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Personal Network Analysis and Health among Latinas

Abstract: Interpersonal contacts play important roles in women's health decisions. By using personal network analysis with a focus on specific role relationships, we can better examine interpersonal influences on health decision-making. Data were collected through face-to-face surveys of Hispanic women (N = 1632). Using an ego network name generator and name interpreters, participants detailed their personal networks for discussion about women's health issues. Participants reported a mean of 1.99 (SD = 1.33) social network contacts with whom they discuss women's health issues, of whom the most commonly reported contacts were female friends, sisters, mothers, and husbands, boyfriends, or partners. Many of the contacts nominated were family members, yielding a high personal network density (M = 0.84, SD = 0.32). Controlling for participant demographics and other forms of social influence, role relations' encouragement to get a Pap test and personal network exposure to Pap test discussions were associated with Pap test status. Personal network analysis should leverage information on specific role relations. Given the importance of personal network contacts for women's health status, health educators and medical professionals must account for women's personal social networks in developing health interventions.

Keywords: personal networks, social norms, network exposure, role relations, health outcomes

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Introduction

Increasingly, the field of public health has explored social determinants of health, "the complex, integrated, and overlapping social structures and economic systems that are responsible for most health inequities" (Commission on Social Determinants of Health, 2008). These social determinants include socioeconomic status, institutional policies, characteristics of the physical environment, and notably, social networks (Viswanath and Bond, 2007; Viswanath and Emmons, 2006). Network interventions have been successful in promoting a variety of health behaviors (Latkin and Knowlton, 2015). By using personal network analysis, we can better examine interpersonal influences on health decision-making (Frank, 2015; Moran et al., 2016). Personal networks are individuals' own understanding of their social connections and of the ties among those connections (Marin and Hampton, 2007). The individual reporting her personal network is dubbed the ego, and the people to whom she is connected are her alters. Although personal networks may not always be accurately perceived by the ego, when we consider social influence processes, the perception of social influence may be more important than the actual underlying social relations (Lapinski and Rimal, 2005). Thus, by shedding light on individual perceptions of network relations, personal networks provide insight into how persuasion by social relations may occur. For the purposes of this study, we are particularly interested in a narrow, domain-specific personal network, the network based on the social relation of talking about women's health issues among Latinas.

Our study uses a role-relation approach (Marin and Hampton, 2007) that focuses on the specific relationship that participants have with their alters. Previous research has found significant effects based on not only how much people talk about health messages, but more specifically, the actual people with whom they talk. For example, Chatterjee et al. (2009) found that discussion with a spouse or family member was more strongly associated with HIV/AIDS related behaviors than discussion with friends

or other acquaintances. The specific role relationships that matter are likely to vary both by the topic of health conversations and the specific population of discussants (Latkin and Knowlton, 2015).

Personal network analysis allows examination of social influence processes among close connections. Early understandings of network processes suggested mechanisms of network influence through social diffusion such that ideas and behaviors are spread through contact with other people who have already adopted the behavior (Burt, 1999). In his development of the theory of diffusion of innovations, Rogers (1995) suggested that new ideas are diffused by innovators who are the first to choose to adopt a new idea, followed by early adopters and then the early and late majority of people. In more recent work, Hornik and Yanovitzky (2003) identified social diffusion as the process through which exposure to messages is re-transmitted through social networks. Within these social networks, people learn not only about new behaviors, but they also learn which behaviors are appropriate as they talk about health messages (Hornik and Yanovitzky, 2003). Thus, personal networks can both expose people to behaviors and provide information about social norms. This network transmission of normative information can include both descriptive norms (norms about how others act) and injunctive norms (norms about appropriate or inappropriate behavior; Lapinski and Rimal, 2005; Latkin and Knowlton, 2015; Rimal and Lapinski, 2015). For example, Latkin et al. (2009) found that people in the same social network were more likely to share normative beliefs than those in different networks. Moreover, the average descriptive norms of other network members influenced individuals' risk behaviors, even when controlling for the individuals' own descriptive norms.

