Original Paper

Social Network Types and Acute Stroke Preparedness Behavior

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Key Words

Abstract

Objectives: Presence of informal social networks has been associated with favorable health and behaviors, but whether different types of social networks impact on different health outcomes remains largely unknown. We examined the associations of different social network types (marital dyad, household, friendship, and informal community networks) with acute stroke preparedness behavior. We hypothesized that marital dyad best matched the required tasks and is the most effective network type for this behavior. ***Methods:*** We collected in-person interview and medical record data for 1,077 adults diagnosed with stroke and transient ischemic attack. We used logistic regression analyses to examine the association of each social network with arrival at the emergency department (ED) within 3 h of stroke symptoms. ***Results:*** Adjusting for age, race-ethnicity, education, gender, transportation type to ED and vascular diagnosis, being married or living with a partner was significantly associated with early arrival at the ED (odds ratio = 2.0, 95% confidence interval: 1.2–3.1), but no significant univariate or multivariate associations were observed for household, friendship, and community networks. ***Conclusions:*** The marital/partnership dyad is the most influential type of social network for stroke preparedness behavior.

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Introduction

Presence of informal social networks has been associated with more favorable health status [1], higher functional status [2], reduced cardiovascular mortality [3, 4], and decreased overall mortality [5–7]. However, the mechanisms by which social networks impact health remain unclear. Several plausible mechanisms have been proposed and include health behavioral pathways (e.g., exercise and utilization of medical interventions), psychological pathways improving cognitive and emotional states (e.g., self-efficacy, distress, and coping skills), access to material resources and goods (e.g., healthcare access, housing, and human capital), and physiological pathways (e.g., immune, neuroendocrine and cardiovascular systems) [8, 9]. These pathways are not mutually exclusive and may influence multiple disease risk and health outcomes [9, 10].

One way to elucidate information about the mechanisms linking social networks with health is to examine whether different types of social networks differentially impact health and behaviors [11]. This differential impact may be a result of variations in the primary tasks performed by members of different social networks. According to the task-specific model, social support networks are more effective in influencing an individual's behavior and well-being when they best manage the specific requirements of the tasks to be performed [11–16]. The requirements and criteria for specific tasks may include network members' proximity and contact, length of commitment to the task, commonality of lifestyle and social roles, as well as the network size [16]. The spouse/partner relationships constitute one type of a primary support network that has been associated with decreased mortality, particularly among men [15]. In addition to support tasks provided by other network types, the marriage/partnership network provides a range of relatively exclusive services including cooking, bathing, dressing, and shopping [14]. Household members other than a spouse or partner (e.g., adult children) may also provide support services that are similar to those provided through the marriage/partnership network. Other informal networks include friendship and community networks whose primary tasks involve leisure activities, hobbies, companionship, shopping information, and spiritual support. If a task-specific match is essential to social network influences on health outcomes, then different types of support networks may be needed for different health promotion strategies and health outcomes.

In this paper, we examined the associations of different types of informal social support networks, including spouse/partner, household, and friend networks, and involvement in community organizations, with time to acute stroke medical attention. Like most major chronic diseases, much of the emphasis on stroke morbidity and mortality reduction has focused on primary and secondary prevention strategies, such as lifestyle modification and pharmacological interventions, that aim to reduce vascular disease risk factors and recurrence. Unfortunately, the success of these prevention efforts has been limited. The approval of the only treatment for acute stroke, tissue plasminogen activator delivered within 3–4 h of symptom onset, provides an alternative strategy for the reduction in the stroke health burden. Available evidence suggests that most individuals are not 'prepared' with only 3–20% of acute stroke patients seeking and receiving medical care within the optimal 3-hour time frame [17]. Unlike prevention strategies that seek to avoid the occurrence of stroke through long-term and lasting reductions in risk factors, the strategy to treat stroke within a 3- to 4-hour time window would best be characterized as 'preparedness', that is, the ability to prepare for a stroke event. Specifically, stroke preparedness requires that individuals experiencing stroke symptoms, or those around them, recognize the signs of stroke and take immediate action to seek emergency treatment.

