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Homophily and health behavior in social networks of older adults

Mr. Jason D. Flatt, MPH, MCHES, Mr. Yil Agimi, MPH, and Dr. Steve M. Albert, PhD

University of Pittsburgh, Graduate School of Public Health, Department of Behavioral and Community Health Sciences, Pittsburgh, Pennsylvania (Mr. Flatt, Mr. Agimi and Dr. Albert)

Abstract

A common network phenomenon, homophily, involves developing relationships with others that are similar to you. The intent of this study was to determine if older adults' health behaviors were shared within social networks. We interviewed older adults from low-income senior housing (egos) on egocentric social network characteristics and key health behaviors for themselves and for named social ties (alters). Findings suggest strong effects for homophily, especially for those who smoked and were physically inactive. Public health interventions for older adults should consider the influence that social relationships have on personal health behaviors. Network-based interventions may be required.

Keywords

health behaviors; social networks; older adults

As the majority of adults in the U.S. age, there is an increasing need for better understanding how social relationships impact health. It is expected that more than 20% of the population in the U.S. will be age 65 and older by 2030.¹ This demographic shift will require changes to the delivery of health care, disease prevention and health promotion services. Studies have shown that certain behavioral determinants promote healthy aging.^{2–3} Several modifiable risk factors such as tobacco use, physical activity, diet, and weight have been found to promote successful aging. Many of these modifiable lifestyle factors are also the leading causes of chronic disease, disability, and mortality in the U.S.

It has also been suggested that older adults' living arrangements may have an impact on their health and well-being.⁴ The majority of older adults live independently in the community and studies have shown that housing type plays an important role in health.⁵ According to a study examining residential differences and health behaviors among older adults, residents of low-income seniors apartments were more likely to have poorer health habits compared to those living in their own homes.⁶ Those living in low-income senior communities were also more likely to be obese, quit smoking at an older age, and participate in less intense exercises.

Correspondence: Jason D. Flatt, MPH, MCHES, University of Pittsburgh, Graduate School of Public Health, Department of Behavioral and Community Health Sciences, A214 Crabtree Hall, 130 DeSoto Street, Pittsburgh, PA 15261, (; Email: jdf50@pitt.edu)

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This study utilizes a previously validated social network measure, the Convoy Model⁷, to examine whether health behaviors (smoking, obesity and physical activity) are shared within the egocentric networks of older adults living in low-income senior housing. Respondents (egos) were asked to name their social contacts (alters) and report on alters' health behaviors. Our intent was to examine whether this social network tool would provide results similar to studies using more complex methods.

SOCIAL NETWORKS AND HEALTH

Studies examining the social ties of older adults have suggested that social relationships have a strong influence on health behaviors later in life. Social networks are a way of depicting the webs of social ties that connect older adults to others.⁸ It has been suggested that social networks may impact health by protecting against stress or through the spread of social contagions that influence individuals to adopt or terminate certain health behaviors.⁹

Several studies have demonstrated the power of social influence on health and well-being in later life. In fact, studies have shown that certain social ties can have a positive or negative influence on older adults' physical, mental, and emotional well-being.^{10–12} The “social influence network theory” posits that influence occurs via mental processes where individuals must integrate various opinions in order to form their own.¹³ This theory also suggests that there is a single process of interpersonal influence. Friedkin and Johnsen have also shown that interpersonal influence may cause opinions to shift in order to reflect the opinions of one's social group.¹³ In the case of health behaviors, it may be possible that interpersonal influence may cause an individual's health behaviors to shift towards that of their social network.

Network theorists suggest that social ties tend to share common beliefs, attitudes, and healthy and unhealthy behaviors.¹⁴ In support of this notion, several studies have suggested that health behaviors spread in social networks in a contagious manner. A study that examined a large network for over thirty-plus years found that obesity tends to spread among close social ties.¹⁵ This study found that a person's chances of becoming obese increased by 57% if he or she had a friend that also became obese. Additional studies have also shown that health behaviors are shared in social networks^{16–19}. For instance, a study found that individuals that smoked were more likely to be connected to contacts who smoked, and smoking cessation also tended to spread among groups of people that were connected.¹⁶

Various methods have been used to study the social network characteristics of older adults. Networks tend to be examined via egocentric or sociocentric network analysis. Egocentric networks are concerned with looking at an individual (the ego) and gathering information from the ego's perspective on his or hers social contacts (alters).⁹ A benefit of collecting egocentric network data is that information is gathered much more quickly since it is based on the self-reports of egos.²⁰ Elicitation of sociocentric network data (direct and undirected ties) requires a much more extensive collection of information from the ego and all of their named alters.