In their study of influences on reproductive health choices in Bolivia, Valente and Saba (1998) included network measures of interpersonal communication by measuring the number of people to whom respondents spoke about family planning with a name generator of up to 5 people. Personal network exposure (the percent of network connections who engaged in family planning) moderated the influence of a mass media campaign on family planning. Specifically, for those women whose personal networks did not include many people who used family planning, the mass media campaign was a large influence in determining their own decision about family planning. In contrast, for those people whose communication networks included a high percentage of people using contraceptive methods, the media campaign was not as significant a contributor (Valente and Saba, 1998).

In addition to network exposure to ideas and social norms, personal networks may have effects through other structural characteristics of the network. Personal network size is the number of people to whom the ego (focal person) is connected. Larger network sizes may indicate increased opportunities for exposure to ideas or increased network diversity. In networks of people with similar ideas, network size may amplify exposure to information or normative approval. In their study of condom usage, Latkin et al. (2003) found that the size of both the primary personal network and the size of more specific networks for health advice and financial support were all positively associated with condom usage. A second structural characteristic, personal network density, is a measure of how closely connected people with whom the primary ego communicates are. "A dense personal network indicates that a person's friends know and like one another. Dense personal networks can reinforce behavioral norms since once a behavior is accepted by a majority of the group it is reinforced" (Valente, Gallaher, and Mouttapa, 2004:1692). Previous research has yielded mixed evidence of whether personal network density is associated with health outcomes. In a study of risky health behaviors, network density was not associated with cigarette smoking, drinking, or marijuana usage (Wenzel et al., 2010). However, density has been associated with condom use, such that people whose friends knew each other (more dense networks) were less likely to use condoms (Latkin et al., 2003).

In their study of the role of personal networks in condom usage, Latkin et al. (2003) not only included the size and density of participants' personal networks, but they also assessed other potential, normative mechanisms including talking to others about condom usage and having others explicitly encourage condom usage. Both were highly associated with participants' condom usage. However, these normative perceptions were general, rather than localized within the personal network. In contrast, in their study of male condom usage, Barrington et al. (2009) assessed descriptive norms within the networks as whether each of their network contacts used condoms, and they assessed injunctive norms within the network as whether each network contact had encouraged the participant to use condoms. Both the personal network descriptive norms and the personal network injunctive norms were positively associated with participant condom use. For our study, we assess talking about and encouragement of specific cervical cancer screening behaviors for each network connection to ascertain personal network injunctive norms.

This study focuses on Latina women's personal social networks for women's health topics. When Latinos living

in Los Angeles were asked to rank order the most important ways in which they obtain health information, the number one response was from family and friends (Wilkin, 2013). This especially strong interpersonal influence highlights the need to examine Latinas' personal networks. The specific behavior examined for our study was Pap testing. Pap tests enable early detection and treatment of cervical cancer. Hispanics have the highest rate of new cases of cervical cancer each year of any major racial/ethnic group in the United States (Centers for Disease Control and Prevention, 2013). In qualitative interviews of Latina women who had been screened for Pap tests, one of the primary motivating factors they identified was having personal connections with cancer experience (Torres et al., 2013). In a focus group of Hispanic women living in Texas, a participant explicitly tied beliefs about Pap tests to family, "One woman said: 'It's to prevent cancer, even more important if one has children'" (Byrd, 2007:131). Given the substantial health disparities and existing evidence of interpersonal influence, Pap testing was deemed a particularly relevant health outcome for our population of interest.

Doctors and medical professionals are also important sources for disseminating information about cervical cancer prevention for Hispanic women (Drewry, Garces-Palacio, and Scarinci, 2010). In the U.S., doctors value patient autonomy and informed decision making by individuals. However, in a cross-cultural survey, individuals of Mexican descent were far more likely to hold a family-centered model of medical decision-making rather than the individual or patient-centered model favored by African American and European American respondents (Blackhall et al., 1995). Interestingly, these "family-centered" decisions may deliberately exclude the patient who needs to be "protected" from the truth of her condition (Murphy, 1998).