All types of social networks may potentially play a role in taking the necessary actions to seek medical treatment in a timely manner. However, we posit that this positive effect of

social support will vary by the type of social network present. Specifically, we hypothesize that the presence of a marital/partnership dyad, as compared with other informal social networks, will be more likely to increase the probability of seeking timely medical services for stroke symptoms. We tested this hypothesis in a large and ethnically diverse population of patients diagnosed with ischemic stroke (IS) or transient ischemic attack (TIA) at a teaching hospital in New York City.

Methods

Study Population and Recruitment

Data for this research were drawn from the baseline interviews for the Stroke Warning Information and Faster Treatment (SWIFT) study, a community-based randomized educational intervention aimed at improving awareness of stroke symptoms and time to arrival to the emergency department (ED) upon onset of stroke symptoms. The study population and methodology have been published elsewhere [18]. Briefly, from 2005 through 2009, the SWIFT study prospectively enrolled IS and TIA patients at the Columbia University Medical Center (CUMC) in New York City who were over 18 years of age and lived in a household with a telephone. Patients were identified through an ongoing comprehensive stroke surveillance system, which screened all patients admitted to CUMC for IS/TIA within 48 h of admission. A trained study research associate approached the identified patients while in the hospital or in the ED, and determined their eligibility for the SWIFT study. Patients were not eligible if they were unable to give informed consent, discharged to a long-term nursing home or required 24-hour care, had a modified Rankin score (a widely used measure of extent of disability) >4, had severe aphasia limiting comprehension, a pre-stroke dementia history or end-stage disease resulting in probable mortality ≤1 year. To participate in SWIFT, patients also had to be able to take part in an intervention session in either English or Spanish. The CUMC Institutional Review Board approved this study and all participants provided written informed consent. The current analyses included 1,077 patients who completed the baseline interview.

Data Collection and Key Measures

All data were collected prior to randomization and intervention, and represent baseline actions, attitudes and risk factors. Trained research staff administered an in-person interview at the time of participants' enrollment into the study, and collected additional data from medical records related to the index IS/TIA diagnosis. The interviews were conducted in English or Spanish and on average took 90 min to complete. The interview instrument contained standardized questions used in the American Heart Association 'Get With the Guidelines' hospital survey, the Behavioral Risk Factor Surveillance System survey, and other questions previously validated in a target population by our team in previous research [7, 18].

Data on time parameters, such as the time of onset of stroke symptoms and arrival at the ED, were gathered through interview and medical record data. Participants, and family members when applicable, were asked about the time symptoms began or last known time of feeling well using a sequence of questions as follows: (1) Where were you and what were you doing when symptoms first started? (2) What time did the symptoms start? (3) Did anyone observe what was happening (study staff contacted the bystander for information about the time of onset)? (4) When was the last time you remember feeling well (if patient does not remember time of onset)? (5) Were you completely well when you went to sleep and what time did you go to sleep (if patient reported waking up with the symptoms)? The outcome measure was defined as the time from IS/TIA symptom onset to triage in the ED, and was categorized into fewer versus more than 3 h. The cutoff of 3 h was selected because the tissue plasmino-

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gen activator treatment for IS/TIA must be delivered within 3–4 h of symptom onset and a CT scan must be performed prior to the delivery of treatment.

Information on different types of social support networks were collected during the interview and included martial status, household size and composition, friendship networks, and community resource utilization. Participants were asked if they were married or living with a partner, divorced, widowed or single, and were categorized into two groups of married/living with partner and other marital arrangement. Participants also reported the number and relationships of people with whom they lived. These questions were adapted from the Berkman and Syme [6] 'Social Network Scale' . We used these data to construct two variables, living along versus not living alone, and living with more versus fewer than 2 individuals. Friendship networks were captured by asking 'how many friends do you know well enough to visit in their homes or have visited you over the past week'. Responses were categorized into two groups of individuals with ≥3 versus <3 friends based upon past analysis [7]. In terms of utilization of community resources, our formative work identified the types of community activities in Northern Manhattan, the primary area of residence for study participants, and provided a list of choices, which included religious organizations, community centers, senior centers, adult education programs, craft centers, and other items. For each organization, participants were asked about the frequency of participation ranging from no involvement to daily involvement (no participation, less than once a month, once a month, more than once a month but less than once a week, once a week, more than once a week but not daily, daily). Presence of community networks was defined as at least weekly participation in specific types of community activities versus less than weekly participation.

