective examined to what extent public housing children's social networks were associated with their own health characteristics. This question seeks to advance our understanding of the contribution of social networks to low-income children's health and well-being.

METHODS

Setting

The study took place in Montgomery County, Maryland, an affluent suburb of Washington, DC. Public housing residents live in homes that are either scattered among market-rate housing developments (scattered) or clustered in small public housing projects (clustered). In the market-rate developments, no more than five percent of residents live in public housing, potentially increasing children's exposure to higher income neighbors. In contrast, in the clustered public housing, all residents of these small developments (ranging in size from 19–71 homes) live in public housing units operated by the Montgomery County housing authority, thereby increasing the proximity to lower income neighbors. While both scattered and clustered housing units are located in wealthy neighborhoods (Census tract median income $96,866 for scattered public housing and $92,722 for clustered public housing, p=0.134), we explored potential differences that may stem from variation among neighbors that are more physically proximate.

Several features of public housing assignment make it a strong natural experiment (Schwartz, 2012; Schwartz et al., 2015). As public housing units become available, the housing authority randomly selects eligible families from a waiting list. Long waiting lists, limited housing availability, and large differences between rent levels in subsidized versus market-rate apartments lead the majority of families to accept the offer and remain in their originally assigned public housing homes. Prior research describes this setting in greater detail and has estimated that fewer than 10 percent of families turn down the first unit offered by the county housing authority (Schwartz et al., 2015). In addition, our previous research on this population found that housing type was significantly associated with socioeconomic and health features of adults' social networks and that these features were, in turn, associated with adults' own health (Pollack et al., 2014; Schwartz et al., 2014). We further found that features of caretakers' social networks were linked with children's health behaviors (Kennedy-Hendricks et al., 2015).

Data sources

We performed an in-person, computer-assisted survey of adults and children living in scattered and clustered public housing within Montgomery County. The public housing authority provided household-level data. The [blinded for review] Institutional Review Board approved this research.

In August 2011, at the time of recruitment into the study, 948 public housing units for non-elderly households in Montgomery County were occupied. After an introductory mailing, 148 of 948 households (16%) opted out of the survey. One household moved in during the study period, leaving 801 eligible households. A total of 453 heads of household responded to the survey (57% response rate). Of the 453 households, 272 included at least one child. One child per household was randomly selected to participate. Of the 272 eligible households, 209 children (77%) agreed to participate in the interviews, which were conducted in English or Spanish. Interviews included over 80 questions about the children's family, neighborhood and school environment, health, and characteristics of the children's social network members.

Social network assessment

To assess children's social networks, we used a personal (egocentric) approach (McCarty, 2002). This approach concentrates on the members of a social network, or the "alters," from the perspective of the focal individual (the "ego"), who in this study, was the child (McCarty, 2002). We first asked children to name up to 20 other children (alters) whom they know and have talked with recently, beginning with peers most important to them. We instructed children not to name adults but they could list "family members, friends, neighbors, schoolmates, teammates, people you know from church" or elsewhere. Then, respondents identified which of the alters lived in their neighborhood. Children who named less than 5 neighbors were prompted to name up to 5 additional neighbors. Thus, respondents could have named up to 25 alters. Children identified which network members were friends. In addition, they identified alters with whom they shared secrets in order to identify close friends for sensitivity analyses.

To assess the health characteristics of respondents' network members, children provided information whether each of their alters: (1) does a lot of exercise such as playing sports or running around; (2) tries to eat fruits and vegetables most days; (3) is overweight or fat; and (4) often seems sad or unhappy. Teens, ages 13 to 18, also identified (5) which alters drink alcohol socially. Although these five measures reflect the child's perceptions of their network members, research has suggested that children may be particularly responsive to their perceptions of peer behaviors (Prinstein and Wang, 2005). For each of the five health characteristics, we divided the number of alters that each child identified as having the health characteristic by the total number of alters. Our main analyses focused on the proportion of network members with each health characteristic that the child identified as a friend.

Children also indicated whether each pair of network members knew and had contact with one another. A pair of alters who sometimes or often had contact with one another in the

past year were considered to be social network ties (McCarty, 2002). In order to account for the diffusion of behaviors and norms within a child's social network, we calculated network density as the proportion of existing ties in a network relative to all possible ties (McCarty and Wutich, 2005).