Given this cultural context, it is unsurprising that discussion with family and friends has been found to be a more important predictor of perceived efficacy of cervical cancer prevention measures than doctor recommendations (Casillas et al., 2011). In their study, Casillas and colleagues assessed whether participants had ever had conversations about HPV vaccination with either family or friends; their method did not allow them to separate the influence of particular roles. A strong history of "promotoras" or lay health workers in the Hispanic community has successfully leveraged personal contact in an intervention to improve Pap test screening (Fernandez et al., 2009). In a focus group setting, Hispanic women revealed that a barrier to screening was their perception that their husband, boyfriend, or partner did not want them to go to a doctor for a Pap test because of the intimacy of the screening procedure (Byrd et al., 2007). In addition to husbands, Latina women who have been screened value children, siblings, and friends or neighbors as potential sources of emotional support (Torres et al., 2013). Personal network data may provide further insight into how and which friends and family influence the cervical cancer screening choices of Latinas. Our study aims to answer the following research question.

> RQ1. What are the characteristics of Latinas' personal networks for women's health issues in terms of a) role relationships, b) personal network size, c) personal network exposure to Pap test discussions, d) network injunctive norms encouraging Pap testing, and e) personal network density?

As described above, previous research has shown network size, network exposure, and network injunctive norms to be associated with a variety of health outcomes including family planning, condom use, and substance abuse. However, the effects of network density are less clear. Moreover, we were not able to find studies that have specifically examined personal networks for cervical cancer screening using quantitative methods. Thus, we pose the research question of how these personal network characteristics function in screening behaviors among Latina women.

> RQ2. While controlling for other participant attributes (age, education, health insurance status, doctor encouragement, descriptive norms, and patient autonomy), how do these personal network characteristics relate to Pap test status?

Methods

Participants

Participants were recruited for a face-to-face survey at clinics and local community sites in Los Angeles between April 2012 and December 2013. To be eligible, participants had to self-identify as Hispanic or Latina, be between 21 and 50 years old, and not have previously been diagnosed with cervical cancer or another reproductive cancer; 1,632 women met these eligibility criteria and completed the survey. Each participant was asked to give her fully informed consent and was given a $20 incentive for completing the survey. The study protocol was reviewed and approved by the University of Southern California Institutional Review Board. Surveys were conducted by interviewers in either English or Spanish depending on the participant's preference and lasted approximately 45

minutes. Interviewers used computer-assisted personal interviewing (CAPI) to assist in data collection.

Just over half (55.7%, *N* = 909) of participants had some form of health insurance (see Table 1). Among those who disclosed their income, 86.9% (*N* = 1,245) had household incomes of $30,000 or less. In terms of education, 52.2% (*N* = 852) of women had less than a high school diploma, 29.1% (*N* = 475) had a high school diploma, and 17.7% (*N* = 290) had at least some college. Participants were a diverse group; the majority were born in Mexico (57.2%, *N* = 934) with others born in the United States (20.6%, *N* = 336), El Salvador (9.9%, *N* = 161), and Guatemala (8.2%, *N* = 134).

Personal Network Measures

We assessed women's domain-specific networks for women's health. Using a personal network name generator based on that used in the General Social Survey (Burt, 1984) and narrowed for our particular interest, participants were asked to nominate up to five other people with whom they spoke about women's health issues. Interviewers entered either the first name or initials into the tablet computer; the CAPI software piped in that designator in subsequent questions about the alters. Participants were asked to provide a series of name interpreters. First, for each alter nominated, participants reported their role relationship (e.g. husband, mother, etc.); to obtain precise role relationships, 22 categories were included on the survey instrument, and participants could specify the exact role relationship if none of the provided 22 categories fit. For each alter, participants reported whether they had ever discussed Pap tests and whether the alter had ever either encouraged or discouraged the participants from getting a Pap test (-1 = *discouraged*, 0 = *no recommendation*; 1 = *encouraged*). This name interpreter for encouragement allowed us to examine normative influence from specific

roles and to examine normative influence aggregated across the personal network. The final name interpreter was alter gender. Relationships among alters were assessed by asking participants to report how well each network contact knew each other (e.g. *strangers*, *just friends*, or *especially close*).