Several different techniques have been used to generate egocentric networks. In the early 80's, Kahn and Antonucci utilized the Convoy Model to identify the protective circle of friends and family that surrounded older adults.⁷ A support network was elicited by having older adults name contacts and then place them into three concentric circles.²¹ Placement of alters into each of the circles was based on the ego's perceived level of closeness to that person. Name generating techniques like this are commonly used to elicit egocentric social networks of older adults as well as other populations.^{10, 22–23}

Typically, network characteristics or the structure of one's social network are examined for specific attributes. These characteristics can be used to describe individual ties such as frequency of contact, multiplexity (functions performed through the ties), duration, and reciprocity or equal exchanges.²⁴ Overall network characteristics usually include size, density, boundedness, and homogeneity. Size or range typically refers to the number of network members; density describes how the different members are connected or know each other; boundedness is used to describe group structures; and homogeneity relates to how similar members are to each other.

SOCIAL NETWORKS AND AGING

It is known that older adults' networks tend to shrink over the lifespan. This is often due to family members moving away and the loss of friends from relocation or aging and eventually passing away.^{25–26} In 2005–2006, the National Social Life, Health and Aging Project's (NSHAP) examined a nationally representative sample of older adults ages 57 to 85 and found that on average older adults' ego networks were comprised of 3.6 ties.^{27–28} However, other studies have suggested that community-dwelling older adults' network may range from 7 to as high as 12.^{10,29}

Older adults' networks are most likely to be comprised of family members, young persons, longtime acquaintances, those close in proximity, and those they have frequent contact with.²¹ Additional studies on the composition of older adults' social networks suggest that older adults have specific types of networks, such as family, friend, non-friend, and non-family.³⁰ A study examining social influence in older adults' networks found that on average three to five social ties were the most influential on older adults' health behaviors.³¹ It was suggested that family members (i.e., spouse and children) and friends were the most influential on health behaviors. This also suggests the importance of closeness and the role that social influence may play in shaping health behaviors in later life.

HOMOPHILY

The term homophily is used to describe the social phenomenon in which people tend to cluster or have more frequent contact with those that are similar to them.^{15, 32–33} In other words, birds of a feather tend to flock together. Homophily has been found to occur among those with similar backgrounds, occupational statuses, gender, race and ethnic group, and beliefs and values. In regards to older adults, it has been suggested that their relationships tend to be highly homogeneous, especially in terms of sex, age, and socioeconomic status.^{34–35} Studies examining health behaviors and social networks have suggested that

health habits are also likely to be shared by those who are socially connected. Christakis and Fowler's sociocentric social network study¹⁵ showed that obesity was more likely to have occurred among those who had similar backgrounds and characteristics.

With this in mind, we sought to examine whether older adults' health behaviors are shared within their social networks and how homophily might be relevant for health behaviors. The purpose of this study was to examine whether an elicitation of older adults' egocentric networks would provide similar results as those found in more complex sociocentric network analyses, and to examine the occurrence of homophilous (sharing similar) health behaviors.

METHODS

A convenience sample of 118 older adults, aged 50 and older, was recruited from 2007 to 2010 from low-income, county-sponsored, senior housing in a Northeastern U.S. city. Respondents were drawn from two larger studies on medication usage and health habits of older adults. All participants in this study were consented in accordance with the Institutional Review Board at the University of Pittsburgh. Older adults who provided information on demographics, key health indicators, and the social network mapping questionnaire were included in this current study.

An interview was conducted over the phone or face-to-face depending on the preference of the respondent. The section of the interview on social networks and health lasted approximately 20 to 25 minutes. The first part of the interview involved questions on demographics, health service utilization and other health indicators. The second part of the interview involved egocentric network mapping and questions on the health behaviors of each the respondent's social ties.