Other data collected included psychosocial and socioeconomic factors, medical history, vascular risk factors, family history of stroke and cardiac disease, and functional and cognitive status. Years of completed formal education were dichotomized into those who had completed high school versus those who had not received a high school diploma. Mutually exclusive insurance categories included no insurance, private insurance, Medicare only, and Medicaid ± Medicare. Information on the country of birth was used to distinguish foreign- and US-born individuals. On patient admission, arrival by ambulance was recorded on the medical record. As a measure of stroke severity, participants were assessed using the National Institute of Health Stroke Scale (NIHSS) by the stroke fellow and scores were recorded at baseline (enrollment) and discharge.

Statistics

Our main analysis examined the association between different social networks and acute stroke preparedness, defined by a dichotomous variable representing patient arrival to the ED within 2 h of symptom onset. We first examined marital status, friendship networks, household living status, and community resource utilization in separate models. We then ran logistic regression models with all social support networks together, and adjusted for age, race/ethnicity, and gender, and any additional variables associated with the outcomes at $p < 0.1$ in the univariate analyses. The final model was generated using forward selection to determine factors to retain in the model. Additionally, age, gender, and race-ethnicity were focused into the final multivariable models. All analyses were performed with SAS software (version 9.1).

Results

Table 1 describes the sociodemographic characteristics, stroke history, and preparedness behavior of the overall sample. Of the 1,077 participants, about 50% were female, 50% were foreign born, and 51% had completed a high school education. Nearly half of the participants

Table 1. Demographic characteristics of the SWIFT study (n = 1,077), 2005–2009

Characteristics		n	%
Gender	Female	539	50
Immigration to the US	Yes	538	50
Race-ethnicity	White	302	28
	African American	226	21
	Latino	549	51
Education	Completed high school	549	51
Insurance	Medicaid/none	408	50
Social support networks	Married/partner	326	40
	Lives alone	237	22
	Lives with >2 people	431	40
	Identified 3 or more friends	570	53
	Religious organization	517	48
	Community participation	296	27
Ambulance arrival	Yes	324	30
Stroke severity	NIHSS = 0	291	23
	NIHSS = 1	291	23
	NIHSS >1–17	582	54
	Present under 3 h	183	17

Continuous variables	Mean	Range
Age, years	63	18–98
Household size, persons	2.5	0–9
Years in community	24	0–34
Baseline stroke knowledge, %	71	0–95
Time from onset to hospital, h	44	median 13

were of Hispanic racial/ethnic background with somewhat similar proportions of non-Hispanic whites (28%) and non-Hispanic African Americans (21%). The median time between the onset of symptoms and arrival in the ED hospital was 12.8 h (interquartile range: 0.30–48, mean 44 ± 16 h), with only 183 participants (17%) arriving in <3 h. About 40% of participants reported living with a spouse/partner, while 22% reported living alone. More than half of the participants identified at least three friends whom they could visit at home, 48% participated in religious community services, and 27% engaged in other community activities, both on a weekly basis. About 76% of the participants had a preliminary IS diagnosis, 30% arrived by ambulance, and the mean NIHSS stroke severity score was 4.0.

In univariate models (table 2), living with a spouse/partner was significantly associated with arrival to the ED within 3 h of stroke symptoms (odds ratio, OR = 2.0, 95% confidence interval, CI: 1.1–2.5). Living with two or more persons was also associated with increased odds of arriving within 3 h of symptoms, but this association did not reach statistical significance (OR = 1.6, 95% CI: 0.9–1.8). Early time to arrival was not significantly associated with number of persons in the household ($p < 0.14$). Further, number of friends or friendship networks, and weekly participation in religious or non-religious organizations were not significantly associated with early arrival time (OR = 1.2, 95% CI: 0.9–1.3, and OR = 1.1, 95% CI: 1.0–1.1, respectively).