In addition to reporting on the characteristics of the alters that participants nominated, we computed multiple network measures to enable us to describe Latinas' personal network characteristics. Personal network size is the number of alters that participants nominated in response to the name generator; it could range from 0 to 5. Personal network exposure is the percent of a person's network with a particular attribute. Given our interest in conversations, we operationalized personal network exposure as the proportion of women's alters with whom they had discussed Pap tests. Our measure on personal network injunctive norms is the average encouragement to get a Pap test from network contacts; it could range from -1 to 1. Personal network density assesses the extent of connections among the participants' alters. Density was calculated as the number of ties that participants reported as *just friends* or *especially close* divided by the number of possible ties among alters; as with all such density measures, it could range from 0 to 1.

Additional Measures

Participants were asked a variety of demographic questions including their age, educational attainment, and whether they had any kind of health care coverage. Following Moran et al. (2013), we assessed descriptive social norms for cervical cancer screening by asking participants to report how many out of 100 Latina women like them have routine Pap tests. The dependent variable health outcome was Pap test status (dichotomous). Participants were recorded as

Table 1. Participant Characteristics

	Overall (*N* = 1632)		Current Pap test (*N* = 1121)		Never Pap test or >3 years ago (*N* = 511)	
	%	*N*	%	*N*	%	*N*
Health insurance	55.7	909	64.2	706	40.0	203
Doctor encouraged a Pap test	75.9	1239	83.9	916	64.6	323
Doctor discouraged a Pap test	1.3	21	0.4	6	3.0	15
Patient autonomy						
Should tell patient	86.7	1415	86.2	978	88.8	437
Should tell patient's family	84.9	1385	88.3	981	79.7	404
	M	*SD*	*M*	*SD*	*M*	*SD*
Age	37.3	8.7	38.1	8.2	35.4	9.4
Education (number of years of school)	10.0	3.8	9.6	3.9	10.9	3.5
Descriptive norms (out of 100 women)	50.1	23.5	52.3	23.9	45.5	21.8

having a current Pap test if they were at a clinic to get a Pap test. In line with Torres and colleagues (2013), participants were classified as not adhering to Pap screening if they had not had a Pap test ever or if they had not had a Pap test within the previous three years.

In their reporting of personal health networks, participants could nominate a doctor or other health care professional and specify that role relationship. However, given previous research that highlights importance of doctor recommendations for cervical cancer screening (Drewry et al., 2010), all participants were also specifically asked whether a health care provider had ever encouraged or discouraged them from getting a Pap test, regardless of whether they had included such a professional in their personal networks.

Following Blackhall et al. (1995), patient autonomy was assessed by presenting participants with a scenario about a hypothetical patient who has cancer that the physician believes cannot be cured. Participants were asked whether the physician should tell the patient that the patient would probably die from cancer. The same question was asked about whether the physician should tell the patient's family (1 = *yes*, 0 = *no*).

Analysis

Personal network measures were calculated in SPSS 23. Of the 1,632 participants, 221 (13.5%) reported no personal network connections with whom they talked about women's health issues. An additional 412 women (25.2%) reported only a single connection. In analyses, we used the maximum number of women possible; thus, descriptive statistics about role relationships and network size include all 1,632 participants. However, reports on personal network exposure are limited to those participants with at least one alter, and statistics for network density are limited to participants with at least two alters. Logistic regression was used to analyze statistical associations with Pap test status. Regression models controlled for age, education, insurance status, whether a doctor or medical professional had encouraged the participant to get a Pap test, descriptive norms, and patient autonomy. Social network measures were entered separately into logistic regression models.

Results

The first research question was descriptive in nature, the composition of Latinas' personal networks for talking about women's health issues (see Table 2). When listing the members of their social networks with whom they commonly talked about women's health issues, participants most frequently identified their female friends (35%, *N* = 565), sisters (27%, *N* = 440), mothers (23%, *N* = 381), and husbands, boyfriends, or partners (21%, *N* = 336). Less frequently identified roles included women's daughters (15%, *N* = 240) and other female