Measures

Background characteristics include age, sex, race, education, marital status and living arrangements. For the key health behavior measures, several items from the 10 Keys to Healthy Aging Indicators³⁶ were used (e.g., "Do you currently smoke cigarettes?" and "How many hours a week do you exercise?"). Respondents were also asked about their height and weight so that Body Mass Index (BMI) could be calculated. BMI was then coded as either normal (<24.9) or overweight (>25.0).

Measures for egocentric social network were based on the Convoy Model.²¹ The network mapping interview began with the interviewer explaining our interest in better understanding the respondent's social network. Prompts were read to elicit network alters, and respondents (i.e., egos) were asked to place the first names of contacts into two different bull's eye circles based on their closeness with that person. People that were placed in the inner circle were those they felt closest to. The middle circle included individuals that they felt comfortable with but not as close.

Egos were then asked about the key health behaviors of named alters in the inner and middle circles. Detailed information was elicited for the first four alters in each circle. Health

behaviors included whether the alter currently smoked, was overweight, exercised regularly, and lived in the same building. This mapping technique allowed for the elicitation of a large quantity of egocentric data while reducing participant and researcher burden.

Social network variables were based on each respondent's egocentric network data. Network size was coded as the total number of listed alters in the inner and middle circles. Two types of network ties were recorded: the inner circle (i.e., closest ties) and the middle circle (i.e., close but not as close as the inner circle ties). Proportions of social network members who were smokers, overweight, or physically inactive were also calculated for the inner and middle circles.

Analysis

To assess homophily between ego health behavior and the proportion of named alters with the same health behavior, we used t-tests to examine differences in means. Analyses were conducted separately for inner and middle network circles. To assess the independent effects of homophily, linear regression models were developed controlling for age, race, gender, and educational attainment.

RESULTS

Demographic characteristics are listed in Table 1. The average age of the respondents was 70 and the vast majority of participants were female. There were slightly more African American respondents than Caucasians. The respondents' educational attainment was quite high with more than 80 % having completed high school or the equivalent (GED), and close to 25% completed some type of post-secondary education. The majority of respondents lived alone and less than 10% were married. In regards to health behaviors and characteristics, around 18% of respondents reported that they currently smoked, close to 80% were overweight, and more than one-third were physically inactive.

In regards to network size, the average number of social ties reported by respondents was 5.38. A total of 571 alters were identified of which 344 (60%) were from the inner circle and 227 were from the middle circle. Examining the average number of ties by race, we found that Caucasians reported an average of 5.09 ties and African Americans listed 5.56, $p = .32$. In regards to proximity, about 24% of the inner circle and 21% of the middle circle lived in the same building as respondents.

Examining the number of ties by smoking status, the average number of alters was 5.42 for both smokers and non-smokers. The average number of alters by weight status was 5.54 for over-weight and 5.00 for normal weight, $p = .32$. Finally, we found that there was a significant difference in the number of ties by ego's activity level with regularly active egos having an average of 5.77 ties compared to inactive egos with 4.86 ties, $p = .048$. We also examined proximity (living in the same building) by health behavior but found no significant differences.

T-tests were performed on the mean proportion of alters listed by egos with similar health behaviors (Table 2). Findings suggest egos who smoked had a larger proportion of alters in

their inner network who smoked (45%) compared to non-smoking egos (15%), $p = .001$. In addition, overweight egos were more likely to have an inner network that was overweight (41%) compared to egos with a healthy weight (25%), $p = .044$. Finally, inactive egos had a higher proportion of inactive alters in the inner network (52%) than egos who were regularly active (33%), $p = .014$. There was not a significant difference in the proportions of alters with similar health behaviors in the middle circle by egos' health behaviors.

Multiple linear regression models are presented in Table 3. In all three models, multivariable analyses assessed the association between the proportions of alters reported to engage in a similar behavior as the ego's adjusting for age, race, gender, and years of education. The strength of the association is indicated by the coefficient and statistical significance (p -value). The association between alters' health behaviors and the ego's health behaviors remained significant for smoking (model 1) and physical inactivity (model 3) after adjusting for all of the demographic variables. There was not an association between alters' weight and ego's weight; however, African American respondents were more likely to have a lower proportion of overweight alters compared to Caucasians after adjusting for age, gender, ego's health behavior and years of education.