Being married/living with a partner (OR = 2.01, 95% CI: 1.23–3.08) continued to increased the likelihood of timely arrival to the ED, in multivariate models adjusted for race-ethnicity, age, education, gender, vascular diagnosis, and transportation type. No other so-

Table 2. Social network types and acute stroke preparedness[a] in the SWIFT study (n = 1,077), 2005–2009

	Unadjusted univariate models		Final multivariate model	
	OR	95% CI	OR	95% CI
Married/partner	2.0	1.1–2.5	2.01	1.2–3.3
Living alone	0.8	0.7–1.1	NS	
Living with ≥2 people	1.6	0.9–1.8	NS	
Friendship	1.1	0.8–1.7	NS	
Weekly participation in religious community activities	1.2	0.90–1.3	NS	
Weekly participation in nonreligious community activities	1.1	1.0–1.1	NS	
Gender				
Female vs. male	1.2	0.6–1.5	0.89	0.6–1.4
Race/ethnicity				
African American vs. white			1.34	0.7–2.7
Hispanic vs. white			1.36	0.7–2.6
Education				
Completed high school vs. did not complete high school	1.4	0.7–2.6	1.34	0.7–2.7
Transportation to ED				
Ambulance vs. other modes	3.0	1.7–4.9	2.93	1.8–4.8

Multivariate models controlled for age.

[a] Timely arrival was defined as arriving to the ED within 2 h of onset of stroke symptoms.

cial network type was selected into the final multivariate model. Arrival by ambulance versus other transportation modes (OR = 2.93, 95% CI: 1.81–4.75) and TIA versus IS diagnosis (OR = 3.26, 95% CI: 2.02–5.25) also showed strong associations with presenting in the ED within 3 h of symptoms. African American and Hispanic stroke participants were associated with a greater odds of early arrival compared to whites, but the associations were not statistically significant (OR = 1.3, 95% CI: 0.7–2.7, and OR = 1.4, 95% CI: 0.7–2.6, respectively).

Discussion

In this study, we found that the social support network defined by being in a married/partner relationship was associated with increased acute stroke preparedness as defined by arrival to the ED within 3 h of stroke symptom onset. While many studies have examined factors related to patient delay in seeking treatment for stroke symptoms, few studies have explored the social contexts and the mechanisms that give rise to timely use of medical treatment for stroke. Our results are broadly consistent with some research showing that family and friends play a positive role in seeking acute stroke care, including shorter delay times for patients who do not live alone [25], experienced stroke symptoms in the presence of a family member, talked to another person or family member when symptoms began [19], and reported the importance of advice and directions of family and friends in seeking immediate care for stroke [19]. However, our data specifically suggest that there is something beyond co-habitation association with timely arrival. Other studies have demonstrated that the presence of or consultation with family members delayed time to ED or showed no differences in time to seek emergency treatment by presence of other individuals or by marital status [25].

Indeed, in the acute cardiac literature, we find similar conflicting results for preparedness type behaviors. Numerous studies have explored social support influences on preparedness for acute cardiac situation or stroke [19, 21–27, 29–32]. The majority of these studies were conducted over a decade ago, primarily focused on the presence of others at the time of acute cardiac symptoms, and have produced mixed findings. In one study, patients who were in the presence of someone else when symptoms occurred were 8 times more likely to reach the ED within 3 h compared with patients who were alone [24]. In another study of individuals experiencing acute myocardial infarction, in those who were alone during the onset of symptoms, delays in seeking emergency treatment were on average about 50 min longer than in those who experienced symptoms while other persons were present. Of particular interest, in those of older age who lived alone, total delay time differed significantly between men (36 min) and women (52 min) [22]. In contrast, results from a 1994 study showed that patients experiencing symptoms alone had a median pre-hospital delay time of 2 h compared with 9 h for patients experiencing symptoms when a family member was present [23]. Another study reported that patients appear to need the 'permission' of health care providers or family to act. Presence of social support, including marital status, was also found to be an important determinant of access to emergency medical services (calling 911) for persons who suffered an acute cardiac event [24].