Children's health and health behaviors

Corresponding to the five health characteristics of children's social networks, we examined children's own health characteristics. Using information reported by teen respondents (13–18 years) and by the caregivers of young children (8–12 years), we coded children as engaging in exercise if they reported participating in either vigorous (e.g., activities making the child sweat and breathe hard) or moderate (e.g., walking and biking) physical activity for at least 20 minutes per day on average (U.S. Department of Health and Human Services, 2008). To assess diet, teens and caretakers reported how many servings of fruits and vegetables the child eats on a typical day. We classified children with at least four servings as having an adequate intake (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010). By dividing the child's reported weight in kilograms by height in meters squared, we calculated body mass index (BMI) and categorized children as overweight or obese given their age and gender using the 2000 CDC growth charts (Vidmar et al., 2004). We used the Kessler 6 scale (Kessler et al., 2003) to assess psychological distress among children ages 10 and older. Children reported how often over the last 30 days they experienced feeling: nervous, hopeless, restless or fidgety, so depressed that nothing could cheer him/her up, that everything was an effort, and worthless. We summed responses, ranging from all (4 points) to none (0 points) of the time, to create a continuous measure, in which higher scores indicated greater psychological distress. Teens also reported whether they ever drank alcohol (Harris et al., 2009).

Control variables

Child demographic variables included age, sex, race and ethnicity. The public housing authority's annual recertification records provided information on household poverty status. The head of household survey provided data on the head of household's nativity, his or her educational attainment, and gender. We defined family structure as two parents living together, single parent household, or another arrangement. In order to account for the influence of caretakers on their children's health, we additionally controlled for the caretaker health characteristic corresponding to each of the five health characteristics: head of household's exercise behavior (U.S. Department of Health and Human Services, 2008), fruit and vegetable consumption (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010), depression (Kroenke et al., 2009), overweight or obese status, and any alcohol consumption.

Statistical analysis

We first examined whether children living in scattered versus clustered public housing had social networks with different health characteristics. Outcomes measures were the percentages of friends with each of the health characteristics. We estimated separate generalized linear regression models specifying the logit link function for each health characteristic and adjusted for potential child, caretaker, and household-level confounders of

the relationships explored in our analyses. We also estimated models that included the interaction of gender and housing type to test whether gender modified the relationship between housing type and social network composition, given prior research suggesting potential gender differences (Kessler et al., 2014; Sanbonmatsu et al., 2011). We used the Holm-Bonferroni procedure to correct for multiple hypothesis testing and assess statistical significance (Holm, 1979). All analyses included weights to correct for potential sampling bias and non-response and to make our estimates representative of households in Montgomery County public housing. To improve interpretability, we produced recycled predictions (Graubard and Korn, 1999) to describe the association of type of public housing with social network composition. In sensitivity analyses, we ran models in which the composition of children's social networks was based on: (1) close friends, (2) neighbors who were not relatives, and (3) all alters.

Our second research question focused on the association between social network composition and children's health outcomes. This research question did not leverage the natural experiment of public housing assignment; rather, this question assessed associations among all children, adjusting for scattered or clustered housing type. Logistic and linear regression models estimated the relationship between the health composition of children's social networks and each health outcome. For example, for the outcome measuring whether or not the child exercised, the main independent variable was the proportion of the child's social network engaging in exercise. As above, we adjusted for child and household characteristics, included weights, used the Holm-Bonferroni procedure, and ran sensitivity analyses altering network categorizations.

RESULTS

Among the 209 children, 82 were 8–12 years old and 117 were teens aged 13–18. Table 1 presents the characteristics of the overall sample and compares children in scattered and clustered housing. Half the children were female (51%), the mean age was 13 years, and the majority were African American (65%). We observed few significant socio-demographic differences between children in scattered and clustered housing. The characteristics of households with children who participated in the survey were not significantly different from Montgomery County's overall public housing population (Appendix Table A).

Table 2 displays the study sample's health and social network characteristics. Most children (71%) reported exercising. Nearly one third (29.6%) of children consumed adequate fruits and vegetables, and 38.9% were overweight. The average Kessler score for children ages 10 years and older was 3.9 (possible range 0–24, with higher scores indicating greater psychological distress). Sixteen percent of teens reported trying alcohol. There were no significant differences in these outcomes by housing type.

Children identified a mean of 17 alters (25 maximum) in their social networks. On average, 87% of these alters were friends, 34% close friends, and 29% neighbors. Children perceived half of their friends to exercise regularly, 44% to eat fruits and vegetables, 7% to be overweight, and 5% as seeming sad or unhappy (Table 2). Teens reported that 7% of their

friends, on average, drank alcohol. In Appendix Table B, we show the health characteristics of alters who are (1) close friends, (2) non-family neighbors, and (3) all alters.