DISCUSSION

Several important results emerged from this study on older adults' egocentric networks. First, results suggest that homophily in health behaviors was evident for close contacts (the inner circle). Homophily was also more pronounced for smoking and physical inactivity. Second, our method of eliciting networks obtained similar results as those using more complex sociocentric network analysis.^{15–16} However, longitudinal studies are needed to determine whether this simpler egocentric elicitation may hold promise for examining the social transmission of health behaviors among older adults' and confirming the contagion-like spread found by other studies. Second, our findings suggest that the elicitation of egocentric network holds some promise as a useful method for gathering details on older adults' social relationships and their shared health habits.

With respect to smoking, older adults who smoked cigarettes were more likely to have close social ties that also smoked. Smoking remains an important modifiable health behavior in late life. According to the 2001–2002 National Epidemiologic Survey of Alcohol and Related Condition (NESARC), one in seven older adults aged 65 and older reported that they used tobacco in the past year.³⁷ This is especially concerning since more than 90% of deaths related to tobacco use occur among adults over 50 years of age, and close to 70% of smoking-related deaths occur among older adults 65 and older.^{38–39}

Studies have also shown that group smoking cessation programs for older adults are able to meet their unique addiction-related, physical, emotional and social needs.³⁹ However, social triggers and social isolation are considered common barriers to cessation and are associated with an increased risk of relapse. Additional studies examining smoking cessation efforts in low-income senior housing have found that socio-environmental barriers make it extremely difficult for quitting smoking and maintenance over time.⁴⁰ Smoking cessation efforts for

this population may benefit from group interventions that incorporate older adults' closest social ties.

In regards to physical activity, results from the 2001 Behavioral Risk Factor Surveillance System (BRFSS) showed that only 42% of men and 32% of women aged 65 and older in the U.S. met the recommendation of 30 minutes of moderately intense physical activity on five or more days per week.⁴¹ In this study, only 36% of respondents reported being physically inactive, less than 2 hours of physical activity per week. In regards to shared health behaviors, we found that physical activity levels were shared among older adults' networks. We also found that respondents who were more physically active were more likely to have a greater number of social ties. This may be due to increased opportunities for social interactions and the role of social support. A recent study on low-income, multiethnic public housing residents found that older adults with fewer social ties were less active than those with larger social networks.⁴² Further research is needed to determine which aspects of social relationships may be important for increasing physical activity among those living in low-income senior communities.

There is also a growing prevalence of overweight and obese older adults in the U.S. About 69% of adults aged 60 years and older have been identified as being overweight or obese, and this is of significant concern because of increased risks for diabetes, heart disease, disability, and mortality.⁴³ We found that 78% of respondents in this study were overweight based on BMI calculations. However, we did not find that overweight egos were more likely to have alters that were overweight. In this research, overweight African American elders were less likely to have overweight alters when compared to their whites counterparts. Further research is needed to examine the reasons for this finding. It may be due to cultural and/or race-related differences in perceptions of weight. Several studies have suggested that non-Hispanic blacks are more likely to under-assess their weight,⁴⁴ and misperception of weight may occur among older African Americans when reporting on named alters. Finally, while our health behavior measures have been used with older adults in previous studies³⁶, further research is needed to determine the reliability of these single-item measures in older African Americans.

Study Limitations

Findings from this research should be interpreted in light of its study design. First, data was drawn from a convenience sample and are cross-sectional. The data should not be used to make causal inferences. In addition, we cannot infer that these results apply to all older adults or even those that live in low-income senior housing elsewhere.

A larger concern is the validity of ego reports of alter health behavior. We were not able to validate such reports (indeed, we asked only for first names to encourage respondents to feel comfortable reporting on the health behavior their contacts). Still, confidence in these findings is evident in (i) the objective, observable quality of the behaviors (smoking, physical activity and overweight status are easily visible), (ii) variance in the proportion of alters reported to demonstrate the behaviors, (iii) plausible differences in health behavior between close and less close network contacts, and (iv) similarity to findings from sociocentric elicitations that suggest close social contacts are more influential on egos'

health behaviors. Still, it would be valuable to conduct a validation study that would explicitly compare egocentric and sociocentric reports of social networks among older adults. We were unable to identify any studies that directly compared results from egocentric and sociocentric elicitations.