While distinguishing between the presence of different types of social network members at the time stroke symptoms occur can improve our understanding of the situational or circumstantial context of the decision to seek emergency treatment for stroke, identifying which social networks in general influence stroke preparedness, the focus of our study, has more practical implications for intervention planning. We considered several different network types, including marital/partnership dyad, household, friendship, and community networks, and found only marital/partnership dyad to play a role in preparedness behavior for acute stroke. These findings are consistent with the task-specific model, which proposes that the choice of an optimal support network depends on specific requirements for the tasks to be preformed. In our previous research in the same underlying population as in the current study, we found that social isolation specifically related to friendship, but not marital status, predicted poorer outcomes following stroke, including recurrent stroke, myocardial infarction, and vascular death. In that work, we suggested that friend networks may be positively associated with increased vascular risk reduction behaviors including increased physical activity, participation in vascular screenings and perhaps increased health literacy [28]. In comparison, the preparedness behavior as considered in this study may utilize different support mechanisms than vascular risk reduction behaviors, which more closely matches the tasks performed by a spouse/partner. We propose that three characteristics of the marital/partner relationship may be particularly important for early arrival time: *proximity, intimacy, and social control*. Perhaps the most important component of the task-specific model related to the marital dyad is proximity of spouse/partner. Because spouses/partners are in each other's company for a great percentage of time over the day, including evenings and upon awakening, they are more likely to be present when stroke symptoms occur. Intimacy implies that the spouses/partners share unique knowledge about each other's physical states and behaviors. Intimacy may be associated with the spouse's ability to detect even subtle neurological changes related to stroke. This may be especially important in light of recent findings that even mild stroke patients (NIHSS range of 2–5) may have some initial difficulty recognizing that they are experiencing an emergency. Finally, in the marital/partner relationship, the role of social control should not be underestimated. Social control may be the action component critical for early arrival to the ED. The spouse/partner is more likely to call 911 or insist that medical treatment is necessary. Further examination of some of these possible mechanisms for shorter delay among spouses/partners is needed.

The use of retrospective recall to identify the timing of stroke symptoms is the only feasible method for collecting this information. In addition to eliciting this information from the participants, we questioned their family members or other individuals when they were present at enrollment and/or were identified as being present at the time of symptom occurrence. While this method likely increased the accuracy of time of stroke onset, it may suggest that this information may be less accurate for patients who were alone at the time of stroke symptoms or did not arrive at the ED with another person (most likely patients with more limited social network). It is unlikely, however, that this bias would systematically vary by social network type and affect the final observed associations. Our study strengths include the use of a large multiethnic sample of patients and a standardized protocol for identifying, screening and enrolling patients. This efficient method of patient recruitment as well as our team's past experience in working with stroke patients from the target population helped to achieve a high participation rate of 90%. All patients were enrolled at a single medical center which reduces variability in patient registration and triage, and recording of medical record data, such as time of presentation at the ED and arrival by ambulance.

Conclusions

Our study suggests that the presence of the marital/partnership dyad is the most influential component of the social support network for acute stroke preparedness behavior. In contrast to previous research documenting positive effects of other social networks on vascular risk reduction, we find no evidence that household, friendship and community networks improve early arrival for emergency treatment of stroke. Proximity to the acute stroke episode, the ability to detect even small neurological changes and/or a greater level of control over the partner's actions may increase the probability of acting emergently. Further, our findings suggest that specifically providing spouses/partners with the knowledge and skills to recognize and act on stroke symptoms may result in shorter times to present for emergency care for stroke.

Disclosure Statement

Dr. Bernadette Boden-Albala is an American Heart Association Spotlight Speaker. The co-authors have nothing to disclose.

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