Figure 1 displays the predicted probabilities, adjusting for covariates, comparing the social network composition of children living in scattered and clustered public housing. Children in public housing scattered among market rate developments tended to perceive their friends as having healthier characteristics than those living in clustered public housing developments. Children in scattered housing identified more friends who exercised (adjusted predicted probability 55% versus 46%, p=0.032), more friends ate fruits and vegetables regularly (adjusted predicted probability 48% versus 38%, p=0.082), and fewer friends who were overweight or obese (adjusted predicted probability 6% versus 8%, p=0.220) or drank alcohol (adjusted predicted probability 6% versus 10%, p=0.108, teens only) in comparison to children in clustered housing. After the Holm-Bonferroni adjustment, however, these differences were not significant. We did not observe significant interactions with gender and reclassifying network ties in our sensitivity analyses produced qualitatively similar results (Appendix Table C).

Table 3 displays the associations between children's social network composition and individual health outcomes. For each 10 percentage point increase in the proportion of teens' friends who drink socially, the odds of the teen drinking alcohol rose by 2.77 (95% Confidence Interval [CI]: 1.65, 4.66). We found a significant interaction between gender and social network composition with respect to mental distress: while there was no association between males' social network composition and the Kessler score, among female children, for each 10 percentage point increase in the proportion of friends that the child perceived as sad or unhappy, the Kessler score increased by 0.94 points (95% CI: 0.25, 1.62). Sensitivity analyses produced similar findings (Appendix Table D).

DISCUSSION

Our findings highlight the importance of social networks for the health of children living in public housing. In particular, drinking behavior of friends was associated with teens' likelihood of consuming alcohol, and, among girls, viewing friends as sad or unhappy was significantly associated with their own mental distress. At the same time, the study demonstrates the potential limits of housing policy to shape children's social networks in the setting of affluent neighborhoods.

In examining whether differences in housing environments lead to changes in children's social network composition, the current results stand in contrast to previous work from MTO, which found significant effects of moving to a low poverty neighborhood on some aspects of children's social networks that differed by gender (Sanbonmatsu et al., 2011). We did not find strong evidence that living in different types of public housing produced differences in the health composition of children's social networks and no evidence of variation in this relationship by gender. However, MTO did not include a formal enumeration of social networks and participants from MTO were recruited originally from high-poverty urban neighborhoods whereas both groups in our study sample resided in an affluent suburban context.

There are several potential explanations for why we did not find that public housing was associated with differences in the health composition of children's social networks. We were likely underpowered to detect small differences in social network composition that may still have had public health significance. Two notable signals were the large differences (nearly 10 percentage points) in the predicted probabilities of friends of children living in scattered versus clustered housing that exercised and ate fruits and vegetables, both of which may be meaningful from a policy perspective. Future research should examine these relationships further given the suggestively large, but non-significant, differences in social network composition among children living in the two types of public housing. It is also likely that children's broader social environments—including family and school environments— play significant roles in shaping social networks (Alexander et al., 2001; Wilson et al., 2011). To the extent that children in scattered and clustered housing attended the same schools, and with schools being the foremost setting in which peer social ties are formed (Gifford-Smith and Brownell, 2003), our ability to see significant differences by housing type may have been reduced. Moreover, the overall affluence of the neighborhoods in which the public housing units were located also may have reduced our ability to observe significant differences. Most recipients of housing assistance do not attend well-resourced schools or live in wealthy neighborhoods. Instead, they are frequently geographically clustered in low income, segregated neighborhoods (McClure et al., 2015; Metzger, 2014). Larger differences in the social environments of different micro-neighborhoods may lead to stronger impacts on social networks.

At the same time, we did find that some aspects of children's social networks were significantly associated with children's own health. This extends prior studies by focusing on children in public housing. Our findings are consistent with prior research that has shown associations between social networks with teen alcohol consumption (Fujimoto and Valente, 2011; Mundt, 2011) and found gender differences in the association between peer mood and mental distress (Conway et al., 2011; Prinstein, 2007). Children in public housing represent a vulnerable population and there has been a paucity of research on the social networks of low-income children. It may be possible to leverage social networks in interventions that promote healthy behaviors and improve mental health among this population (Valente, 2012).

This study has several limitations. First, our response rate was relatively low (57%); however, we found few differences on observable household characteristics among respondents participating in this study and non-responders and applied survey weights to account for potential sampling bias and non-response. Second, the study took place in one affluent county in the U.S., limiting the study's generalizability. However, the county's poverty rates are comparable to many suburbs nationally. The county is widely seen as a leader in using inclusionary zoning to disperse public housing (Calavita and Mallach, 2010), and thus an appropriate setting in which to test whether these types of policies impact children's social networks. Third, the study examined children's perceptions of their peers' behaviors rather than the peers' actual behaviors, raising the potential for measurement bias away from the null hypothesis of no association. However, research suggests that even the perceptions of peer behavior may influence children's health (Bahr et al., 2005; Prinstein and Wang, 2005). Further, prior research indicates fewer discrepancies in children's