CONCLUSIONS

To our knowledge, no other study has utilized this method to examine homophilous health behaviors in the social networks of older adults living in low-income senior housing. This tool holds promise for detecting homophily in the networks of older adults. However, further study is needed to determine its usefulness in other populations.

Previous research has shown that social networks may hold promise for promoting health behaviors and improving older adults' health outcomes. Our results suggest that older adults living in low-income senior housing tend to engage in similar health behaviors as those they are closest to. We feel that these findings are especially important to consider when developing health promotion programs for this population. These findings are also unique in that they may suggest the need for health promotion efforts for seniors who live in low-income residential communities, as they may be at a greater risk for poorer health habits in later life.

With the expected growth in the older adult population in the next four decades, it is important to explore new and innovative health-promoting strategies that target older adults and their closest social ties. Targeting the social environment of older adults may be one of the ways to address several modifiable health behaviors and risks in later life.⁴⁵ Community health programs for older adults should consider the influence of social relationships on personal health behaviors and the occurrence of homophily. Further, health promotion efforts should consider seniors and their closest social contacts when targeting behaviors like smoking and physical activity. Finally, studies are needed to determine the potential for network-based interventions to promote healthy behaviors. A particular focus should be given to how social networks can be utilized to promote smoking cessation, increase physical activity, and reduce obesity in older populations.

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Table 1Demographic profile of older adults^a living in low-income senior housing, (n=118)

Demographic Characteristic	N	Percent
Gender		
Female	97	82.2
Male	21	17.8
Race/ethnicity		
African American	69	58.5
White	47	39.8
Other	2	1.6
Education		
Not high school graduate	22	19.0
High school graduate	61	52.1
GED	5	4.3
Vocational school or college	29	24.6
Health Behaviors of Ego		
Smoke	21	17.8
Overweight	92	78.0
Physically Inactive	42	35.6

^a Respondents ranged in age from 50 to 95, with a mean age of 70.25 years (standard deviation = 10.13).

Table 2

Proportion of egos' network that engages in unhealthy behaviors

Health Behaviors of Ego ^a	Mean Proportion of Network with Unhealthy Behaviors	SD	N	P-value
Inner Circle ^b				
Smoker	.45	.34	21	.001
Non-smoker	.15	.02	95	
Overweight	.41	.38	90	.04
Not Overweight	.25	.31	23	
Regularly Active	.33	.41	41	.01
Physically Inactive	.52	.31	70	
Middle Circle ^c				
Smoker	.33	.32	14	.18
Non-smoker	.20	.33	77	
Overweight	.35	.36	70	.15
Not Overweight	.22	.32	20	
Regularly Active	.57	.38	30	.82
Physically Inactive	.59	.38	58	

^aEgo refers to respondent;^bThe inner circle was based on social ties (alters) that egos felt closest to.^cThe middle circle was based on alters that egos felt comfortable with but not as close.

Table 3

Multiple linear regression models of proportion of alters with health behaviors by ego's with same health behaviors adjusting for demographics

Demographic Characteristic	Model 1 Smoking Alters ^b			Model 2 Overweight Alters ^b			Model 3 Physically Inactive Alters ^b		
	Coefficient	P-value	% Variance explained	Coefficient	P-value	% Variance explained	Coefficient	P-value	% Variance explained
Male	.001	.992	.0001	-.028	.745	.084	-.109	.201	1.44
African American	.018	.346	.09	-.244	.001	10.18	-.104	.136	1.96
Age	.001	.464	.016	-.005	.146	1.74	-.003	.388	.656
Education	-.007	.369	.624	.009	.374	.64	-.002	.862	.026
Ego's Health Behavior ^a	.300	<.001	14.90	.152	.074	2.62	.163	.022	4.71

^a Ego refers to respondent;

^b Alters refers to egos' social ties.