Table 2. Personal Network Composition and Structural Characteristics for Latinas

	Overall (*N* = 1632)		Current Pap test (*N* = 1121)		Never Pap test or >3 years ago (*N* = 511)	
	%	*N*	%	*N*	%	*N*
Alters nominated						
Husband, boyfriend, or partner	20.6	336	20.8	233	20.2	103
Mother	23.3	381	23.0	258	24.1	123
Sister	27.0	440	27.2	305	26.4	135
Daughter (a)	14.7	240	16.3	183	11.2	57
Other female relative	18.9	308	18.6	209	19.4	99
Female friends	34.6	565	35.7	400	32.3	165
Doctor or other healthcare professional	2.0	33	2.2	25	1.6	8
	M	*SD*	*M*	*SD*	*M*	*SD*
Proportion of alters (b)						
Female	0.86	0.28	0.86	0.28	0.86	0.27
Participant's family	0.62	0.40	0.63	0.41	0.63	0.40
Personal network size (c)	1.99	1.32	2.04	1.33	1.86	1.31
Personal network density (d)	0.84	0.32	0.83	0.32	0.87	0.29
Proportion who have discussed Pap tests (b)	0.87	0.28	0.91	0.24	0.78	0.35
Average encouragement to get Pap test	0.63	0.43	0.67	0.41	0.51	0.43

(a) Differences are significant at *p* < .01.
(b) Excludes 221 participants with no alters.
(c) Differences are significant at *p* < .05.
(d) Excludes 633 participants with 1 or fewer alters.

relatives including aunts and cousins (19%, $N = 308$). Although the majority of women reported that their doctors had encouraged Pap testing when explicitly asked (76%, $N = 1239$), only a small minority included doctors or other health care professionals in their personal networks (2%, $N = 33$). All of the other role relationships were nominated by less than 5% of participants. In addition to examining specific role relationships, we also computed the proportion of alters with particular characteristics as has commonly been done in personal network studies (e.g. Latkin et al., 2003). On average, 86% of network alters were female, and 62% were family members. Thus, Latinas' women's health discussion networks were largely consistent when examined at the aggregated level of proportion who shared an attribute, rather than through individual role relations.

Participants reported a mean personal network size of just 1.99 ($SD = 1.33$) social network contacts with whom they discuss women's health issues. Network size varied considerably with a modal response of 2; 5% ($N = 88$) of women volunteered the maximum number of network contacts, a full 5 alters. Personal network exposure was high; participants talked about Pap tests with most of the members they specified in their women's health discussion networks (87%). Specifically, among women who include a husband, boyfriend, or partner in their personal networks, 87% had talked to the partner about Pap testing. Likewise, of those whose networks included mothers, sisters, daughters, or female friends, 89%, 92%, 93%, and 90% had talked about Pap tests with each role, respectively. The vast majority of these conversations were neutral or positive, such that very few network alters discouraged Pap tests. Less than 1% of husbands, boyfriends, or partners, mothers, sisters, daughters, or female friends discouraged the participant from getting a Pap test. Indeed, averaged across participants' personal networks, there was a moderately high level of encouragement for Pap testing ($M = 0.63$, $SD = 0.43$ out of -1 to 1 theoretical range) indicating a positive aggregate personal network injunctive norm. Unsurprisingly given the high proportion of family members nominated, many of the contacts within participants' personal networks were also acquainted with each other. Thus, personal network density was high ($M = 0.84$, $SD = 0.32$).

The second research question asked whether personal network composition is associated with Pap test status. Based on previous research suggesting the importance of these factors in cervical cancer screening for Latinas, each model controlled for age, education, health insurance status, whether a doctor or other health care professional had encouraged the participant to get a Pap test, descriptive norms, and patient autonomy. Odds ratios and significance levels for these factors varied little across the models (for exact statistics, see Table 3). Pap test screening was associated with older age and less education. Both health insurance status and doctor recommendation were highly associated with increased likelihood to have a current Pap test. Likewise, descriptive normative beliefs that other Latinas like them regularly obtained Pap tests were also associated with Pap test status. For most models, participants' beliefs that both the patient and the patient's family should be involved in cancer prognosis conversations were positively associated with Pap test status.