perceptions of close friends' behaviors and these close friends' own reported behaviors (Prinstein and Wang, 2005); our sensitivity analysis limiting social network composition measures to close friends confirmed the main analyses' findings on alcohol use and mental distress. In addition, it is unlikely that perceptions of friends' behaviors and health varied differentially among children living in scattered and clustered housing. Nevertheless, future work should survey peers directly to assess the relative degrees to which perceptions and peers' own reported behaviors are associated with children's own health. Fourth, we limited the number of peers that children were able to list in their social network to 25. While research suggests that lower numbers of peers support a more stable network structure (Golinelli et al., 2010), this may have biased our results. Fifth, self-reported weight and height may differ from measured weight and height; therefore, our measures of overweight and obesity may somewhat biased. Again, we would not necessarily expect any measurement error to be differential by housing type because the data collection methods were standard for all participants. Sixth, we explored a somewhat limited set of health behaviors and outcomes in this study, which does not provide a comprehensive picture of children's overall health. Seventh, as noted previously, the small sample size limited our ability to conduct an instrumental variable or formal mediation analysis when testing the relationships between housing type, social networks and children's health. Finally, because this was a cross-sectional analysis, we cannot assess causation in the association between social network characteristics and health.

Conclusion

In summary, social networks were significantly associated with alcohol consumption among teens living in public housing and mental distress among girls, underscoring their potential importance for vulnerable children's health. Future interventions should consider the role of peer networks when aiming to reduce risky behavior and improve children's mental health. The results also highlight the need to examine the impact of public housing on social networks across a wider range of neighborhood environments to inform policies around economically integrated housing.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

We thank Matthew Hoover, PhD of the RAND Corporation for preparing the social network density measures used in the statistical analyses, Kimberly Gudzune, MD MPH of the Johns Hopkins School of Medicine for her assistance regarding choice of measures, and Rachel Johnson Thornton, MD PhD of the Johns Hopkins School of Medicine for her helpful advice. This work was supported by a grant from the MacArthur Foundation (96241–0). Dr. Pollack's salary is supported by the National Cancer Institute and Office of Behavioral and Social Sciences (K07 CA151910).

References

Alexander C, Piazza M, Mekos D, Valente T. Peers, schools, and adolescent cigarette smoking. J. Adolesc. Heal. 2001; 29:22–30.

Bahr SJ, Hoffmann JP, Yang X. Parental and peer influences on the risk of adolescent drug use. J. Prim. Prev. 2005; 26:529–551. [PubMed: 16228115]

Bruening M, Eisenberg M, MacLehose R, Nanney MS, Story M, Neumark-Sztainer D. The relationship between adolescents' and their friends' eating behaviors - breakfast, fruit, vegetable, whole grain, and dairy intake. J Acad Nutr Diet. 2012; 112:1608–1613. [PubMed: 23017570]

Calavita, N.; Mallach, A. Inclusionary housing in international perspective: Affordable housing, social inclusion, and land value recapture. Cambridge, UK: Lincoln Institute of Land Policy; 2010.

Chetty, R.; Hendren, N.; Kline, P.; Saez, E. Summary of Project Findings. The Equality of Opportunity Project. National Bureau of Economic Research; 2013. Available online at: www.equality-of-opportunity.org. [Accessed January 1, 2015]

Chetty, R.; Hendren, N.; Kline, P.; Saez, E. Where is the land of opportunity? The geography of intergenerational mobility in the United States. National Bureau of Economic Research. Working Paper No. 19843. 2014.

Conway CC, Rancourt D, Adelman CB, Burk WJ, Prinstein MJ. Depression socialization within friendship groups at the transition to adolescence: The roles of gender and group centrality as moderators of peer influence. J. Abnorm. Psychol. 2011; 120:857–867. [PubMed: 21842961]

Cunningham SA, Vaquera E, Maturo CC, Venkat Narayan K. Is there evidence that friends influence body weight? A systematic review of empirical research. Soc Sci Med. 2012; 75:1175–1183. [PubMed: 22749656]

De Jesus M, Puleo E, Shelton RC, Emmons KM. Associations between perceived social environment and neighborhood safety: Health implications. Health Place. 2010; 16:1007–1013. [PubMed: 20598624]

De la Haye K, Robins G, Mohr P, Wilson C. Obesity-related behaviors in adolescent friendship networks. Soc. Networks. 2010; 32:161–167.

Emmons KM, Barbeau EM, Gutheil C, Stryker JE, Stoddard AM. Social influences, social context, and health behaviors among working-class, multi-ethnic adults. Heal. Educ. Behav. 2007; 34:315–134.

Fauth RC, Leventhal T, Brooks-Gunn J. Welcome to the neighborhood? Long-term impacts of moving to low-poverty neighborhoods on poor children's and adolescents' outcomes. J. Res. Adolesc. 2007; 17:249–284.

Flatt JD, Agimi Y, Albert SM. Homophily and health behavior in social networks of older adults. Fam. Community Health. 2012; 35:312–321. [PubMed: 22929377]

Fujimoto K, Valente TW. Decomposing the components of friendship and friends' influence on adolescent drinking and smoking. J. Adolesc. Heal. 2011; 51:136–143.

Gifford-Smith ME, Brownell CA. Childhood peer relationships: social acceptance, friendships, and peer networks. J. Sch. Psychol. 2003; 41:235–284.

Go M-H, Tucker JS, Green HD, Pollard M, Kennedy D. Social distance and homophily in adolescent smoking initiation. Drug Alcohol Depend. 2012; 124:347–354. [PubMed: 22417919]

Golinelli D, Ryan G, Green H, Kennedy D, Tucker J, Wenzel S. Sampling to reduce respondent burden in personal network studies and its effect on estimates of structural measurse. Field methods. 2010; 22:217–230. [PubMed: 21113275]

Graubard BI, Korn EL. Predictive margins with survey data. Biometrics. 1999; 55:652–659. [PubMed: 11318229]

Harris, K.; Kalpern, C.; Whitsel, E.; Hussey, J.; Tabor, J.; Entzel, P.; Udry, J. The National Longitudinal Study of Adolescent Health: Research Design. Survey Research Design Instrument; 2009. Available online at: http://www.cpc.unc.edu/projects/addhealth/design. [Accessed July 1, 2014]

Hipp JR, Perrin AJ. The simultaneous effect of social distance and physical distance on the formation of neighborhood ties. City Community. 2009; 8:5–25.

Holm S. A simple sequentially rejective multiple test procedure. Scand. J. Stat. 1979; 6:65–70.

Kennedy-Hendricks A, Schwartz H, Thornton RJ, Griffin BA, Green HD, Kennedy DP, Burkhauser S, Pollack CE. Intergenerational social networks and health behaviors among children living in public housing. Am J Public Health. 2015:e1–e7. ePub Ahead of Print.

Kessler RC, Barker PR, Colpe LJ, Epstein JF, Gfroerer JC, Hiripi E, Howes MJ, Normand S-LT, Manderscheid RW, Walters EE, Zaslavsky AM. Screening for serious mental illness in the general population. Arch. Gen. Psychiatry. 2003; 60:184–189. [PubMed: 12578436]

Kessler RC, Duncan GJ, Gennetian La, Katz LF, Kling JR, Sampson Na, Sanbonmatsu L, Zaslavsky AM, Ludwig J. Associations of housing mobility interventions for children in high-poverty neighborhoods with subsequent mental disorders during adolescence. JAMA. 2014; 311:937–948. [PubMed: 24595778]

Kirke DM. Chain reactions in adolescents' cigarette, alcohol and drug use: similarity through peer influence or the patterning of ties in peer networks? Soc. Networks. 2004; 26:3–28.

Kleit RG. The role of neighborhood social networks in scattered-site public housing residents' search for jobs. Hous. Policy Debate. 2001; 12:541–573.

Kleit RG, Carnegie NB. Integrated or isolated? The impact of public housing redevelopment on social network homophily. Soc. Networks. 2011; 33:152–165.

Kroenke K, Strine TW, Spitzer RL, Williams JBW, Berry JT, Mokdad AH. The PHQ-8 as a measure of current depression in the general population. J Affect Disord. 2009; 114:163–173. [PubMed: 18752852]

Leventhal T, Brooks-Gunn J. Children and youth in neighborhood contexts. Curr. Dir. Psychol. Sci. 2003a; 12:27–31.

Leventhal T, Brooks-Gunn J. Moving to opportunity: an experimental study of neighborhood effects on mental health. Am J Public Health. 2003b; 93:1576–1582. [PubMed: 12948983]

Macdonald-Wallis K, Jago R, Page AS, Brockman R, Thompson JL. School-based friendship networks and children's physical activity: A spatial analytical approach. Soc. Sci. Med. 2011; 73:6–12. [PubMed: 21680072]

Macdonald-Wallis K, Jago R, Sterne JAC. Social network analysis of childhood and youth physical activity: a systematic review. Amer J Prev Med. 2012; 43:636–642. [PubMed: 23159259]

Maturo CC, Cunningham SA. Influence of friends on children's physical activity: a review. Amer J Public Health. 2013; 103:23–38.

McCarty C. Structure in personal networks. J. Soc. Struct. 2002:3.

McCarty C, Wutich A. Conceptual and empirical arguments for including or excluding ego from structural analyses of personal networks. Connections. 2005; 26:82–88.