While controlling for these factors, Model 1 tested the association between personal network size and Pap test status. The relationship was not statistically significant ($OR = 1.1$, $p = .07$). In bivariate tests, participants with current Pap tests did have larger personal networks than those who had a Pap test more than three years previously or never. However, that effect disappeared when controlling for other participant characteristics. Model 2 examines injunctive encouragement from specific role relationships. Each of the four most commonly nominated roles was entered into the model simultaneously. Although encouragement from a sister had no impact, encouragement from a husband, boyfriend, or partner ($OR = 1.6$, $p = .01$), mother ($OR = 1.5$, $p = .02$), and a female friend ($OR = 2.0$, $p = .02$) were all positively associated with current Pap test status. In contrast, the proportion of alters who shared characteristics was not associated with Pap test status (see Model 3). Neither the proportion of network contacts who were female, nor the proportion of network contacts who were family members showed any relationship to participants' Pap test decisions. The fourth model examines personal network exposure and the averaged network injunctive norm for Pap testing. Although network exposure (the proportion of network members who had discussed Pap testing with the participant) was highly related to participants' Pap test status ($OR = 2.9$, $p < .001$), the average personal network injunctive norms were not. Last, Model 5 introduces personal network density. Given that density can only be calculated for participants with a minimum of 2 network contacts, this model includes the smallest number of participants. Network density was not associated with Pap test status.

Table 3. Logistic Regression Analyses of Pap test Status on Personal Network Characteristics for Latinas.

	Model 1 (N = 1447)		Model 2 (N = 1447)		Model 3 (N = 1257)		Model 4 (N = 1258)		Model 5 (N = 914)	
	OR	p	OR	p	OR	p	OR	p	OR	p
Age	1.02	.021	1.02	.002	1.02	.003	1.02	.006	1.03	.003
Education (years school)	0.93	<.001	0.93	<.001	0.94	.001	0.94	.001	0.93	.001
Health insurance (a)	2.59	<.001	2.58	<.001	2.44	<.001	2.32	<.001	2.26	<.001
Doctor encouraged a Pap test (b)	2.75	<.001	2.65	<.001	2.66	<.001	2.41	<.001	3.05	<.001
Descriptive norms (c)	1.01	<.001	1.01	<.001	1.01	<.001	1.01	<.001	1.01	<.001
Patient autonomy (a)										
Tell patient	1.52	.023	1.52	.025	1.54	.029	1.56	.027	1.40	.164
Tell patient's family	1.74	.001	1.68	.002	1.60	.010	1.53	.022	1.47	.076
Personal network size (d)	1.09	.066								
Encouraged to get a Pap test by:										
Husband, boyfriend, or partner*			1.59	.014						
Mother*			1.47	.023						
Sister			0.90	.727						
Female friend*			1.99	.020						
Proportion of alters:										
Female					1.00	.99				
Participant's family					1.00	.98				
Proportion who have discussed Pap tests*							2.87	<.001		
Average encouragement to get Pap test (b)							1.33	.109		
Personal network density									0.74	.250

* Network characteristics with statistically significant associations.

(a) Reference category is no.

(b) Ranges from -1 to 1.

(c) Descriptive norms out of 100 women

(d) Ranges from 0 to 5.

Conclusions

This paper both describes the composition of Latinas' personal networks for women's health issues and examines the association between personal networks and a health outcome, Pap test status. The most commonly identified role relationships were female friends and mothers. Previous qualitative research had indicated children as an important source of support for cervical cancer screening among Hispanic women (Torres et al., 2013), but our research did not bear this out. Sons were rarely nominated (by less than 2% of participants), and daughters were less frequently nominated than other female relatives. Earlier research also raised the question of what role women's husbands, boyfriends, or partners would play. During focus groups, Hispanic women indicated that their partners might disapprove of Pap testing (Byrd et al., 2007); however, in our quantitative data, only one participant reported that her partner had discouraged her from getting a Pap test. Partners may be more supportive of cervical cancer screening than women perceive; alternatively, women who perceive disapproval from their partners may be less likely to include them in their networks for discussion of women's health issues. Future research would benefit from direct assessment of women's husbands, boyfriends, or partners.