McClure K, Schwartz AF, Taghavi LB. Housing Choice Voucher location patterns a decade later. Housing Policy Debate. 2015; 25:215–233.

McPherson M, Smith-Lovin L, Cook JM. Birds of a feather: Homophily in social networks. Ann Rev Sociol. 2001; 27:415–444.

Metzger MW. The reconcentration of poverty: Patterns of housing voucher use, 2000 to 2008. Hous. Policy Debate. 2014; 24:544–567.

Mundt MP. The impact of peer social networks on adolescent alcohol use initiation. Acad. Pediatr. 2011; 11:414–421. [PubMed: 21795133]

Pollack CE, Green HD, Kennedy DP, Griffin BA, Kennedy-Hendricks A, Burkhauser S, Schwartz H. The impact of public housing on social networks: a natural experiment. Amer J Public Health. 2014; 104:1642–1649. [PubMed: 25033153]

Preciado P, Snijders T, Burk W, Stattin H, Kerr M. Does proximity matter? Distance dependence of adolescent friendships. Soc. Networks. 2012; 34:18–31. [PubMed: 25530664]

Prinstein MJ. Moderators of peer contagion: A longitudinal examination of depression socialization between adolescents and their best friends. J. Clin. Child Adolesc. Psychol. 2007; 36:159–170. [PubMed: 17484689]

Prinstein MJ, Wang SS. False Consensus and Adolescent Peer Contagion: Examining Discrepancies between Perceptions and Actual Reported Levels of Friends' Deviant and Health Risk Behaviors. J. Abnorm. Child Psychol. 2005; 33:293–306. [PubMed: 15957558]

Renna F, Grafova IB, Thakur N. The effect of friends on adolescent body weight. Econ. Hum. Biol. 2008; 6:377–387. [PubMed: 18672412]

Sampson RJ, Morenoff JD, Gannon-Rowley T. Assessing "neighborhood effects": Social processes and new directions in research. Annu Rev Sociol. 2002; 28:443–478.

Sanbonmatsu, L.; Ludwig, J.; Katz, LF.; Gennetian, LA.; Duncan, GJ.; Kessler, RC.; Adam, E.; McDade, TW.; Lindau, ST. Moving to Opportunity for Fair Housing Demonstration Program: Final Impacts Evaluation. Washington, DC: 2011.

Schwartz, H. Housing policy is school policy: Economically integrative housing promotes academic success in Montgomery County, Maryland. In: Kahlenberg, RD., editor. The Future of School Integration. New York, NY: Century Foundation; 2012.

Schwartz H, Burkhauser S, Griffin BA, Kennedy DP, Green HD Jr, Kennedy-Hendricks A, E PC. Do the Joneses help you keep up? A natural experiment in exposure to non-poor neighbors. Hous. Policy Debate. 2015; 25:320–352.

Seo D-C, Huang Y. Systematic review of social network analysis in adolescent cigarette smoking behavior. J. Sch. Health. 2012; 82:21–27. [PubMed: 22142171]

Shelton RC, McNeill LH, Puleo E, Wolin KY, Emmons KM, Bennett GG. The association between social factors and physical activity among low-income adults living in public housing. Am. J. Public Health. 2011; 101:2102–2110. [PubMed: 21330588]

Shoham DA, Tong L, Lamberson PJ, Auchincloss AH, Zhang J, Dugas L, Kaufman JS, Cooper RS, Luke A. An actor-based model of social network influence on adolescent body size, screen time, and playing sports. PLoS One. 2012; 7:39795.

U.S. Department of Agriculture and U.S. Department of Health and Human Services. Dietary Guidelines for Americans, 2010. 7th ed. Washington, DC: U.S. Government Printing Office; 2010.

U.S. Department of Health and Human Services. 2008 Physical Activity Guidelines for Americans. ODPHP Publication No. U0036. Washington, DC: 2008. Available online at: www.heath.gov/paguidelines. [Accessed July 1, 2014]

Valente TW. Network interventions. Science. 2012; 337:49–53. [PubMed: 22767921]

Vidmar S, Carlin J, Hesketh K, Cole T. Standardizing anthropometric measures in children and adolescents with new functions for egen. Stata J. 2004; 4:50–55.

Wilson DK, Lawman HG, Segal M, Chappell S. Neighborhood and parental supports for physical activity in minority adolescents. Am J Prev Med. 2011; 41:399–406. [PubMed: 21961467]

Highlights

- This research is one of the first studies to examine the peer social networks of children living in public housing.
- Female children with more unhappy friends had worse mental health.
- Social networks were associated with alcohol use among teens.
- This study did not show that public housing location significantly impacted social networks.

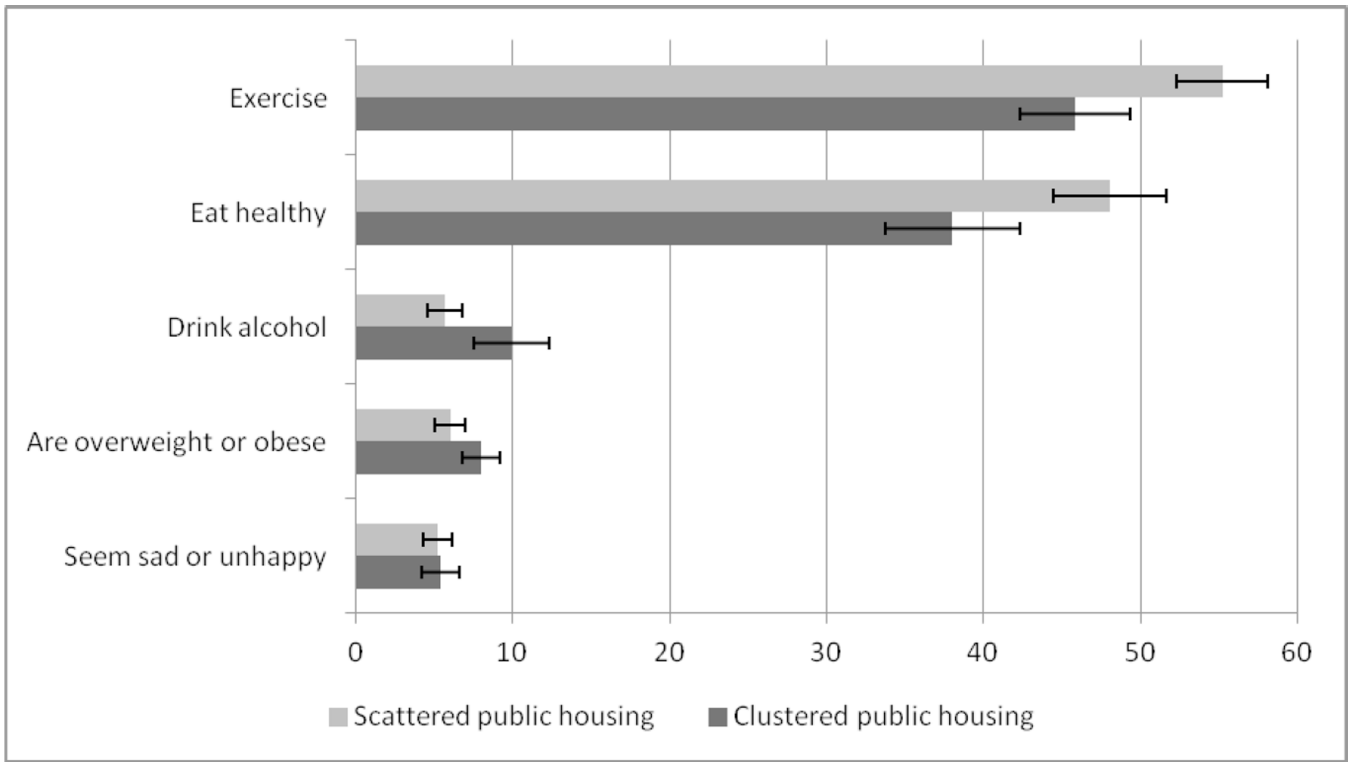

Figure 1. The percent of alters with each health characteristic among children living in housing that is scattered in market rate developments versus clustered in public housing developments

Alters are limited to friends. Predicted probabilities adjust for the child's age, gender, race/ethnicity, number of years lived in the neighborhood, household income to poverty ratio, whether or not the head of household was born in the U.S., the head of household's educational attainment and gender, family structure, network density, and caretaker's corresponding health characteristic. We estimated separate models for each outcome: in the model predicting the proportion of alters who exercise, N=194; in the model predicting the proportion of alters who eat healthy, N=197; in the model predicting the proportion of alters who seem overweight, N=193; in the model predicting the proportion of alters who seem sad or unhappy, N=197; and in the model predicting the proportion of alters who drink alcohol, N=111 (only assessed among teen respondents). Although confidence intervals for several measures do not overlap for several predicted probability estimates, these p-values were no longer statistically significant after implementing the .Holm-Bonferroni adjustment.