Our tests of relationships between Pap test status and network characteristics controlled for a variety of patient demographics and potential social influences. Notably, in our sample, health insurance coverage was not high and was strongly associated with Pap test status. Doctor recommendations were likewise very strongly associated with Pap testing; the associations we found for encouragement from friends and family were significant even after accounting for doctor influence. As has previously been found (Byrd et al., 2004), participants who perceived the Pap testing was common for women like them were more likely to get Pap tests; however, these descriptive norms were less important than personal network influences. Patient autonomy was positively associated with Pap test status in almost all models. This suggests that women who most value their own and their family's participation in medical decisions were also the most likely to value screening. Both choices to be screened

for cervical cancer and preferences for patient and family awareness of prognosis may reflect a desire for knowledge about their health status. Interestingly, there was no difference in the pattern of results found for patient involvement and patient family involvement; participants were equally likely to feel that both patients and their families should be involved.

After controlling for these underlying factors, the pattern of associations of network characteristics and health provide support for two potential means of influence from social network contacts. First, individual encouragement from specific other family members was associated with Pap test status, even after controlling for doctor recommendations and patient autonomy. In contrast, the average encouragement across all network contacts was not associated with Pap test status. These seemingly contradictory findings highlight the importance of examining specific role relations. Fishbein and Ajzen (1975) have long argued the importance not merely of injunctive normative support, but of support by specific people with whom individuals are motivated to comply. Our research reinforces the importance of examining specific referent others, rather than averaging across social categories (e.g. proportion female) or across all personal network members (e.g. network level injunctive norm). When leveraging the many types of data available from personal network analysis, aggregating overmuch may lose the nuance that such analytic techniques can provide. Instead, we argue for capturing and analyzing networks with as much detail as possible. Other network scholars have argued the importance of network specificity (e.g. Latkin and Knowlton, 2015); we argue for a similar specificity at the level of alters nominated.

The second network characteristic associated with Pap test status was personal network exposure, or the proportion of network contacts with whom participants specifically discussed Pap testing. The potential mechanism for influence in this case resonates with social diffusion models (Hornik and Yanovitzky, 2003). In contrast to the normative approval mechanism indicated above, this mechanism highlights the importance of information. Descriptive normative information may benefit from aggregation across personal network members due to repeated exposure and consistency within the network. Neither of the structural characteristics of personal network size nor personal network density were associated with Pap test status. Given the highly consistent support from specific role relations, the number of network contacts and their closeness may not matter for cervical cancer screening.

Limitations

Our focus on a narrowly defined network with specific role relations allowed us to examine multiple plausible types of network associations with health status. Some research has suggested that name generators used to elicit personal networks should specify a time frame over which discussion of important issues has occurred (e.g. six months). However, such time frames may limit the number of alters that participants nominate, thereby excluding people who have had important contributions previously (Marin and Hampton, 2007). As we were assessing a narrow relation of discussion of women's health for this research, we chose the more inclusive approach of encouraging the most important connections across time to be named. This choice does not allow us to focus on the most important recent contacts.

Additionally, since the data collection was through a cross-sectional survey, we cannot make claims about finding causal relationships. Although our results highlight the two most plausible mechanisms of social influence through Latinas' personal networks, it is possible that women select to talk to people with whom they already agree about women's health issues through a homophily network mechanism, rather than their network composition indicating patterns of social influence (see Aral, Muchnik, and Sundarajan, 2009; Latkin and Knowlton, 2015). Future research should examine the evolution of social network influences over time while maintaining the specificity of role relations that we have employed here.

Conclusions

Given the importance of social network contacts in helping women to determine their health needs, health educators and medical professionals must take women's personal social networks into account. Our results suggest that it may prove beneficial to incorporate family members and friends when advising patients on cervical cancer prevention activities. Multiple target audiences may enhance dissemination of messages through personal networks and improve normative support for health behaviors from key influencers. In addition to interventions that employ community members as lay health workers (Fernandez et al., 2009), more interventions should leverage social networks to improve cervical cancer screening rates. For example, Valente (2012) outlined methods of selecting individuals who are already well embedded in network structures to serve as lay health workers when disseminating health information.

Encouraging patients to identify members of their health-related social network and encouraging discussion with those individuals may also prove a valuable tool. Future research should examine whether these personal network associations are as pronounced in other racial and ethnic groups and for other health outcomes.

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