Table 1

Socio-demographic and household characteristics of child respondents, by housing type

	All public housing	Clustered public housing	Scattered public housing	*P* value
N (unweighted) (%)	209 (100%)	70 (33.5%)	139 (66.5%)	
Age (years)	13.0	12.8	13.2	0.386
Male (%)	48.2%	43.5%	52.0%	0.263
Race/Ethnicity				
Latino/a (%)	21.3%	18.7%	23.4%	0.432
Black (%)	65.2%	69.5%	61.7%	0.270
Asian (%)	2.7%	2.4%	2.9%	0.831
White (%)	10.8%	9.4%	12.0%	0.573
Number of years of child's life HH has lived in neighborhood	5.801	5.677	5.903	0.731
Caretaker born in the U.S. (%)	65.2%	68.0%	62.8%	0.469
HH income to poverty ratio				
<0.5 (%)	33.0%	36.4%	30.2%	0.387
>0.5 & <=1 (%)	23.8%	27.3%	21.0%	0.337
>1 & <=2 (%)	31.3%	24.3%	36.9%	0.065
>2 & <=3 (%)	9.1%	8.2%	9.9%	0.679
>3 (%)	2.8%	3.8%	2.0%	0.461
Head of HH educational attainment				
Less than HS (%)	39.7%	45.0%	35.3%	0.195
Vocational school training (%)	30.1%	23.3%	35.7%	0.070
HS grad, Some college, Associate's (%)	19.7%	18.4%	20.7%	0.713
Bachelor, Grad, or Prof. degree (%)	10.6%	13.3%	8.3%	0.269
Head of HH female gender (%)	88.8%	89.4%	88.2%	0.812
Family structure				
Two parent HH (%)	15.0%	17.1%	13.2%	0.483
One parent HH (%)	62.9%	65.0%	61.2%	0.595
Other family structure (%)	22.1%	17.8%	25.6%	0.204
Social network density				
Friend alters SN density	0.232	0.228	0.236	0.729
Close friend alters SN density	0.241	0.238	0.244	0.879
Non-family neighbor alters SN density	0.216	0.241	0.196	0.241
All alters SN density	0.458	0.466	0.451	0.737

Note: Apart from number of observations (N), all other results are weighted to correct for potential sampling bias and non-response.

Table 2

Unadjusted child health and social network characteristics

	All public housing	Clustered public housing	Scattered public housing	*P* value
Child health characteristics				
Exercises	71.0%	66.5%	74.8%	0.260
Has adequate fruit & vegetable intake	29.6%	29.3%	29.9%	0.929
Is overweight or obese	38.9%	31.7%	44.6%	0.108
Kessler score	4.477	5.032	4.210	0.211
Has consumed alcohol	16.2%	12.5%	18.8%	0.376
Social network characteristics of friend alters				
Exercise	50.4%	44.4%	55.3%	0.022
Eat fruits/vegetables regularly	43.6%	38.9%	47.4%	0.175
Overweight or obese	6.7%	7.3%	6.3%	0.524
Sad or unhappy	5.3%	5.2%	5.3%	0.954
Drink alcohol	7.0%	7.2%	6.9%	0.919

Note: Results are weighted to correct for potential sampling bias and non-response.

Table 3

The association between social network characteristics and child health outcomes

Outcome **Child health characteristic**	***Exposure*** **Social network composition**	**Adjusted odds ratios (95% CI)**
Child exercises [a]	Percent of friends who exercise	1.11 (0.98, 1.26)
Child eats adequate fruits/vegetables	Percent of friends who eat healthy	1.01 (0.92, 1.11)
Child is overweight or obese	Percent of friends who are overweight or obese	1.01 (0.65, 1.58)
Teen drinks alcohol	Percent of friends who drink socially	2.77* (1.65, 4.66)
Outcome **Child health characteristic**	***Exposure*** **Social network composition**	**Regression coefficient (95% CI)**
Kessler Score	Percent of friends who seem sad or unhappy	0.45 (−0.20, 1.10)

Asterisk(*) indicates Holm-Bonferroni corrected p-value<0.05

All estimates adjust for age, gender, race/ethnicity, head of household's nativity, the number of years that the household has lived in the neighborhood, household income to poverty ratio, the head of household's gender and education attainment, family structure, network density, and corresponding caretaker's health characteristic.

[a]The odds ratio estimates the change in odds of the child exercising with each 10 percentage point change in the proportion of friends the child perceives as exercising regularly (N=176).

[b]The odds ratio estimates the change in odds of the child eating adequate fruits and vegetables with each 10 percentage point change in the proportion of friends the child perceives as eating healthy (N=178).

[c]The odds ratio estimates the change in odds of the child being overweight or obese with each 10 percentage point change in the proportion of friends that the child perceives as overweight (N=157).

[d]The odds ratio estimates the change in the odds of the teen drinking alcohol with each 10 percentage point change in the proportion of friends who drink socially; only children aged 13–18 (teens) reported on this behavior (N=97).

[e]The regression coefficient displays the increase in Kessler score points with each 10 percentage point increase in the percentage of friends who seem sad or unhappy; only children 10 years and older reported on this characteristic (N=168). [e]